UKERC

UK ENERGY RESEARCH CENTRE

Personal Carbon Trading (PCT): Bringing together the research community

27-28 November 2008
St. Anne's College, Oxford

Workshop Report

UKERC/MR/MP/2009/001

Recorded by:
Sarah Keay-Bright
Tina Fawcett
Rachel Howell

Edited by:
Sarah Keay-Bright

Reviewed by:
Yael Parag

Event organised and sponsored by:

UKERC
The meeting place

THE UK ENERGY RESEARCH CENTRE

Operating at the cusp of research and policy-making, the UK Energy Research Centre's mission is to be the UK's pre-eminent centre of research, and source of authoritative information and leadership, on sustainable energy systems.

The Centre takes a whole systems approach to energy research, incorporating economics, engineering and the physical, environmental and social sciences while developing and maintaining the means to enable cohesive research in energy.

To achieve this UKERC has developed the Energy Research Atlas, a comprehensive database of energy research, development and demonstration competences in the UK.
www.ukerc.ac.uk

THE UKERC MEETING PLACE

UKERC also acts as the portal for the UK energy research community to and from both UK stakeholders and the international energy research community. The National Energy Research Network (NERN), supported and facilitated by UKERC, acts as an umbrella network for energy researchers across all disciplines. The UKERC Meeting Place, based in Oxford, is a key supporting function of UKERC that aims to bring together members of the UK energy community and overseas experts from different disciplines, to learn, identify problems, develop solutions and further the energy debate.

Core Organising Team
Yael Parag, Environmental Change Institute, University of Oxford
Nick Eyre, Environmental Change Institute, University of Oxford
Matt Prescott, Royal Society of Arts
Sarah Keay-Bright, UK Energy Research Centre, Oxford University
Karyn John, UK Energy Research Centre, Oxford University
Gill Seyfang, University of East Anglia

Executive Summary

A recent Government study into personal carbon trading[1] (PCT) concluded that as a policy instrument PCT *"has potential to engage individuals in taking action to combat climate change, but is essentially ahead of its time and expected costs for implementation are high.[2]".* Yet, at the same time Defra has recognised that *"further research is being taken forward by academics and research institutions outside of Government, and Defra will keep a watching brief on their progress"[3].* PCT related research studies being undertaken in different universities and institutions across the UK, or overseas, have not yet been brought together in a coherent way and interaction between researchers has been limited. In addition, the Defra studies have highlighted some areas for further research. Thus, the key aims of the workshop were to:

1. 'Map the field' of PCT research: learn what each of us is doing and our respective research focus;
2. Determine where we have got so far, in terms of knowledge and understanding of PCT and its related issues;
3. Discuss future research directions with regard to funding opportunities;
4. Create a PCT researchers' network; and
5. Discuss and agree the process for publishing a PCT edited volume through the *Climate Policy* journal that provides a comprehensive, state-of-the-art review of PCT research to date.

These key aims have largely been met. In the Appendix of the main report is a document setting out the research interests of the workshop participants, giving a flavour of who is doing what where. The *Climate Policy* journal has expressed interest in publishing a special issue on PCT in early 2010. Papers for this special issue are now being coordinated by the Environmental Change Institute of the University of Oxford.

Before a PCT scheme could be introduced some basic research is requried to better understand, for example, how a PCT scheme would be implemented, how it would function and the impact it would have. The current urgent and dynamic policy context requires Governments to keep their options open and to be well placed to act as necessary when the time is right. Hence, answers to key research questions need to be obtained as soon as possible so that should a 'policy window' present itself, policy-makers would understand the issues involved in implementing a PCT scheme and could proceed with some confidence and minimal delay. Related to this, workshop participants expressed disappointment that Defra has chosen not to support further research into PCT at such a critical time. Workshop attendees agreed that a coherent interdisciplinary research programme is urgently needed and that the Research Councils are likely to provide the best chance of funding a UK focused programme of research.

A key output of the workshop was the identification and prioritisation of numerous research requirements. These requirements were clustered into research themes which will make up the proposed research programme. Some participants volunteered to draft text for these research themes and workshop attendees identified their own interests in particular themes. A PCT Google Group has been set

[1] The definition of PCT for the purposes of the workshop, is as follows: *PCT is a scheme in which carbon emissions, including from those from personal energy use, are traded.*
[2] http://www.defra.gov.uk/environment/climatechange/uk/individual/carbontrading/index.htm see news release at: http://www.defra.gov.uk/news/2008/080508c.htm
[3] Ibid.

up to provide a networking resource for the PCT community to: share information; coordinate the special issue; and prepare the research programme. All those invited to the workshop, including experts from Government or industry with an interest in this research area, have been invited to join this Google Group.

The research themes identified and prioritised are:
1. Cost benefit analysis
2. PCT effect (see below)
3. Policy fit
4. Behaviour and markets
5. Equity and distribution
6. Transition from here to end goal.

The following key issues emerged from the workshop and these were broadly agreed by participants:

The benefit of 'certainty' is key
A key benefit of PCT is the instrument' s effectiveness at controlling the rate of carbon emissions reduction with certainty. A 'hard cap' would provide a guarantee for reaching the desired endpoint (e.g. a specified level or profile of UK emisisons leading to x ppm by time t; climate related policy goals). This benefit needs to be assessed for any policy instrument or package and weighed with other considerations. Research should also address the challenges presented by a hard cap.

Countless design possibilities to achieve multiple objectives
In addition to achieving climate related policy goals there are potentially many objectives (e.g. relating to economic, social, environmental policy; efficiency and costs/benefits; fit with existing policy landscape) which need to be considered - including their interactions, tensions, priority, weightings – when selecting policy measures and packages in general, and specifically with respect to designing a PCT scheme and its supporting measures. A variety of different PCT models already exist and the following key characteristics define their design: scope of cap; allocation rule; surrender rule. Such characteristics along with the objectives mentioned above give rise to potentially many different scheme design possibilities. The implications of different design characteristics for scheme objectives need to be eplored as an input to policy-making.

Uncertainties associated with Defra's cost benefit analysis
The cost benefit analysis (CBA) carried out by Defra received considerable criticism, partly because of concerns about the framework used, but largely because of the lack of sensitivity analysis to the values selected for particular variables. The CBA is very sensitive to the following variables: number of accounts, and the cost to run them; value placed on carbon (which is very low at £29/tCO2 for 2013); assumed additional benefit from PCT relative to alternatives i.e. PCT effect. Further, the uncertainties relating to these variables are large e.g. cost to run an account estimated at £20 - £50 per year. Joshua Thumin of CSE demonstrated that both positive and negative outcomes for Net Present Value can be achieved by using different values (within the identified bounds of uncertainty) for these key variables.

There was considerable discussion surrounding the PCT effect. Defra opted for a low value (2.5%) in the possible PCT effect range identified of 0-10%, based on a survey of the energy feedback literature (Darby, 2006). The PCT effect reflects the additional value that PCT would bring over alternative instruments such as upstream trading and other policies already in place such as smart metering which are aimed at delivering demand reduction by behavioural change. Defra assumed that the only PCT effect over and above effects delivered by other policy instruments is visibility (i.e. an individual's increased awareness of their own carbon consumption and their

response to this information), but many question this. For example, the following non-exhaustive list of factors was identified by some participants as contributing to the PCT effect: information; feedback; responsibility; allowance; ownership; empowerment; and re-enfranchisement. However, in accordance with Defra's definition of the 'PCT effect', any such factors that could be achieved through other policy measures would not be considered to contribute to the PCT effect. Participants hypothesised that the dynamic effect of empowerment/ownership may be essential for a long-term sustained transformation.

Participants agreed that another key point relating to the PCT effect is that the feedback (information) used by Darby is not coupled with an incentive or deterrent. (However, after the workshop Defra pointed out that these could be delivered through other mechanisms so do not contribute to the PCT effect). Joshua Thumin used the analogy of speeding: people slow down when they see a speed camera because there is the deterrent of a fine coupled with available, accessible and accurate information (speedometer) and the means to act (apply the brakes). A deterrent without information would not be as effective, likewise nor would information without the deterrent (i.e requirement to purchase additional credits if personal allowance exceeded). The social psychological dimension must therefore be brought in to the CBA.

Evaluation of costs and benefits, including an improved understanding of the PCT effect, was therefore identified by participants as a research requirement of highest priority.

Further economic analysis would be appropriate and desirable. It is not the cost of making small reductions but the cost of making large reductions over time that needs to be understood in addressing climate change cost effectively. Participants agreed that evaluation should draw from the broader field of complexity, non-linearity, whole systems thinking etc.

Scale and scope

Scale is important and it is necessary to get it right, e.g. local solutions (i.e. individual allowances) in national framework (i.e. cap); national solutions in global framework. There was general agreement that it would not be sensible to cap at local or regional level. Implementing at EU level rather than national level could be more desirable, as there is a bigger market, EU aviation could be captured and competition issues may be less of a problem. If aiming to go global then implementing PCT successfully at national level may be a necessary pre-requisite. The following issues were raised with respect to how PCT could fit with the EU emissions trading scheme (EU ETS):

1) Withdraw from EUETS and implement PCT
2) Reform EU ETS to allow emissions permits to be allocated to different actors in different countries or reform EUETS so it is essentially PCT Europe wide. Easier to reform than abolish.
3) PCT fills in EU ETS gaps (the non-traded sector) – though enthusiasm could be low if perceived as 'gap filler'
4) EUETS includes electricity generation and there would be overlap between PCT and EUETS, even if PCT only covers direct energy use by individuals. Therefore need to understand and address double-counting. EU ETS reporting framework is relevant.
5) Covering only individual direct energy use would lead to 2 different prices in the economy if co-existing with EUETS. This would imply the need for separate currencies, but this is feasible.

PCT schemes could be designed to cover 100% of UK emissions, but some proposed schemes are currently looking at 40% (individual direct energy use) to avoid conflicting with the EUETS. If focusing on 40% then the scheme should be framed and adjusted to fit within other policies notably the EUETS and planned Carbon Reduction Commitment. Coverage of emissions has two dimensions: 1) upstream and downstream; 2) direct and indirect emissions. It can be argued that all carbon is personal. There may be greater public support for 100% coverage if it makes people feel they have influence over the whole system. Feasibility of including indirect/embedded emissions is a research question.

If aviation is not included, then the PCT scheme would be less redistributive and provide less flexibility in reducing personal emissions. Inclusion or exclusion of different forms of transport would be important with respect to public perceptions of any scheme. Research needs to answer whether personal responsibility can be extended from the supplier of transport to the passenger, and how personal emissions should be measured with focus on the trade-off between feasibility and accuracy.

Acceptability, understanding opinion and the role of voluntary schemes
Four informative presentations[4] were given on the second day, the key points of which have not been captured above:

Yael Parag of the Environmental Change Institute, University of Oxford, gave an overview of what social and political acceptability means and how it is possible to gain a better understanding of it through consideration of the whole policy cycle and the agenda-setting process. Policy windows present opportunities for new policy ideas to be politically supported. They often occur by chance or due to an external factor, so researchers are more likely to actively engage with policy windows once they have occurred. She therefore concluded that basic research needs to be carried out ahead of the occurrence of a policy window. The current coupling of a severe economic downturn with a key point in climate negotiations and a new US president might present a policy window in the near future.

Richard Starkey of the Tyndall Centre, Manchester University, explored thinking by philosophers and non-philosophers relevant to the equity and allocation principles underpinning PCT and concluded:

- No theory of justice explored straightforwardly supports equal per capita allocation (EPCA)
- EPCA can perhaps be justified as the closest feasible approximation to the allocation that is in theory fairest

Rachel Howell, of the Environmental Change Institute, University of Oxford, informed on when it is useful and appropriate to use opinion surveys or focus groups and what such techniques have already revealed about public opinion relating to PCT schemes. She emphasised that who we ask, what and when we tell them as well as what we ask is critical to outcomes of opinion research.

Matt Prescott's (Royal Society of Arts) presentation gave a brief overview of the CarbonDaq pilot operated by Carbon Limited which enables volunteers to monitor their carbon emissions from petrol/diesel consumption through use of the Nectar loyalty card. Matt outlined considerable benefits in working through the Nectar loyalty card instead of introducing a new carbon card. It was found that local climate and energy solutions were popular with volunteers as compared with selling credits to "someone with a big car in London". Matt finished by presenting a possible model where local authorities could operate the scheme and translate incentives, benefits

[4] http://www.ukerc.ac.uk/TheMeetingPlace/Activities/Activities2008/0811PCT.aspx

or costs down to households or at community scale. In the group work that followed, participants agreed that voluntary schemes may pave the way and provide necessary policy space for a mandatory scheme. However, a mandatory scheme is necessary to effectively cap and so reduce emissions. Some participants questioned whether it would actually be possible to get a PCT effect from a voluntary scheme. Nevertheless, it should be possible to learn various lessons from a voluntary scheme, despite limitations, that would be useful for implementing a mandatory scheme successfully.

Contents

Workshop background and key aims

A recent Government study on personal carbon trading (PCT) concluded that as a policy instrument PCT is an idea ahead of its time, initial cost estimates were high and it requires more research. Yet, at the same time Defra has recognised that *"further research is being taken forward by academics and research institutions outside of Government, and Defra will keep a watching brief on their progress".* Defra remains committed to the challenge of reducing emissions associated with individuals' activities, and will continue to explore further ways to reduce these and encourage emission-saving behaviours[5].

Currently a number of researchers are independently looking at different aspects of personalising carbon emissions as a mean of mitigating climate change. Policy suggestions for allocating individuals with personal carbon budgets/allowances/shares/credits include schemes such as Personal Carbon Allowances (PCA), Tradable Energy Quotas (TEQ), Cap & Share (C&S), hybrid schemes and others (hereafter represented under the umbrella term, personal carbon trading (PCT)). Yet, the bits and pieces of PCT research being undertaken in different universities and institutions across the UK, or overseas, have not yet been brought together in a coherent way and interaction between researchers has been limited.

Accordingly, the aims of the proposed meeting were:
1. 'Map the field' of PCT research: learn what each of us is doing and our respective research focus;
2. Determine where we have got so far, in terms of knowledge and understanding of PCT and its related issues;
3. Discuss future research directions with regard to funding opportunities;
4. Create a PCT researchers' network; and
5. Examine the possibility of publishing a PCT edited volume that provides a comprehensive, state-of-the-art review of PCT research to date.

PCT by nature involves an interdisciplinary approach, as it engages psychology, sociology, policy, IT technology, economics and the interface between these disciplines. Issues such as behaviour changes due to information flow or new technologies are inherent to the understanding of PCT. This meeting will bring together researchers from multiple disciplines to advance the PCT research agenda. In the last year we have noticed an increasing interest in PCT coming from activists, politicians, NGOs and students. In response to this interest, a key aspect of our event will be to map out who is doing what regarding PCT and to present a state-of-the-art assessment of available research to different stakeholders interested in the latest research. In addition to this report, the outcomes of the meeting include proposals for research collaboration and a special issue of the journal *Climate Policy.*

This report and all presentations given at the workshop are available on the UKERC website:
http://www.ukerc.ac.uk/TheMeetingPlace/Activities/Activities2008/0811PCT.aspx

[5]http://www.defra.gov.uk/environment/climatechange/uk/individual/carbontrading/index.htm

Session 1: Setting the Scene

Welcome and Introductions

Sarah Keay-Bright welcomed participants, introduced the UK Energy Research Centre (UKERC) and the UKERC Meeting Place, and set out the workshop process. Yael Parag of the Environmental Change Institute, University of Oxford, set out the key aims of the workshop:

1. 'Map the field' of PCT research: learn what each of us is doing and our respective research focus;
2. Determine where we have got so far, in terms of knowledge and understanding of PCT and its related issues;
3. Discuss future research directions with regard to funding opportunities;
4. Create a PCT researchers' network; and
5. Discuss and agree the process for publishing a PCT edited volume through the *Climate Policy* journal that provides a comprehensive, state-of-the-art review of PCT research to date.

Participants were invited to do tour-de-table introductions and to put forward their expectations of the workshop. Expectations included:

- to network
- broaden understanding and learn more
- catch-up with activity elsewhere
- share ideas/opinions
- convergence on issues
- promote common ideas with urgency
- explore and set out psychological, behavioural and economic dimensions
- explore how to address knowledge gaps
- move research agenda forward

The policy context, Helen Champion, DECC.

Helen gave an overview of the Government's research study. She set out the Government's view on the potential effectiveness and strategic fit of PCT:

- Current energy efficiency policies are generally successful at delivering low cost measures
- Potential for personal carbon trading is reducing barriers to behaviour change through a carbon price and increasing visibility of personal carbon emissions
- Carbon price? Alternative mechanisms more cost effective.
- Visibility? Reduction in personal emissions of 0-10%.
- Estimated annual costs to individuals (over and above an upstream system) are fifteen times the benefits.
- Most optimistic scenario, costs are over twice the benefits.

Helen also set out the estimated equity and distributional impacts of the study which indicates PCT would be generally progressive. The study suggests almost 60% (three-fifths) of UK households would have more carbon credits than they need with 71% low income 'winners' and 55% high income 'losers'. However, there exist challenges to the notion that personal carbon trading is fair with some (2.1m) low-income households losing out by a small amount and with rural populations worse off

than urban populations. Nevertheless, the Centre for Sustainable Energy (who were commissioned to carry out this research) felt that areas of concern could be addressed through scheme design, allocation methodology or other measures (e.g. existing benefits system).

The public acceptability study revealed a range of responses, from quite positive to very negative and views were inconsistent. However, participants were generally willing to accept some responsibility for their emissions. There was little evidence that people would be likely to trade but also strong reluctance to the use of a price signal to influence behaviours. Concerns about trust in Government and impact on vulnerable groups were also raised.

Initial estimates of the cost of a system of individual carbon credits for 50 million (adult) participants were between £700m - £2bn to set up and £1-2bn per annum to operate each year. Most functions could be fulfilled by adapting existing systems and no insurmountable technical barriers were identified. It was assumed that a Government organisation would run the enrolment, allocation and ID verification system and individual carbon accounts would be run by private sector organisations and could be tied to existing bank or building society accounts

Defra's conclusion based on the commissioned studies was that PCT is an interesting concept, but early indications of public acceptability is low, there are some challenges to the notion of fairness and the initial estimates of cost are very high while the benefits are low. PCT is therefore "an idea ahead of its time". However, PCT might have potential as a policy instrument if: the implementation costs could be greatly reduced; the estimate of visibility benefits were found to be higher; public acceptability and personal responsibility were greater; or if the social cost of carbon increased and balanced the assessment of costs and benefits. Helen then went on to set out some areas for further research, which might help address personal CO2 emissions and could help inform further PCT research. These are set out in Helen's presentation which is available on the UKERC website[6], and are also incorporated into the participants' 'research requirements' list in Appendix 6.

The Government is committed to keep a watching brief on research being taken forward by others and will consider with interest any further research that provides sufficient evidence to reduce the significance of some of the major challenges identified by the Government's study. The Department of Energy and Climate Change (formed on 3 October 2008) remains engaged, as Defra was, with PCT research.

Discussion:
There was some discussion on the extent to which the Defra report included the concept of non-rationality, with some participants taking the view that non-rationality was not well covered and needed to be. Helen explained that there was a need for a pure economists' point of view setting out costs and benefits. Another participant pointed out that the terms used in the study, rather than the framework used, needed to be debated.

Other participants pointed to the need to incorporate the idea of energy shortages as well as a dynamic context into studies/evaluation; such incorporation would likely mean a higher price for carbon and this would support the case for PCT more strongly. In response to a question asking why aviation was not included, Helen informed that the scope of the Defra project did not allow for the inclusion of aviation data and analysis. How inclusion of aviation in PCT would effectively fit with EU ETS needs to be looked at. There was discussion around the importance of 'visibility' of

[6] http://www.ukerc.ac.uk/TheMeetingPlace/Activities/Activities2008/0811PCT.aspx

carbon, which at least one participant doubted (though hoping to develop opinion on this through the workshop). IPPR informed that it is currently looking at this issue.

Helen informed that the Defra study provided an initial view or benchmark to help bring the discussion forwards; the research community can contribute evidence to the debate and agree or disagree with the findings. The Government remains interested in the concept and any future research being taken forward on this.

The research community response, Nick Eyre, ECI, Oxford University.

Nick Eyre of the Environmental Change Institute, University of Oxford, set out how the research community might respond to the findings of the Defra studies. He began with a summary of areas where further research is not required:

- Does the potential impact of climate change justify action?
- Is personal energy use a big part of the problem?
- Is pricing of carbon in personal energy use likely to be needed?
- Is PCT technically feasible?
- Is PCT more equitable than carbon taxation?
- Is PCT more likely to engage individual action than carbon taxation?

He then set out a considerable number of research requirements under the following headings. These research requirements, along with those put forward by Defra and those emerging over the course of the workshop are documented and prioritised in Appendix 6.

- Scheme costs
- Behavioral responses to carbon budgets
- Detailed equity implications
- Social and political acceptability
- Implications for other policies
- Nature of personal carbon markets
- Enforcement
- Implications of design for all the above

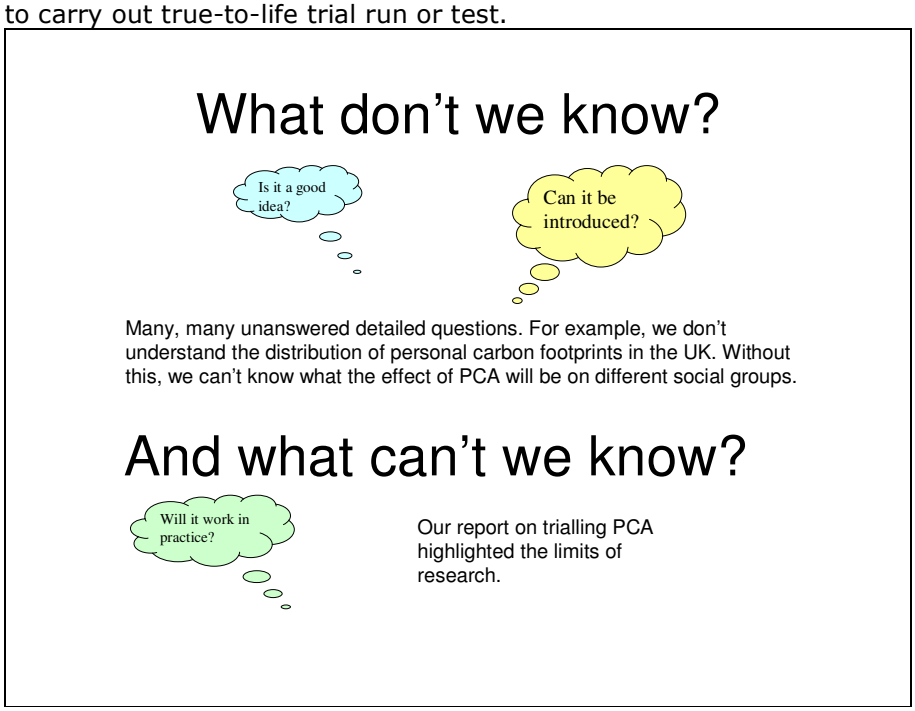
Discussion:
A participant remarked on the difficulty of conducting research about diffuse social norms. It might be useful to research things like framing effects, budgeting, and treatment of carbon as a resource. There was some discussion on opinion and public acceptability. Helen explained that while the Defra study into public acceptability did involve participants from different social groupings, the sample size was insufficient to draw any firm conclusions from this.

Another participant suggested the academic community study and learn from the response of companies to instruments like EU ETS. Some responses will be more efficient than others and it would be useful to understand why this is. Use of Shelling's work on leadership was suggested as it presents a model distribution for acceptability which suggests a tipping point. There is also evidence available on the ineffectiveness of financial rewards and that the 'announcement' effect is enough to get reductions.

The PCT research landscape, Tina Fawcett, ECI, Oxford University.

The research interests of workshop attendees were gathered prior to the workshop and can be found in Appendix 7. Tina summarised these research interests (see the diagram below). First, she set out the location of research activity, pointing to think tanks, universities, independents and PhD students. She then gave a summary of the big research questions which researchers are currently addressing as well as what still needs to be researched. She added that a report on trialling PCT highlighted that

there are limits to research and testing or trialling. For example, it will not be possible to know how such a scheme would truly work in practice as it is not possible to carry out true-to-life trial run or test.



Summary of workshop attendees research interests

Discussion:
One participant suggested that PCT is more of a concept than a policy. She also suggested that opinion changes with knowledge and over time. In the early stages, people like the idea but as they learn about the problems their enthusiasm drops. As people realise alternatives also have flaws, support for PCT rises again (IPPR demonstrated this in their research about public acceptability).

Discussion relating to aviation emissions highlighted that these emissions can be easily externalised with UK citizens travelling to Paris by train and flying on from there. Another participant pointed to the need to better understand how different words are used or can be used.

A participant pointed to some evidence which supports the case for PCT:
- Transition Towns is a very fast growing movement demonstrating an obvious desire for people to get involved.
- While many large scale projects are "disasters", the 1986 'Big Bang' project for the banking system was not. The system could not be tested beforehand but it was well planned and considerable knowledge/expertise had been gathered and applied in advance. It is a case which may provide useful lessons.

Session 2: Objectives and Choice

Models and language *Nick Eyre, ECI, Oxford University*

Nick gave brief presentation on the models and language currently used by researchers looking at issues relating to personal carbon trading. He suggested that the definition of PCT be broad for the purposes of the workshop, more specifically:

PCT is a scheme in which carbon emissions, including those from personal energy use, are traded.

This definition requires carbon emissions to have a monetary value, which normally requires an intervention to set a carbon cap. This implies some type of cap and trade arrangement. Cap and trade schemes involve both a "limit" and a "market", concepts with very different ideological traditions. The terminology around distribution in PCT schemes seems particularly rich and varied. He suggested there is no "value free" terminology and that language may well affect social and political acceptability more than design.

Nick set out the table below which demonstrates that models are defined by key characteristics such as scope of cap, allocation rule and surrender rule. Different combinations of such characteristics can potentially give rise to numerous models or possibilities for scheme design.

Scheme	Scope of cap	Allocation rule	Surrender rule
Ayres	Whole economy	Free to individuals	Individuals (own emissions) Businesses (own emissions)
TEQs/ DTQs	Whole economy	Free to individuals Auctioned to businesses	Energy wholesalers
Rate All Products and Services	Whole economy	Free to individuals	Individuals (including indirect)
Cap and Share	Whole economy	Free to individuals	Energy wholesalers
Cap and Dividend	Whole economy	Auctioned to energy wholesalers	Energy wholesalers
PCA	Personal carbon	Free to individuals	Energy retailers /Individuals?
Household carbon trading	Household energy	Free to households	Energy retailers
Supplier obligation – cap and trade	Household energy	Free to energy retailers	Energy retailers

Key characteristics of PCT schemes

Discussion:
In the discussion that followed, energy scarcity was highlighted as another dimension for such schemes. Reference was made to the tension between energy scarcity and use of fossil fuels (climate change) though it was noted that PCT schemes could be designed and implemented to address both issues. It was also recognized that energy scarcity may result in increased use of available but non-sustainable alternative fossil fuels.

Plenary brainstorm: Objectives of a PCT scheme

Through a plenary brainstorm participants discussed objectives for and of a PCT scheme:

Objectives FOR a PCT scheme (e.g. relating to PCT scheme design)	**Objectives OF a PCT scheme (e.g. relating to impact of scheme)**
Incentives info/engagement	Carbon: certainty; declining cap; ppm stabilisation, rate of reduction

	scarcity of non-renewable energy
Politically acceptable	Equality
Socially acceptable	Improved quality of life
Costs	Resilience vis-à-vis climate change
Simplicity/understandable	Defining (personal) responsibility and distributing appropriately
Technical feasibility	Capture personal carbon
	Urgency
	Empowerment
	Government objectives in general e.g. sustainable economy; fuel poverty
	international obligations
	shared goals (individual/Government) enforceability)

Group work: How do objectives affect design/selection of scheme?

Participants worked in small groups, following the process set out in the box below, to consider the question, *"What do these goals mean vis-à-vis choice of different PCT approaches or alternatives?"*

Participants worked in groups of 4 to 5 to discuss what different objectives could mean for policy choice (including different PCT options). Nominated rapporteurs briefly reported back to the plenary group building on output of previous group(s), informing of how their discussions differed, agreed or complemented.

The groups broadly agreed that the key objectives of reducing carbon with certainty and reducing emissions at a controllable speed would support selection of a PCT scheme over non-capping schemes. Scope would be a fundamental decision that would affect policy choice and indeed PCT scheme choice. Several groups identified effectiveness, efficiency (including costs and benefits), and equity (allocation and scheme impacts, with potential tension between the two) as key objectives that would influence policy and PCT scheme choice. Fit with the political landscape and existing policy such as EU ETS was also identified. There was general support for the conclusion that, compared with upstream capping, downstream capping is more likely to positively impact behaviour but will cost more. Reflecting on the group work the following hypothesis was proposed:

Could PCT create a society that is willing and able to stay within cap and so achieve what other instruments can not through re-empowerment and re-enfranchisement?

Session 3: Scope

Group work (rotating stations): Scope

Participants were divided into three groups and considered the following questions in accordance with the process set out in the box below:

1. Personal carbon or all carbon in the economy?

2. If only personal, what are the implications of including: aviation, public transport; small businesses and business transport; other sectors outside EUETS; embedded/indirect emissions (e.g. food)?
3. What scale: local; regional - England/Scotland/Wales/Northern Ireland separately; national - UK; international – EU or global?

Rotating stations. Participants were organised into three groups of 6 to 7 participants. Each group considered one of the three questions for 30 mins. The groups rotated twice, spending 15 minutes at each station, commenting and adding to previous group output. Facilitators were based at each station and used different coloured pens for output of different groups. Facilitators fed back a summary of participants' output, highlighting consensus, sticking points etc. A short plenary discussion followed.

The group output is summarised below but set out in full in Appendix 4.

Question 1: Personal carbon or all carbon in the economy?
The first group discussed the pros and cons of covering only domestic emissions i.e. 40% UK emissions. PCT schemes could be designed to cover 100% emissions, but most proposed schemes are currently looking at 40%. The group concluded it is a philosophical issue which has scheme design implications.

Key issues identified relating to 40% versus 100% coverage:

- Strong case that all carbon is personal
- More coverage if go outside UK by including indirect emissions
- Can those focussing on 40% versus whole systems co-exist? If you want to focus on 40% this is possible but need to frame/fit in whole system.
- Key barrier to only covering 40% is that people know impact is wider. You can't affect 60%. If it is 100%, you feel you have a little influence over the whole system.
- EUETS doesn't capture all upstream and there would be overlap between PCT and EUETS if PCT covers 40%. EU ETS reporting framework is relevant.
- Covering only 40% affects pricing – there would be 2 different prices in the economy if co-existing with EUETS. If 2 markets, how do they interact?
- Two dimensions: up/down-stream; direct and indirect emissions.
- Concern that corporations would buy up individual allowances for speculation.

Research questions were identified and these are set out in Appendix 6.

Question 2: If only personal emissions covered (i.e. 40% UK), what are the implications of including: aviation, public transport; small businesses and business use of transport that are outside EUETS; and embedded carbon and services (e.g. food)?

Aviation and public transport:
- If aviation not included makes it less redistributive
- Can we extend personal responsibility from supplier of transport to passenger? Accuracy of measurement of transport emissions (individual versus carrier) is an issue. At which point do you measure – before or after combustion? What level of detail is relevant and necessary?
- If aviation excluded then implications for perception of a scheme by the public (public might perceive it ineffective)

- Not including public transport can have a positive feedback (except aviation, taxis) as sends message that it is good to use public transport.
- Public transport can be regulated through other instruments. Aviation has significant technological issues relating to CO2 reduction.
- How do you justify philosophically treating aviation and public transport differently?
- Do you allocate the auction revenue from DTQ on a per capita basis (to include aviation)?

Small business:
- Is the tax system a good enough model for defining scope relating to how to account for private versus business CO2 emissions?

Indirect emissions:
- Can you define personal emissions responsibility with respect to indirect emissions?
- Embedded emissions may be too difficult, however it is a research question and there is some evidence of attempts to tackle this e.g. carbon labeling for food and products (Tesco).
- Embedded emissions would be covered by other schemes if a national cap is applied – higher price would trickle down to consumers.

Electricity:
- What is the shape of the carbon curve for electricity every half hour and geographically? (carbon costs less at night).
- Is it possible to influence the grid?

Question 3: What scale: local; regional - E/S/W/NI separately; national - UK; international – EU or global?

Local level:
General agreement that it would not be sensible to cap at local level. Supportive measures could be local (e.g. 'how to' information and support).

UK – national level:
If you cap, where do you cap it?
Could PCT be introduced at national level?
Is it politically feasible to withdraw from EU ETS?
Illegitimacy/leakages of getting away from the cap – Is this real? Northern Ireland?

EU level:
There was general agreement that capping at EU level could be more desirable than capping at national level. Competition issues may be less of a problem. However, it was recognized that it would be hard if not impossible to abolish the EUETS. There were differences in opinion about how PCT could fit with the EU ETS:

6) Withdraw from EUETS and implement PCT
7) Reform EU ETS to allow emissions permits to be allocated to different actors in different countries (Levels: people, generators, fuel suppliers)
8) Reform EUETS e.g. so it is essentially PCT Europe wide. Easier to reform than abolish.
9) PCT fills in EU ETS gaps – though enthusiasm could be low if perceived as 'gap filler'
10) PCT covering 40% overlaps with EUETS – understand and address double-counting

Global:

Group 3 suggested that if going global then strong national obligation to try it out and make it work.

Session 4: Comparing policy packages and pathways

Costs and benefits presentation *Joshua Thumin, CSE.*

Joshua Thumin of the Centre for Sustainable Energy gave a presentation on, "Personal Carbon Trading: The Costs and Benefits". CSE carried out an assessment of equity and distributional impacts of PCT and worked with Accenture on a technical feasibility and cost assessment of PCT. Through CSE's involvement in the Government's research programme, they also helped inform the economic assessment of PCT.

Joshua began by referring to two observations relevant to any economic cost/benefit analysis of PCT:

1. CBA doesn't make sense as a stand-alone exercise. Alternatives need to be compared to make a CAB meaningful and this particular study compared PCT to upstream trading.
2. CBA is just one of the inputs to the political cost/benefit analysis

Key costs include:
- Setup costs (sensitive to amortisation[7] period)
- Annual running cost of an account
- Number of accounts required
- Time burden for participants (was also included in Defra study but not traditionally included when assessing policy tools)

The main components of benefits include:
- Assumed value of carbon saved (the Shadow Price of Carbon)
- Assumed size of the "PCT effect"

The shadow price of carbon, representing the cost to society of environmental damage, was estimated using the Stern Review social cost of carbon with adjustments for inflation and growth plus application of Green Book discount rates:

Year	**£/tCO2**
2007	26
2010	27
2013	29
2020	33
2030	40
2040	49
2050	60

The PCT effect reflects the additional value that PCT would bring over alternative instruments such as upstream trading. Joshua informed that Defra selected the range of 0-5% for the PCT effect based on a review of literature relating to effects of consumption feedback on energy demand (by Sarah Darby, University of Oxford).

[7] The reduction of the value of an asset by prorating its cost over a period of years.

Controversially, this assumes that visibility is the only additional benefit and many question this.

A summary of the key inputs/outputs for the Government's PCT study are:
- PCT Effect: 2.5%
- 50 million accounts
- £52.07 – central estimate of total additional cost from PCT over an upstream system per person per year (or £15-20 to run an account for a year)
- Shadow Price of Carbon = £29/tCO2
- Cost:benefit ratio = 15:1

Using examples, Joshua demonstrated that CBA is very sensitive to the following assumptions:
- Number of accounts, and the cost to run them
- Value placed on carbon
- Assumed additional benefit from PCT

The uncertainties are large as the cost to run an account could be between £20 - £50 per year. The value placed on carbon is highly debatable and the assumed additional benefit from PCT is an open question. Joshua presented numerous research questions, many relating to improving understanding of key variables/assumptions and to how the costs can be reduced. These research questions can be found in Appendix 6.

Discussion:
There was considerable discussion surrounding the PCT effect. Defra opted for a low value (2.5%) in the possible PCT effect range of 0-10%. It was mentioned that Sarah Darby's work had given a range up to 15% but the feedback in her work is not coupled with an incentive or deterrent. Joshua used the analogy of speeding: people slow down when they see a speed camera because there is the deterrent of a fine coupled with available and accessible accurate information (speedometer) and the means to act (apply the brakes). A deterrent without information would not be as effective, likewise nor would information without the deterrent. Joshua therefore concluded that the social psychological dimension needs to be brought in to the CBA. Another participant presented the argument for greater understanding and consideration of a dynamic context and non-linearity.

Group work: Comparing policy options

During this session, participants were asked to review the key objectives as previously agreed in Session 2 and, taking these objectives into account, consider the following two questions using the process set out in the box below:

1. What is the right comparative test for deciding best policy packages/pathways?
2. Research requirements for comparing policy packages.

Participants were divided into three groups and asked to work through both questions. Rapporteurs were to briefly report back building on output of previous group(s), informing of how their discussions differed, agreed or complemented

The groups' outputs are summarised below and set out in full in Appendix 5.

One group made key points about the framework that could or should be used to assess costs and benefits of any scheme or policy, and these points were supported in plenary though participants agreed that particular attention would need to be paid to communicating output effectively (as policy-makers are used to dealing with simple numerical outputs of traditional neo-classic economics models):

1. The question should be not the cost of making small reductions in carbon emissions but the cost of making large reductions in carbon emissions. Whatever the conclusion we may come to about the effectiveness of PCTs for small reductions it is plausible that they are specifically adapted to efficiencies in large reductions.

2. The research discipline is NOT neoclassical economics. It is the broader field of complexity, non-linearity, network theory, incentives transition, discontinuity and culture, anthropology. There is vast knowledge available for use in these fields. Non-linear thinking requires that we should now (at this late stage) take up this opportunity.

Other points relating to assessing costs and benefits, on which there was general agreement, included:

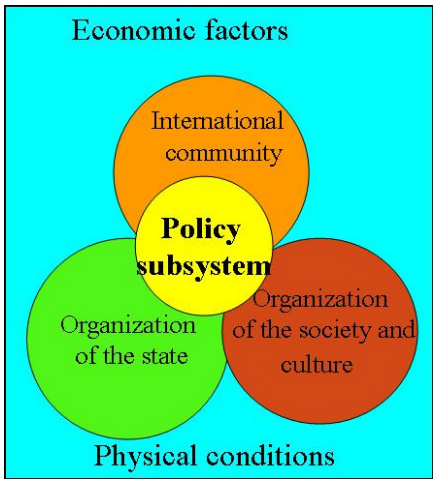
- Does PCT get you further to long-term endpoint compared with other policies? Downstream might cost more than upstream but will upstream get us to endpoint in time (certainty)? Therefore conduct and factor in risk analysis, error margins. The Government CBA study compared alternatives for the single year 2013 and 2020 – but what are the costs/benefits of various policy options for delivering an 80%+ reduction? We need to know the costs of achieving large-scale change and the final solution.
- If benefit effectiveness (i.e. certainty) is a key priority and therefore a screening criteria, then the use of a CBA framework could be appropriate.
- The Marginal Damages (MD) curve is very steep; what is the cheapest way to avoid? Explore Marginal Abatement Cost (MAC) curves.
- Extend sensitivity analysis and stress test.
- Is cost benefit analysis the appropriate framework? Just costs/benefits or more to it? Is cost so significant? Could be negative impacts of upstream e.g. engagement or lack of it. Could be negative benefits of downstream e.g. costs of redundant policies.
- The dynamic effect of empowerment as means could be <u>essential</u> for long-term transformation.
- Incorporate feedback loops into evaluation.

Participants agreed that a key research question relates to better understanding the size of the PCT effect which depends on: info; feedback; responsibility; allowance; ownership; empowerment; re-enfranchisement. There was also discussion on getting the scale of policy implementation right. It was suggested and supported that small scale solutions within large scale frameworks will be necessary; more specifically, personal actions at local level within a national capped scheme as part of a broader international framework.

Session 5: Acceptability and Equity

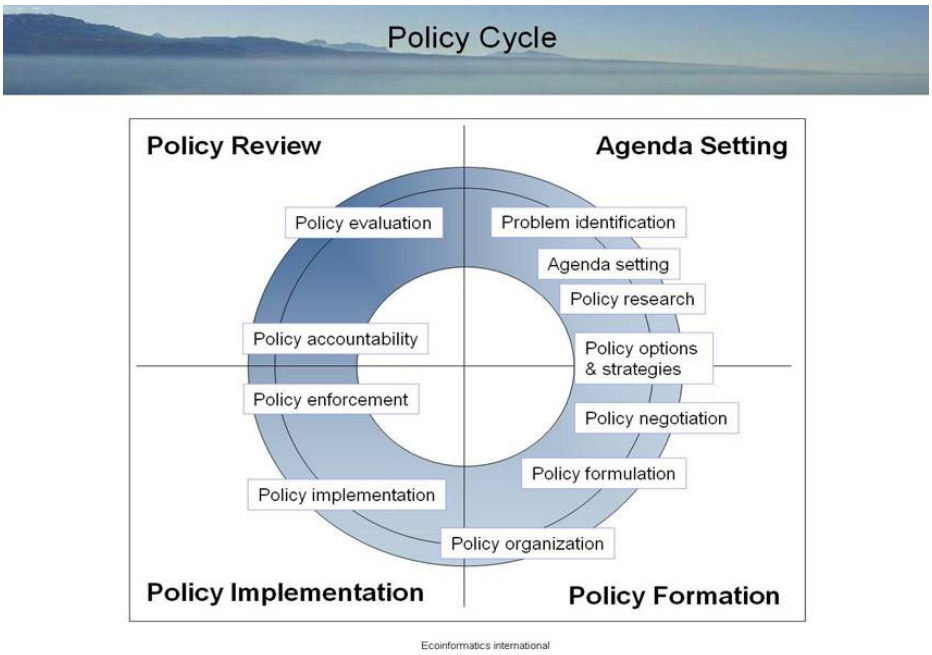
What do we mean by "social" and "political" acceptability? Yael Pareg, ECI, Oxford University.

Yael Parag from the Environmental Change Institute, University of Oxford, gave the presentation, "Unpacking social and political acceptability". She set out the key aspects of what 'acceptability' can be taken to mean: receptiveness; support; not to act against; participate; advocate. She emphasized that 'acceptability' of a concept may differ from 'acceptability' of something that is actually going to happen to you. Understanding social acceptability may involve conducting focus groups, surveys and interviews with members of the public. Whereas understanding political acceptability may involve conducting interviews with politicians, NGOs, lobby groups etc. The contextual factors influencing policy were presented using the diagram below:



Contextual factors influencing policy

Barriers to the political acceptability of PCT schemes are more easily identifiable through consideration of the entire policy cycle, as illustrated in the diagram below:



Yael referred to Kingdon who argues that in order to understand and influence policy, one must understand the agenda-setting process. He sees the agenda-setting process as the result of four factors:

- The problem stream, i.e. in which issues are recognised as significant problems
- The policy stream, i.e. in which advice is regarded as 'good advice' at a given time
- The political stream, which refers to the wider political environment of elections, government changes, public opinion, etc
- Policy windows, i.e. an opening for new views to enter either the problem stream or the policy stream.

Policy windows can be triggered through provoking interest in a new problem, or through influencing a change in what is seen as 'good advice'. Kingdon concludes, however, that policy windows often occur by chance or due to an external crisis, and therefore researchers are more likely to actively engage with policy windows once they have occurred. It is therefore important that necessary research has been completed and findings are ready to communicate by the time the policy window opens.

Overlapping between the streams can increase the likelihood of PCT to be more politically acceptable. David Miliband opened a window of opportunity for PCT in the solutions and politics stream. Now there appears to be an opportunity as there is a coupling between an external crisis (energy, economy) and a new US president. It seems that PCT is currently at the agenda-setting stage and is not yet established in the policy stream.

Discussion

Policy windows:

The starting point for discussion was the suggestion that the research community needs to anticipate which policy windows might open. For example, one participant said that it is unlikely Ed Miliband will open the same window as David Miliband – i.e. PCT in its current form may not be an attractive policy. A possible window may open around the Climate Change Act. We have agreed reducing carbon caps over time –

but politically the implications of this for the non-industrial half of the economy are not yet worked out. It was reported that Tony Grayling, influential former government advisor and now at the Environment Agency, has said that the Climate Change Act opens the window for PCT.

Political acceptability:
There is a difference between political acceptability and acceptance. Political acceptability can be more definitive than social acceptability – e.g. congestion charge driven through by politicians. Also political acceptability can change more quickly than social acceptability. When trying to understand what may be politically acceptable, we must remember that decisions can be made in a non-rational way. PCT would need buy-in from all three main political parties. The Conservative Party floated the idea of flight rationing – but that idea seemed to disappear very quickly. The Environmental Audit Committee came out in favour of PCT – that was an all-party committee – but how important was their support?

What problem does PCT solve?:
How you define your problem is important to what solutions are sought. What is the problem that PCT can solve? Can PCT address apathy about carbon emissions, or could stressing the current lack of engagement with carbon turn politicians off PCT (because the public wouldn't respond to PCT as a policy)?

Status of PCT:
The competing instrument to PCT is upstream cap and trade, expansion of EUETS. It is healthy at this stage to have competition between policy instruments.
PCT is not yet a 'solution' – it is still under development.

What researchers can and can't do:
Researchers can't really influence the opening of policy windows. There is some concern about the negative language used to debate PCT in the media (to date and in the future), but there is recognition that researchers can't control how people choose to talk about this. ECI had a first meeting with NGOs last year, and received a lukewarm response to PCT. If we could understand and address their concerns around PCT, that could help grow support for the idea. In order to understand how to develop PCT, could we look at how current climate policies made it through the policy cycle? Or should researchers just get on with developing PCT so it is ready as a policy if an opportunity arises for its adoption?

Personal carbon trading and equity issues, *Richard Starkey, Tyndall Centre, Manchester University.*

Richard Starkey of the Tyndall Centre, University of Manchester, gave the talk, "The fair allocation of rights and revenue". Richard began by focussing on the question, "How can we judge if Equal Per Capita Allocation (EPCA) is fair?". However, to suggest that the different PCT models being debated at the moment (e.g. PCA, TEQ, C&D, C&S) would all result in an equal per captita revenue allocation is not accurate. He highlighted the differences and concluded that there exists no agreement between instruments on fairness. He then moved onto the question, "How can we judge if EPCA is fair?". Richard proposed to look at two arguments put forward by non-philosophers as few philosophers have written on climate change and to review these arguments using the philosophy literature. The two key arguments presented were:

1. Everyone should be allocated an equal share of rights/revenue as the atmosphere is a "commons"
2. Everyone living rurally (in a cold region, alone) should be allocated additional rights/revenue

Richard presented arguments relating to ownership of the atmosphere bringing in the idea that the atmosphere has been given to humans by God and the opposing idea that humans do not 'own' the atmosphere and that the world was not made by anybody, for anyone or any purpose in particular.

Richard moved on to the second argument relating to the allocation of additional rights/revenue to rural inhabitants. Richard explored ideas relating to whether living rurally or having children is a 'chosen' or 'unchosen' taste. The latter might support an argument that more energy/revenue can be justified.

Richard concluded:

- No theory of justice explored straightforwardly supports equal per capita allocation (EPCA)

- EPCA can perhaps be justified as the closest feasible approximation to the allocation that is in theory fairest

Discussion

Equal per capita allowance:

EPCA (equal per capita allowance) is a pragmatic simple option which offers one type of fairness. However, fairness could change between the situation when people receive their allocation and what happens after trading has taken place. A defence of EPCA is that equal ownership gives the right to emit equally. However, is the atmosphere capable of ownership, and if it is unowned, what does that mean? The commons is unowned but necessary to all life. Non-traditional philosophy might have some insights into this, e.g. indigenous understandings of responsibility. There is also the problem of time. Under a rights framework, people who haven't been born yet have not rights – and this is a problem. It must be possible to define our need for the atmosphere without reference to God. Don't want to weaken consensus around EPCA as a good pragmatic solution which is felt to be fair.

Children:

For pragmatic reasons children would have to have some allowance under PCT. It could be a way of engaging teenagers in the issue. However, there are problems – for example, you need to define at what age somebody moves from child to adult. Based on discussions with a number of audiences, the public view seems to be that children would need between a quarter and a half of the adult allowance.

CSE have undertaken some modelling of what allocation to children would produce the least worst outcomes, within their Defra work.

Children will get 100% of an allowance when adults – so why start off with less than 100%. There are real ethical problems, particularly if you think about developing countries with high birth rates. This has major implications for scaling up PCT to international level.

What can we learn from opinion research and focus groups?

Rachel Howell, ECI, Oxford University.

Rachel Howell of the Environmental Change Institute, University of Oxford, presented her talk, "What can we learn from opinion research and focus groups?". She began by giving an overview of research that has already been carried out by different bodies. She presented the findings of IPPR, Defra and from her own work. She demonstrated that different conclusions can be drawn from the same data. For example, IPPR concluded that PCT might be more acceptable than policymakers

believe, though their results *could* also be used to argue that 'people go off the idea of PCT after considering it for a bit', while the Defra results, which led to the conclusion that PCT is "an idea currently ahead of its time in terms of public acceptability", equally show that PCT is viewed positively by at least twice as many participants as favoured the other options presented. The quality (clarity, objectivity, accuracy and depth) of information given to participants, as well as the time given to digest the information is critical to outcomes. In her own research, Rachel sent focus group participants a briefing a week in advance of the discussions, whereas the Defra participants were presented with information about three potential policies in the course of the focus group discussions. From responses to a final question about what her participants considered to be the most important feature of the policies discussed, Rachel was able to confidently conclude that participants had understood that PCT could provide certainty of emissions reduction as it caps emissions and creates a closed system. Rachel highlighted that participants of the Defra study did not generally believe that capping through PCT would be more effective or provide more certainty than a carbon tax for reducing emissions. Rachel pointed out that *Who we ask*, *What we tell them* (*and When*) and *What we ask* is critical to outcomes of opinion research. She also suggested that 'none of these options' or 'none of the above' is not a sensible option to offer in surveys or questionnaires as in reality an instrument/policy will need to be implemented to deliver the required carbon reductions but people often prefer the status quo if they are given the chance to reject new policies.

She concluded that focus groups:

- Allow a lot of data to be gathered in a relatively short time
- Encourage people to explain why they hold the opinions they do
- Allow people to discuss ideas and refine/ change their opinions
- Can include useful exercises to elicit quantifiable data
- Can never involve a representative sample
- May be dominated by strong character(s)
- Should be conducted until no new data is discovered

Opinion surveys:

- Can involve far more people
- Can be statistically analysed
- May allow participants to be more precise
- Allow participants to give their views more confidentially/ anonymously
- May prove difficult to provide enough information clearly enough about a complex topic
- Offer a 'snapshot' or initial opinion
- May provide more 'shallow' data

Discussion

Royal Society of Arts (RSA) research:

RSA has done a lot of work in this area – but still not published fully, although there are some notes on the website. They have carried out surveys, focus groups and carbon footprints. The results showed a preference for PCT over taxation, but actually people didn't really like either scheme. The RSA sample were particularly concerned about the trading aspect of PCT, because it would be likely to favour certain sorts of people.

Loughborough research (for RSA):

Alberto briefly described research he had carried out. Surveys were done by stopping people on the street and asking them to take part in research in a nearby location. The interviews included a carbon footprint at the beginning and lasted about an hour. Interviewees did find the topic interesting. As the questionnaires went on, people became less keen on PCT. Giving people too much information can be misleading.

People can make decisions quickly and this fits with the economic modelling framework.

Methodology issues:
There was some agreement that Opinion Leader's briefing to participants (Defra study) could have been more thorough. It is important to ensure people receive sufficient information in order for them to fully understand a policy proposal. It is also important to make the briefings as neutral as possible and to use an independent facilitator. Methodology is important to determining the result you get, and it is important to be as clear as possible about what you have done. Is there a danger of biasing people against carbon tax, simply because most people react instinctively against a tax? It is important to understand how people do react to the ideas, and not how we might like them to understand things.

Session 6: Voluntary approaches

Voluntary approaches: The RSA experience *Matt Prescott, The Royal Society of Arts.*

Matt's presentation gave a brief overview of the CarbonDaq pilot operated by Carbon Limited. This pilot involved volunteers registering details of their Nectar card/account on the CarbonDaq website (where the volunteer has an account). Whenever fuel is purchased and the Nectar card swiped, the transaction information can be extracted and passed to CarbonDaq. The fuel data is converted to emissions for presentation to volunteers. Matt explained that using an additional card (in addition to payment card and loyalty card) at the point of payment can have several downsides including: point of sale changes; retail staff training; retail opportunity costs; transaction process costs; card costs. This is why the pilot opted to pass data to CarbonDaq through the Nectar card. The pilot looked at different ways to incentivise volunteers: being paid for your efforts to cut emissions; gaining more voting rights to secure funds for projects you want to support; receiving annual leave; entry into prize competitions or other incentives. It was found that local climate and energy solutions were popular as compared with selling credits to "someone with a big car in London". Matt finished by presenting a possible model where local authorities could operate the scheme and translate incentives, benefits or costs down to households or at community scale.

Matt explained a key driver for the pilot was the fact that people, including decision-makers, like to touch, feel and interact in order to better visualise or imagine how a PCT scheme would work. He informed that technological advances could really help how we understand and control personal emissions. For example, mobile phone technology provides a major opportunity to measure carbon footprints, with near to 50% of internet access being through the mobile phone. Matt cited oyster cards used on public transport in London as a very successful example of large-scale smart card technology applied at the personal level.

Group work: voluntary approaches

The participants were asked to address the following three questions using the process set out in the box below:

1. How do we scale learnings from an unrepresentative sample?
2. How might voluntary approaches grow? To what scale?
3. What are the voluntary /mandatory interactions?

Participants were divided into three groups and asked to work through one of the three questions. Self-nominated rapporteurs gave a brief report back to plenary.

Group 1
How do we scale learnings from an unrepresentative sample?

1. Unrepresentative samples, especially if participants are well informed, can provide a useful 'snapshot' of opinion. However, opinion will change over time.
2. Non-intuitive. Interventions necessarily consist of properties which are not immediately desired. Otherwise there would be no need for the intervention.
3. Consider the difference between opinion and learning. It may be behaviour that we want to learn about.

Group 2
How might voluntary approaches grow? To what scale?

1. Grow in a supportive sense (helping people to live within their allowance: bike schemes; city car club).
2. Idea of CRAGS (Carbon Reduction Action Groups) blossoming to full blown PCT not likely.
3. Work place scheme possible but probably small reductions and issues with being too intrusive
4. Mid-level: semi-structured. This would be an alternative to top-down or bottom-up e.g. Paris bike inititiative.

Group 3
What are the voluntary /mandatory interactions?

1. The voluntary approach is helpful in the transition towards a mandatory scheme. Are there downsides?
2. CDP: Successful voluntary initiative.
3. Local and voluntary initiatives will be necessary to meet a global target.

Plenary reflections:

- Mandatory target is easier to introduce if voluntary schemes accepted and successful at local level - NI 186 (a national indicator for Councils). Helps provide policy space for mandatory framework.
- Can not have cap unless mandatory.
- Relevance to PCT effect: can we get a PCT effect from a voluntary scheme?
- Is a strongly encouraged voluntary initiative, like CRAGs, a transition to PCT?
- Small population – isolated (inclusivity issue) yet successful scheme.
- Difficult to measure representativeness as this might not be correlated to socio-economic factors.
- Different lessons will be relevant e.g. behaviour, opinion, scheme design.

Session 7: Piloting and testing

Participants were asked to consider what should be tested, why, who should it be tested on, how and on what scale? The results are set out in the table below.

Plenary brainstorm using a chart with headings: what; who; how; scale. This activity was carried out in parallel with Session 8 to prioritise research requirements.

What	Why	Who	How	Scale	
How people respond to a stimulated PCA	Good way to deepen insights	Sample 100-several hundred	One year in study, frequent feedback and contact by researchers	£550-1000K	Developed in ECI's report on trials
Change in carbon emissions at life stage change e.g. first child	Deeper understanding of peoples' carbon emissions over T	Small sample families	Recruit before birth of child (or retirement/other change) and follow up	Small	
Social/psychological effects other than visibility effects (not excluding)	Could be the crucial contribution that raises the PCT effect above PCT	Normal people	Lab, survey, trials, open to ideas…Or, computer-based game experiment.	Small(ish) 250-500K?	
What words appeal to people, both for the concept and the labels e.g. don't want tax, ration, price. Is carbon good?	To get positive buy-in, as an individual, the Daily Mail	x-section	Survey.	Representative	
Testing carbon literacy and currency (UEA trying to do)					

Session 8: Research requirements and wrap up

In parallel with Session 7, participants were asked to consider a list of research requirements that had been compiled using research questions put forward by presenters and participants over the two days.

Participants were asked to consider a list of research requirements and to prioritise them. They were given 10 sticky dots each and could 'spend' them as they wished e.g. placing more than one by a particular research requirement or research theme.

In the discussion that followed it was agreed that a research programme would be needed to ensure coherence between themes and indeed the disciplines and expertise that would be necessary to bring in. The most likely funder to target would be the Research Councils.

The following people agreed to draft paragraphs on particular research themes. These paragraphs will be combined to develop a research programme which will be coordinated by the Environmental Change Institute. Attendees (and invitees to this workshop that could not attend) will be invited to join a Google Group through which the research programme and journal special issue will be developed. The Meeting Place may be able to support these the development of the research agenda and finalising of the special issue with a follow-up workshop if necessary.

The research themes and committed authors are:
1. PCT Effect (social, psychology): Richard Starkey
2. Policy fit (all climate change; including PCT; overlap/redundancy; perverse outcomes): Nick Eyre
3. Behaviour and markets: David Fleming and Andy Kerr
4. Cost benefit analysis: Joshua Thurmin and Shaun Chamberlin
5. Equity and distribution: Tina Fawcett (liaise with Joshua Thurmin as related bid in progress)
6. Transition from here to end goal: Brenda Boardman.

Appendix 1: Workshop Programme

Personal Carbon Trading (PCT): Bringing together the research community

27-28 November 2008, St Anne's College, Oxford.

A 2-day workshop to bring together research experts active in the field of personal carbon trading with the broad goal of improving coherence of the UK's research effort in this area. More specifically, the meeting aims to increase awareness of each others' work, collectively tackle PCT issues, establish a PCT research network, provide an opportunity to publish in a special issue of a journal and identify research requirements and opportunities for research collaboration.

Day 1

9:15 *Registration*

Session 1: Setting the scene

9:45 **Welcome and introduction**

10:10 **The policy context,** Helen Champion, Defra.

10:40 **The research community response,** Nick Eyre, ECI, Oxford University.

11:10 **The PCT research landscape,** Tina Fawcett, ECI, Oxford University.

11:25 *Refreshment break*

Session 2: Objectives and choice

11:45 **Models and language** Nick Eyre, ECI, Oxford University.

12:00 **Objectives of a PCT scheme**

12:10 **Group work: How do objectives affect design/selection of scheme?**

13:00 *Lunch*

Session 3: Scope

14:00 **Rotating stations group work: Scope**

15:25 *Refreshment break*

Session 4: Comparing policy pathways/packages

15:55 **Costs and benefits presentation** Joshua Thumin, CSE.

16:15 **Group work: Comparing policy options**

17:25 Wrap up

19:30 *Pre-dinner drinks*

20:00 *Dinner*

Day 2

9:00 Welcome and announcements

Session 5: Acceptability and equity

9:30 **What do we mean by "social" and "political" acceptability?** Yael Pareg, ECI, Oxford University.

10:00 **Personal carbon trading and equity issues,** Richard Starkey, Tyndall Centre, Manchester University.

10:30 **What can we learn from opinion research and focus groups?** Rachell Howell, ECI, Oxford University.

11:00 *Refreshment Break*

Session 6: Voluntary approaches

11:30 **Voluntary approaches: The RSA experience** Matt Prescott, The Royal Society of Arts.

11:40 **Group work: voluntary approaches**

12:30 *Lunch*

Session 7: Piloting and testing

13:30 **Piloting and testing brainstorm**

Session 8: Research requirements

14:10 **Research Requirements**

14:40 *Refreshment Break*

15:20 **Research priorities**

Session 9: Wrap-up and outputs

15:50 **Workshop outputs**

16:10 **Feedback**

16:30 *Drinks reception*

Appendix 2: Workshop Attendee List

First name	Surname	Email	Organisation
Brenda	Boardman	brenda.boardman@ouce.ox.ac.uk	ECI, University of Oxford
Arnaud	Brohe	abrohe@ulb.ac.be	Universite Libre de Bruxelles
Stuart	Capstick	stuartcapstick@hotmail.co.uk	Cardiff University
Helen	Champion	Helen.Champion@decc.gsi.gov.uk	DECC
Shaun	Chamberlin	shaun@teqs.net	The Lean Economy Connection
Nick	Eyre	nick.eyre@ouce.ox.ac.uk	ECI, University of Oxford
Tina	Fawcett	tina.fawcett@environmental-change.oxford.ac.uk	ECI, University of Oxford
David	Fleming	david@teqs.net	The Lean Economy Connection
Rachel	Howell	rachel.howell@ouce.ox.ac.uk	ECI, University of Oxford
Andy	Kerr	andrew.kerr@ed.ac.uk	University of Edinburgh / E3 International
Matthew	Lockwood	m.lockwood@ippr.org	Institute for Public Policy Research
Laurence	Matthews	al@treleaver.myzen.co.uk	Cap & Share UK
Greig	Mill	gmill@dmu.ac.uk	Institute of Energy and Sustainable Development, De Montfort University
Deb	Niemeier	dniemeier@ucdavis.edu	UC Davis
Yael	Parag	yael.parag@ouce.ox.ac.uk	ECI, University of Oxford
Matt	Prescott	Matt.Prescott@rsa.org.uk	Carbon Limited
Richard	Starkey	r.starkey@manchester.ac.uk	Tyndall Centre
Deborah	Strickland	deborah.strickland@eci.ox.ac.uk	ECI, University of Oxford
Joshua	Thumim	joshua.thumim@cse.org.uk	Centre for Sustainable Energy
Alberto M	Zanni	a.m.zanni@lboro.ac.uk	Loughborough University

Appendix 3: Session 2 group work on objectives

Note: raw data from flipcharts – not intended to be meaningful to audience wider than workshop participants.

Key question: How do objectives affect design/selection of scheme?

Group 1
- Reduce carbon with certainty (but doesn't help choose between schemes)
- Scope (fundamental decision).
- The traditional policy tests: effectiveness; efficiency (including costs); equity.
- Fit with political landscape
- Detailed scheme design: benefits; risks
- PCT as a distant vision, step towards it more important?

Group 2
- Controllable speed of reductions (a) - CO2e, ppm): equity and efficiency.
- Equity: allocation and scheme impacts (with potential tension between the two). Efficiency: cost/benefit given a)

Group 3
- Downstream more likely to have impact on behaviour but higher costs
- Upstream cheaper but less behaviour impact
- Fitting with EUETS
- Agree with other groups re. top level principles/objectives and compatibility with existing schemes issue

Group 4
- All cap and trade schemes set a cap
- Does PCT create a society that means society is willing and able to stay within cap (achieve what other instruments can not through re-empowerment and re-enfranchisement). Link to efficiency.
- Consider PCT only for individuals and other instruments (EU ETS) mop up rest. (40% vs 60%).
- Equity not a differentiator
- Speed of emissions reduction

Reflections session 2:
- Some hypotheses to be tested
- Ownership – a useful word (empowerment)

Appendix 4: Group work on 'Scope' (Session 3)

Note: raw data from flipcharts – not intended to be meaningful to audience wider than workshop participants.

Question 1: Personal carbon or all carbon in the economy?

Group 1

- 40% personal and 60% not personal (but indirect)
- Strong case that all carbon is personal
    - more % if go outside UK, indirect
- End user in policy – unhelpful to have the 40:60 split; is this an argument for all C in the economy?
- Complexity
- Permit/process split
- PCT could cover 100% but most looking at 40%
- Can those focusing on 40% versus whole systems co-exist?
- Are there issues only possible through collaboration?
- Mega-philosophical issue
- Design implications
- Couldn't wait until we have 100% uncertainty
- We are moving in a piece meal fashion
- If you want to focus on 40% this is possible but need to frame in whole system.
- Barrier to 40% only is people know impact is wider
- Focus groups show people are not confused.
- Barrier to implementation
- Desire – expanded research community
- Workshop – expand research questions

Therefore, we can't work completely in isolation:

- Fairness and acceptability are issues
- Who is dealing with 60, 100%?
- EUETS (50%). EUETS doesn't capture all upstream and there would be overlap between PCT and EUETS if PCT covers 40%.
- We do understand each other and our research
- Adaptive agent-based modelling
- Is it boundary or perspective
- One scheme to cover
- Underestimating the scale of transformation to all society, government, business, academia – need all involved and alignment of purpose.
- EU ETS – addressed idea of working EU wide important (tax based system based on national economies). EU ETS reporting framework is relevant.
- Can't just do 40% as it affects pricing, therefore 2 different prices in the economy.

Group 2

- Downstream carbon trading which includes individuals.
- Has there been research on difference in upstream and downstream approaches?
    - Not at personal level
    - Yes, with suppliers
- Upstream: CRC; SME; EU ETS; heat trans; electricity; agriculture
- What is the question between 60 and 40?
- Two dimensions: up/down-stream; direct and indirect emissions.

- How do you reconcile whole systems schemes with individuals?
- Trade is indirect (not between individual and corporation)
- The working of PCAs implies direct individual-organisation interaction, Question is how.

Group 3
Two separate policies? Whole systems or personal?
Concern that corporations would buy up individual allowances for speculation.
Concern about 60/40 split: You can't affect 60%. If it is 100%, you feel you have a little influence over the whole system.
If 2 markets - How do they interact?

Reseach Questions:
1. Liquidity of the market.
2. Can there be two separate markets and how would they interact
3. People's behaviour in trading.
4. What scenarios influence market prices? E.g. 80% then change over the years.
5. Social modelling and market behaviour.
6. Design questions: relative power of individual and corporations.

Question 2: If only personal, what are the implications of including: aviation, public transport; small businesses and business use of transport that are outside EUETS; and embedded carbon and services (e.g. food)?

Group 1
If only personal (i.e. 40%) then a what are the implications for including:
- aviation, public transport
- small businesses and business use of transport outside EU ETS
- embedded carbon in products and services
- electricity
- can you define personal emissions responsibility re. indirect emissions?
- Embedded too difficult
- Research question, is it really impossible e.g. carbon labelling (Tesco).
- What are implications of not including x, y, z. If aviation not included makes it less redistributive and less flexibility.
- Accuracy of measurement on aviation emissions (individual versus carrier)
- Can we extend personal responsibility from supplier of transport to passenger
- If aviation excluded then implications for perception of a scheme by the public (public might perceive it ineffective)
- Not including public transport can have a positive feedback (aviation, taxis) – good to use public transport, good message.
- Public transport regulate through other instruments. Aviation – technological issues.
- Can we calculate CO2 emissions on planes accurately. At which point do you measure – before or after combustion?
- What is the shape of the carbon curve for electricity every half hour and geographically? (carbon costs less at night).
- How do you justify philosophically treating aviation and T differently?
- Is the tax system a good enough model for defining scope? (relevant to business and individuals)

Group 2
- embedded covered by other schemes if a national cap – price would make up for that – versus labelling
- important to distinguish between PCT specific and non PCT issues
- can you influence the grid?

- Do you allocate the auction revenue from DTQ on a per capita basis (include aviation)

Question 3: What scale: local; regional - E/S/W/NI separately; national - UK; international – EU or global?

Group 1
Local level
Do it as a trial – like Isle of Wight? Seriousness?
No – no sense in capping local, lots of programme of support – should be local, 'how to' stuff e.g. facilitate car-sharing as part of scheme (not in parallel).
Desirable/feasible?
Should/could?
Pros/cons
Is it possible/desirable?
Communities offset everything

UK level
Only UK – dubious?
If you cap, where do you cap it?
Could we bring it in at national level?
Is it politically feasible to withdraw from EU ETS?

EU and Global
Countries all have to agree can EUETS be transformed to capping/carbon
EU is a unit where this could happen. Also not have too much of a competition problem.

11) Withdraw from EUETS and implement PCT
12) Reform EU ETS to allow emissions permits to be allocated to different actors in different countries (Levels: people, generators, fuel suppliers)
13) Reform EUETS so its PCT Europe wide

Issues:

- Poll tax
- Aviation treaties
- Can we have PCT or overall scheme
- Double counting
- PCT fills in EU ETS gaps or a scheme that goes across the board
- Currency
- Double counting in EU ETS and in PCT
- Easier to modify EU ETS than to abolish or replace
- What do we mean by market?
- Very interactive vis-à-vis design, cost (implémentation, modelling)
- Behaving under budget
- Behaving under constraints
- Are we saying we can't imagine a scheme operating at any level so it's a compromise?
- Lose enthusiasm if perceived as a gap filler
- Scope
- Illegitimacy/leakages of getting away from the cap – is this real? Northern Ireland?

Group 2
Incentive scheme first then morph into PCT

Group 3
UK Energy Research Centre

If we want to go global then strong national obligation to try it out and make it work
Local solutions in national framework and national solutions in global framework

1) At whatever point you enter it has to then go downstream
2) EU level scheme preference
3) Interdependency

Session 3 reflections
Level of detail necessary, relevant?
Question – national or international?

Appendix 5: Group work on comparing policy options (Session 4)

Note: raw data from flipcharts – not intended to be meaningful to audience wider than workshop participants.

Group 1:
Research requirements for comparing policy packages

1) What is the putative benefit of PCT?
    a. Game playing: volume; price
2) (Implicit) costs of decision-making – in volatile markets
3) How high does carbon price have to be to make a tangible difference?

Comparative test

- volume to equity/efficiency (cost) with feedback loop
- extend sensitivity analysis
- stress test
- MAC curves
- Upstream schemes
- MD cross MAC curve (graph drawn)

Group 2:

- If benefit effectiveness (certainty) key, then CBA OK
- Costs of getting to large change – solution
- Empowerment as means: dynamic effect – essential long-term transformation
- MD curve is very steep, cheapest way to avoid?
- Risk analysis, error margins factor in

Plausible that right route gives rise to:

- costs
- does PCT get you further to long-term endpoint
- analysis: what voters accept; % PCT effect; or qualitative analysis output; ho to communicate in a way that makes sense to policy-makers
- tinker incrementally with existing system or new system

Dominance of economic analysis in Government

- single year – but what for 80%
- upstream – can start now, fewer objections?
- Downstream might cost more than upstream but will upstream get us to endpoint in time (certainty)?
- Low cap in cap and dividend, then v. v. high price – would Gvt allow that?

- don't lose sight of big picture
- downstream easier to understand than upstream
- don't have time to be pragmatic, systems thinking
- must get scale right – if right ownership will come
- collaboration is around 15; cooperation is around 150 – right framework/scale
- small scale solution within large scale framework

Group 3:

1. The question should be NOT the cost of making small reductions in carbon emissions BUT the cost of making large reductions in carbon emissions. WHATEVER the conclusion we may come to about the effectiveness of PCTs for 1) it is plausible that they are specifically adapted to efficiencies in 2).

2. The research discipline is NOT neoclassical economics. It is the broader field of complexity, non-linearity, network theory, incentives transition, discontinuity and culture, anthropology. There is vast knowledge available for use in these fields. Non-linear thinking requires that we should now (at this late stage) take up this opportunity.
3. Incrementalism is nice but the transition movement is where it can be found.

Research questions general:
Is cost benefit analysis the appropriate framework? Just costs/benefits or more to it?
Is cost so significant? Could be negative impacts of upstream e.g. engagement or lack of it. Could be negative benefits of downstream e.g. costs of redundant policies.

Key research question is PCT effect:
- info
- feedback
- responsibility
- allowance
- ownership
- empowerment
- re-enfranchisement

Appendix 6: Research Requirements (Session 8)

Numbers in square brackets indicate votes (workshop participants were given 10 votes each to indicate priority). Also in square brackets are names of workshop attendees that are interested in the research area.

Costs and benefits [3]

- Can the Defra estimate be reduced? How? [4][Shaun]
- Explore ways to reduce implementation and administration costs
- How best to cost/account for peoples' time?
- How much would it really cost to run a carbon account?
- What is the minimum "infrastructure" requirement for effective allocation and trading? The costs and time of this?
- Is there scope for integration with other schemes? [1]
- Who pays? When? How?
- Is the Shadow Price of Carbon the appropriate measure? If so how is it likely to evolve, and if not, what are the alternatives? [If the social cost of carbon increased and balanced the assessment of costs and benefits] [4] [Joshua]
- PCT effect (2.5%) key questions [10] [Shaun; Stuart; Joshua; Yael]
- (with PCT effect - double counting and other policies)
- The MD curve is very steep – what is the cheapest way to avoid (any policy)?
- Implications for scheme design
- Alternative policies to raise the visibility of personal carbon emissions more cost-effectively
- If the estimate of visibility benefits were found to be higher
- Further assessment of the benefits of delivering visibility
- Implications for scheme design?
- Dynamics of different schemes over time (80% reduction) [1] [Joshua]

Nature of personal carbon markets

- What will the price be? And will it be capped? [2] [Andy]
- What will be the price variability? [5] [Andy]
- Who will be the market intermediaries? And how will they be regulated? [2] [Yael]
- What will be the balance between 'carbon budgeting' and pay as you go' approaches? [2] [Yael; Tina]
- Will banking and borrowing be allowed? (dated rations/units) [Andy; Tina; David]
- What are the implications of links to other schemes? In the UK? Internationally? E.g. offsetting? [Andy; Tina]
- Liquidity of the market [Andy; Tina]
- Can there be two separate markets and how would they interact? [1] [Andy]
- People's behaviour in trading. (Would non-expert traders get ripped off?] [5] [Andy; Yael]
- What scenarios influence market prices?
- Relative power between individuals and corporations.
- What do we mean by market? (Several of the above=design of scheme) [1]
- What is the putative benefit of PCT?
- Game playing; volume; price (implicit) costs of decision making; in volatile market
- How high does carbon price have to be to make a tangible difference? [2]
- Implications for scheme design?
- Prepare population (for whatever) e.g. carbon awareness [2]

Behavioural responses to carbon budgets [4] [Shaun]

- How big is a 'pure price' effect? [3][Tina]
- What is the (social-psychological) effect of combining information on and responsibility for personal emissions in single instrument? [8] [Stuart, Tina, Joshua, Yael]
- What can laboratory experiments tell about the effect of context? [4] [Stuart]
- How might social attitudes change? [2]
- Given all of these, what is the likely range of effects? i.e. how big is the carbon benefit? [2] [Stuart]
- What could realistically be trialled?
- Is society willing to and able to stay within cap through empowerment and re-enfranchisement and so achieve what other instruments can not i.e. speedier and more radical emissions reduction? [4] [Yael]
- Can/should auction revenue from DTQs be reallocated on a per capita basis? [1]
- Implications for scheme design?

Social and political acceptability

- How important is equity to acceptability? [1] [Alberto; Rachel]
- How does acceptability compare to alternative policy options? [1] [Alberto; Rachel]
- How important is knowledge / perception of PCT to acceptability? [1]
- What is the spread of opinion by social group? [1]
- How might this change?
- What will be the key political determinants? [1]
- What are the potential roles for local Government and the voluntary sector?
- Further longer-term deliberative research exploring different engagement techniques and assumptions. [1]
- Implications for scheme design?
- PCT in the context of the policy process/cycle [4] [Joshua]

Detailed equity and distributional impacts [4] [Rachel]

- Aviation and public transport emissions [1]
- Different ways of recovering running costs
- 'Opportunities to act' to reduce emissions and associated costs [3] [Tina; Joshua]
- Distribution of household emissions over time (as cap tightens) [2] [Tina]
- Actual household and road fuel data, alongside housing and income
- Incorporate costs and revenue associated with implementation, administration and auctioning, as well as impact on the taxpayer
- Who are the losers of concern (low income, elderly, rural, in hard to treat homes etc)? Can the effects be mitigated? [4] [Yael; Tina]
- Implications for scheme design? [1] [Yael]
- Analysis of distribution of UK carbon footprints/emissions e.g. sample several thousand. [Tina] [2]

Implications for other policies [4]

- Is PCT designed to replace or complement the EUETS and CRC? [Join to the 'PCT effect' under 'costs'] [4] [Andy; Nick; Arnaud; Tina]
- What is the relationship to CERT and supplier obligation? [Andy; Nick; Arnaud; Tina]
- What does it imply for CCL and fuel taxation? [Andy; Nick; Arnaud; Tina]
- How are fuel poverty and other social goals affected? [2]
- Is it a driver for better information and advice? Or are these precursors?
- Are there any implications for product and building regulation and labelling?

- Analysis of double counting issues and compatibility issues [join with PCT effect] [3] [Andy]
- Analysis of what really is or isn't working and what PCT could/should replace [3] [Yael; Andy]
- How should we test and compare policy options/pathways? What does such a comparison reveal?
- Implications for scheme design?

Enforcement [2] [Nick; Yael]
- Upstream, midstream or downstream? Who has the obligation to stay within the cap? [2]
- What are the penalties if they don't?
- What are the implications of a formal buyout mechanisms versus a penalty?
- Who will enforce?
- How will it be enforced? Civil or criminal law?
- Implications for scheme design?

Scope and boundaries [2]
- Can personal responsibility be extended from supplier to user, so that indirect emissions included? What is possible/impossible? [2]
- How should personal carbon (e.g. re. aviation, PT, electricity) be measured – what level of detail/accuracy is necessary and relevant? [3] [Andy]
- Is the existing tax system a good enough model for defining boundaries relating to small businesses?
- Would leakage be a real problem (at any scale of implementation)? [3] [Arnaud]
- Implications for scheme design? [1]
- Embodied energy of imports [1] [David]
- Consequence/non-feasibility of two markets: personal vs commercial [1] [David]
- The use of TEQs as an energy rationing system under fuel scarcity [1] [David; Shaun]

Additional issues:
Scale (EU dimension)
Cross-cutting dynamics
Policy intensity/trajectory
Economic conditions
Fuel scarcity

Appendix 7: Attendees research interests

Arnaud Brohé, PhD Student at Université Libre de Bruxelles

My research interests relate to the practicalities of a personal carbon trading system and in particular the functioning of this market vis-à-vis to other carbon markets (EU ETS, voluntary, etc.). I am analyzing facts and figures from existing markets in order to identify potential issues that may arise if we were to implement a carbon market for individuals. Lack of independence from the politicians who set the individual targets, transactions costs, double (or multiple) counting issues of emission reductions and the risk of carbon leakages are the main shortcomings of implementing such a scheme. Consequently policy-makers involved in the development of a personal carbon trading scheme should take this issues into consideration while designing experimental schemes.

In order to reduce transactions costs and administrative burden for citizens I am also investigating the potential of domestic project-based flexibility mechanisms (baseline and credits approach) that would include household emissions in the post 2012 EU Emission Trading Scheme.

Stuart Capstick, Cardiff University

I have recently begun a PhD within the Psychology department at Cardiff University investigating 'Climate Risk Discourses', for which I will be using qualitative longitudinal methodology to investigate how public discourses in respect of climate change have changed and developed over the past two decades. For this work, secondary analyses will be applied to a range of studies already undertaken, with later primary research building on findings. Analysis of material according to sociodemographic, cultural and psychological factors is anticipated, with results placed in the context both of current environmental psychological thinking and energy policy.

It is my belief that psychological aspects are important to the debate about PCT, for example where considering the potential for PCT to 'engage' people or to make carbon consumption more visible and personal. In this vein I have, together with Prof. Alan Lewis of the University of Bath, carried out a literature review on the 'Psychology of Personal Carbon Trading' for the IPPR think-tank. We are also currently in the process of carrying out some experimental work (funded by UKERC) to test framing effects of PCT (i.e. whether the presentation of carbon information within a PCT system would have a different effect on environmentally-relevant decision-making than would a carbon tax). Over the past year (during which I have completed a Psychology Masters at Bath) I have in addition carried out research into the experiences of participants in Carbon Rationing Action Groups (CRAGs), finding particularly that social accountability and budgeting effects have the potential to influence choices. My Masters dissertation studied attempts by a small, Bristol-based organisation to influence people's transport behaviours in a pro-environmental direction.

Previous research work has included a review of the links between culture and health in Polynesia, and analysis of educational interventions (both whilst at University of Otago, New Zealand, 2006-7); design, implementation and evaluation of a large-scale peer-mentoring scheme at Bournemouth University (2001-4); and research assistant work in a psychiatric hospital (2000-2001).

Dr David Fleming, Director, The Lean Economy Connection

Past/published research:

-- (1996), "Stopping the Traffic", *Country Life*, vol 140, 19, 9 May, pp 62-65; original proposal of personal carbon trading model "tradable quotas",
-- (1996 and 1997), *Tradable Quotas: Setting Limits to Carbon Emissions*, Discussion Paper 11, London: The Lean Economy Connection;
-- (1997), "Tradable Quotas: Using Information Technology to Cap National Carbon Emissions", *European Environment*, 7, 5, Sept-Oct, pp 139-148;
-- (1998), "Your Climate Needs You", *Town & Country Planning*, 67, 9, October, pp 302-304);
-- ed (1998), "Domestic Tradable Quotas as an Instrument to Reduce Carbon Dioxide Emissions", European Commission*, Proceedings,* Workshop 1-2 July, EUR 18451;
-- (2003), "Building a Lean Economy for a Fuel-Poor Future", in Richard Douthwaite, ed, *Before the Wells Run Dry: Ireland's Transition to Renewable Energy*, Dublin: Feasta;
-- (2005), The Credit System that Can Really Cut Global Warming", *Radical Economics*, 27, p 4.
-- (2005 and 2007), *Energy and the Common Purpose: Descending the Energy Staircase with Tradable Energy Quotas (TEQs),* London: The Lean Economy Connection.

Current Activity

At present I am working jointly with Shaun Chamberlin, on a report on the application of Tradable Energy Quotas as a rationing scheme to be used at a time of energy scarcity, commissioned by The All-Party Parliamentary Group on Peak Oil and Gas (APPGOPO). Shaun is TEQs Development Director at the Lean Economy Connection.

I am close to completion of a book which sets Personal Carbon Trading (Tradable Energy Quotas) in the context as the key response to the range of current hazards, including energy deficits, food, water, social and economic stresses. Title: *Lean Logic.* Publisher: (negotiations current).

Future aspirations/interests

To develop wide recognition of the role of PCTs/TEQs as a form of intrinsic motivation. To raise awareness of the need to have an energy rationing/guaranteed entitlement system in place, ready for application both as a pathway for reducing carbon emissions and as an entitlement system ensuring fair access to energy when the coming shortages in petrol/diesel, gas and electricity begin.

Dr Tina Fawcett, Senior Researcher, Lower Carbon Futures Group, ECI

Much of my work about PCT has been general in nature, exploring the arguments for and against PCT, looking at who might win and lose and comparing this policy with other possible options. I have developed thinking on this topic within my PhD thesis and in more accessible formats (e.g. a co-authored booking making the case for PCA in the UK (2004) and USA (2007)).

Most recently I completed a report, with Catherine Bottrill and others, investigating whether it would be possible to design a worthwhile research trial of PCA and if so, what could be learnt. We concluded that a trial would add significantly to knowledge, despite its inherent limitations, and proposed three different example trial designs. I have also worked with Danish researchers looking at how different energy use patterns, policies and infrastructure in the UK and Denmark would interact with PCT.

In the future I would like to be able to make use of empirical data to further investigate the distribution of UK carbon footprints, to understand in much greater detail who would 'gain' and 'lose' under a PCT scheme.

UK Energy Research Centre

Rachel Howell, Researcher, Environmental Change Institute, University of Oxford.

My research interests are in the field of climate change policy and community initiatives to reduce greenhouse gas emissions at a household level, particularly through behavioural change. I am concerned about issues of justice, equity and public opinion and how these shape, and are impacted by, policy.

As part of ECI's work on PCT I am currently researching Carbon Rationing Action Groups (CRAGs) in order to determine whether they have anything useful to tell us about the potential design of a PCT policy.
Carbon Rationing Action Groups (www.carbonrationing.org) are grassroots groups of concerned citizens who set themselves a carbon ration for the year and provide support and encouragement to members seeking to reduce their carbon footprint. Some groups have a price for carbon for those who exceed the target, and even basic trading systems whereby under-emitters are rewarded using the financial penalties collected from over-emitters. These groups are therefore operate the nearest thing in existence to PCT. I have been interviewing members of different CRAGs to discover whether and how they have cut their emissions, and what they have found easy/difficult about trying to do so; what they think about personal carbon trading, both within CRAGs and in a nationwide, compulsory scheme; and the significance of being in a CRAG, given that emissions reductions are made at an individual/household level.
In 2007 my MSc dissertation was about public acceptability of personal carbon allowances. I ran five focus groups which discussed and compared PCT with carbon taxation. Participants completed questionnaires prior to and after taking part in the focus group discussions in order to statistically analyse changes of opinion. I found that the majority of participants preferred PCAs to carbon taxation, both before and more so after the discussions.

In January I will begin doctoral studies at Edinburgh University as part of the Scottish Alliance for Geosciences, Environment and Society (SAGES) initiative. The PhD will look at the potential for climate change mitigation through education and the intention is to consider PCT as part of that.

Dr Andy Kerr, University of Edinburgh / E3 International Pty Ltd

Can a personal carbon trading scheme fit into the current and future UK/EU policy landscape?
The practical application of a PCT scheme involves a series of interactions with existing and proposed economic instruments [EU ETS; Carbon Emission Reduction Target (CERT); proposed Supplier Obligation (SO)], as well as the wider policy framework (building standards; mandatory vehicle fleet efficiency standards). My research explores the practical implications of these interactions; and the extent to whether a PCT scheme can operate within the current policy framework. This has implications for carbon accounting (double counting allowances); "double regulations" and practical policy making.

Is a personal carbon trading scheme more efficient than current UK policies at delivering emission reductions?
My interest is in the relative efficiency of a PCT scheme compared with the current/proposed policy framework for reducing emissions. Current policies appear rather good at delivering technical efficiencies from the residential sector but rather poor at delivering such efficiencies in the transport sector. My research examines

whether a personal carbon trading can deliver emission reductions more efficiently than current/planned policy frameworks.

How do individuals (and organisations) behave in emissions trading schemes?
The putative value of a PCT scheme appears to lie in the possibility of changing society's normative behaviours…rather than because it can deliver technical efficiencies in energy use (which appear to be achievable more efficiently with other instruments). But how do individuals behave in emissions trading scheme? My research draws on actual organisational behaviour in the EU & (old) UK Emissions Trading Schemes to examine how individuals might behave in a putative PCT scheme.

Recent published work sponsored by the Royal Society for the encouragement of Arts, Manufactures and Commerce (RSA):
Personal Carbon Trading: Economic efficiency & interaction with other policies October 2008
http://www.rsacarbonlimited.org/viewarticle.aspa?pageid=753&nodeid=1

Laurence Matthews, Chair, Cap & Share UK

I will report on developments in Ireland, where Cap & Share is being evaluated by the Irish government. Research commissioned by Comhar in Ireland and carried out by AEA and by Cambridge Econometrics will be summarised, as well as relevant findings from other recent research work.

I will give a perspective on the relationship between C&S and PCT (and other approaches such as carbon taxes, emissions trading schemes, upstream auctions, etc.). Simple diagrams can clarify many of the issues and misconceptions that arise. Finally I will summarise our views on research needs, and set these research questions in a wider perspective of setting priorities for tackling the climate emergency currently faced by humanity.

Deborah Strickland, Environmental Change Institute, University of Oxford.

Deborah Strickland works as a researcher at Oxford University's Environmental Change Institute within the Lower Carbon Future Team. Under the umbrella of Personal Carbon Trading, she is looking specifically at how individuals will need to budget carbon in their everyday lives, and is examining a range of tools which will help make carbon more visible and easily managed. She also works in communications for the Environmental Change Institute, has an MSc in Applied Meteorology and has worked for the Met Office.

Dr Yael Parag Senior Researcher, Environmental Change Institute, University of Oxford.

Some of the questions I am investigating with respect to Personal Carbon Trading (PCT) are: what do people need to own, have, learn and know in order to manage a carbon budget and stay within its limits, and what policy features can assist them? What lesson can be drawn for PCT from other policies? What different political and social barriers PCT will have to be overcome in order for it to be a valid policy option?

My main research interest is in the process through which environmental public policies are shaped. I investigate actors' networks (network: a structure of interrelations and interdependencies between state and non-state actors who have interest in a policy issue and are involved in the policy shaping process) and their various effects along the different stages of the policy process.

Richard Starkey , University of Manchester / Tyndall Centre

My current activity re PCT has involved
(1) writing and recently submitting an overview paper on PCT to the journal Global Environmental Change
(2) working to finish off a very long (35K words) working paper on the fair allocation of emissions rights. It's almost done.
(3) submitting a project proposal on PCT, peak oil and equity to the ESRC/AHRC. Submitted in July and I hope to hear soon whether application successful.

Dr Alberto Zanni, Loughborough University

The research we carried out on personal carbon trading was commissioned by the Royal Society for the encouragement of the Arts, Manufactures and Commerce (RSA) and commenced in December 2007. The research has developed with the following two main objectives:

- To explore individuals/households' preferences for Personal Carbon Trading scheme design attributes and associated value / cost.
- To explore individuals/households' possible behavioural responses to a Personal Carbon Trading system and the value / cost of such changes.

A survey was developed and carried out in two phases in 2008. A pen and paper based survey was carried out in January 2008 during the Cardiff Citizen Forum and comprised of 79 respondents. A computer based hall test survey was implemented in May/June in the South East of England with 208 respondents. The survey contained an exploration of the stated behavioural response to a PCT and a Carbon Tax (CT) and two stated preference experiments exploring preferences with respect to design attributes of a PCT and preferences between a CT and a PCT. The survey also contained a behavioural exercise with the purpose of exploring the likely behavioural adaptation (in terms of domestic and transport energy usage) to both CT and PCT. The main aim of this section of the survey was to identify the behaviours likely to be affected and the potential magnitude of change.

The research work was carried out by Abigail Bristow and Alberto Zanni at Loughborough University, and Mark Wardman and Phani Kumar Chintakayala at the University of Leeds. Results were recently presented at the European Transport Conference. The papers which were presented at the conference are currently under revision in order to be submitted to scientific journal by the end of the year.

Published papers:
Bristow, A.L., Zanni, A.M. and Wardman, M., ''Personal Carbon Trading and Carbon Tax: exploring behavioural response in personal transport and domestic energy use'', European Transport Conference, Netherlands, 8th October 2008.
Bristow, A.L., Zanni, A.M., Wardman, M. and Chintakayala, V.P.K., ''Using stated preference to explore design options for a personal carbon trading scheme'' European Transport Conference, Netherlands, 8th October 2008.