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Personal carbon trading in different national contexts

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Although personal carbon trading (PCT) is envisaged as a policy which could work in many developed countries, most research work has been undertaken in a UK context. Could the significant national variations in energy infrastructure, policy and patterns of personal carbon emissions diminish the viability and effectiveness of PCT outside the UK? This preliminary work has identified important national and regional variations in the EU and the USA, gathered together relevant data, and identified additional challenges for PCT not hitherto recognized within UK-focused research. A research agenda for internationalizing PCT research is proposed, which details the data, methodological development and future debates needed. Consideration of the appropriate geographical scale for implementing PCT suggests national rather than EU-level implementation within Europe, although subnational, state-based implementation may be relevant in the USA. While close attention must be paid to the interaction of PCT and individual national contexts, and detailed design of the policy is likely to vary between nations, the evidence suggests that PCT could be of relevance for many countries, not just the UK.

Keywords: equity; per-capita emissions; personal carbon trading; policy options

Bien que la politique d'échange de carbone individuel « Personal Carbon Trading » (PCT) soit envisageable dans nombreux pays développés, la plupart des travaux de recherche ont été entrepris dans le contexte du Royaume-Uni. Ainsi, les importantes différences qui existent en infrastructure énergétique, en politique et en tendances en émissions individuelles de carbone pourraient-elles diminuer la viabilité et l'efficacité du PCT à l'extérieur du Royaume-Uni ? Ce travail préliminaire a permis d'identifier d'importantes différences nationales et régionales dans l'UE et aux Etats-Unis, de rassembler des données pertinentes, et d'identifier des obstacles supplémentaires au PCT qui jusque-ici n'avaient pas été reconnus dans des travaux concentrés sur le Royaume-Uni. Un programme de recherche pour l'internationalisation des travaux sur le PCT est proposé, décrivant les besoins en matière de données, développements méthodologiques et débats futurs. L'échelle géographique appropriée pour la mise en œuvre du PCT, serait, en Europe, celle des Etats plutôt que de l'UE, et aux Etats-Unis, une mise en œuvre sous-nationale, au niveau des Etats, serait appropriée. Alors qu'une attention particulière doit être portée à l'interaction du PCT au sein des différents contextes nationaux, et que la structure détaillée variera entre pays, les faits montrent que le PCT pourrait être applicable dans beaucoup d'autres pays hormis le Royaume-Uni.

Mots clés: echange de carbone individuel; émissions par habitant; équité; options de politiques

1. Introduction

This article was prompted in part by a Belgian colleague's remark that she wasn't particularly surprised that personal carbon trading (PCT) has been developed as an idea in the UK, an island nation, as opposed to Belgium, where most people live within easy reach of an international border. It made me wonder whether the geography of a country is important in terms of PCT and, if so, why? More broadly, it prompted reflection on whether there are particular national

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characteristics, including geography, which would determine the applicability or attractiveness of PCT as an idea. Is there something special about the UK which has led to the idea being developed here, but which will prevent its wider spread?

Personal carbon trading is a policy idea whose aim is to reduce carbon emissions effectively, efficiently and equitably, using citizen engagement as one of the mechanisms to deliver change. While there are different versions of PCT (see Fawcett and Parag, 2010, for more details), the common features are that each individual is given a free tradable carbon allowance which covers the carbon emitted directly from their household energy use and/or personal transport. Individual allowances in PCT schemes do not cover the embodied carbon emissions in goods and services; only emissions from direct energy uses are included. Allowances would reduce over time in line with national emission reduction targets. Personal carbon trading is, in effect, a downstream cap-and-trade proposal. This idea has attracted political, academic and civil society interest in the UK in recent years, and been the subject of a government-sponsored 'pre-feasibility' study. However, at present, PCT is in the development stage – with full details of its design, implementation, likely effects, costs and enforcement still being worked out. The UK government has no intention of introducing PCT at present, declaring it an idea that is 'ahead of its time' (Defra, 2008a).[1] Most research and debate is confined to the UK (and undertaken within its policy, economic and social contexts) and, as a result, critical development of the concept is advancing more slowly than if wider international interest were engaged.

Two major strands of PCT thinking, 'personal carbon rations' (or allowances) and 'domestic tradable quotas' (now known as tradable energy quotas), were developed by independent researchers based in the UK (Fleming, 1997; Hillman, 1998). Their ideas have been further developed by teams of researchers in a number of UK-based centres, including the Universities of Oxford, Leeds, Loughborough, Manchester and Edinburgh, the Royal Society of Arts (which ran a 3-year programme on PCT) and the Institute for Public Policy Research (Fawcett, 2004; Starkey and Anderson, 2005; Bristow et al., 2008, Harwatt, 2008; Kerr and Battye, 2008; Parag, 2008; Prescott, 2008; Bird and Lockwood, 2009). There has been some work looking at how PCT might be applied in the USA (Hillman et al., 2008; Niemeier et al., 2008), a joint UK/Danish research study (Fawcett et al., 2009) and preliminary research from Sweden (Varnas and Nykvist, 2009). This work has uncovered some new issues which were not previously identified as being important. For example, the Danish research highlighted the complexities of accounting for carbon emissions where household energy is provided via combined heat and power systems. The challenge, therefore, is to conduct a more systematic review of the potential of PCT beyond the shores of the UK.

This article represents a preliminary look at factors which might interact with PCT in different countries. Further, it asks whether the nation state is the only scale at which PCT could or should be considered, or if it could work at an international or subnational scale. The case of PCT as a policy instrument can be seen as part of a wider set of arguments regarding the institutional arrangements that are likely to be most effective in combating climate change.

The article is structured as follows. Section 2 outlines a number of factors which might affect the salience of PCT in different national contexts. In Section 3, the possibility of introducing PCT at the EU level is considered, as are options for subnational introduction. These themes are brought together in the Discussion section (Section 4) and a research agenda for internationalizing PCT research is developed. Finally, conclusions are drawn.

While most of this article applies to PCT in general, some aspects are only of relevance to versions of PCT which cover emissions from personal air travel, as well as all other personal travel and household energy use, the best-known example of which is 'personal carbon allowances' (Hillman and Fawcett, 2004).

2. PCT in different national contexts

The purpose of PCT is to provide a framework for significant and sustainable reductions in carbon emissions from direct personal energy use. Whether PCT can deliver such changes depends not only on its inherent characteristics but also on how it interacts with existing policies and economic, social and energy-use patterns. PCT would need to operate in substantially different energy and carbon emissions landscapes if it is to have international applicability. In this section, the energy and carbon emissions-related factors which seem most likely to influence whether and how PCT could be implemented, and how socially/politically acceptable it might be, are identified and discussed. These factors are split into three categories: general, household energy, and transport. There are other factors which would also have an important bearing on the relevance of PCT, including governance structures, policy-making environments, wider social policy, and national and international politics. One article in this special issue considers the political and policy barriers to the adoption of PCT (Parag and Eyre, 2010), while another considers the issues around regulation and enforcement (Eyre, 2010). What follows is therefore a partial analysis of the factors which may influence the relevance of PCT to different nations, focused on energy- and carbon-related issues.

2.1. General

Two questions which might affect the perception of PCT by national policy-makers are considered here:

1. How much more policy action is thought to be necessary in order to reduce carbon emissions?
2. How significant are personal carbon emissions as a proportion of the national total?

The salience of PCT should increase with increasing urgency for further emissions reduction, and the greater proportion of national emissions that it can tackle.

2.1.1. Progress with emissions reduction

Whether a country is in need of new policy ideas to deliver greater carbon emissions reductions in the medium-to-long term will influence its interest in PCT. Each country has different current per capita emissions, national targets, Kyoto commitments, and a range of existing and planned policies designed to reduce energy use and carbon emissions from the household and personal transport sectors. Some European countries are currently on target to meet their Kyoto commitments (e.g. the UK, Sweden, Germany) and others are not (e.g. Denmark, Ireland, Italy, Spain) (EEA, 2009). The USA does not have a Kyoto commitment and its carbon emissions continue to rise (EIA, 2009b: Table 12.1). Countries are setting their own medium- and long-term carbon reduction goals, which vary in their degree of ambition. The UK has recently adopted the legally binding target of an 80% reduction in national greenhouse gas emissions by 2050, and a reduction of 26% of carbon dioxide by 2020, compared with a 1990 baseline. Germany has set a more challenging target of reducing emissions by 40% by 2020 compared with 1990. Many American states have their own reduction targets and national legislation is being proposed to reduce carbon emissions by 17% by 2020 compared with 2005 levels. The need and perceived need for immediate increased policy effort therefore varies between countries, and between states in the American case. However, if a rise in average global temperature of above 2°C (thought to be the threshold for 'dangerous'

climate change) is to be avoided, the IPCC has said that developed countries will need to reduce emissions by 25–40% from 1990 levels by 2020 and by 80–95% by 2050 (IPCC, 2007). To deliver mid- and long-term reductions on such a dramatic scale, most – if not all – countries will need more radical policies, and PCT may be one possible option. But it will only be recognized as such if its potential as a framework for delivering sustained, longer-term savings is emphasized. There are many simpler, more established, policy options available which can deliver modest savings in the short term.

2.1.2. Variations in national carbon emissions

UK discussions about PCT have taken place against a background of direct personal carbon emissions (DPCE) being known to comprise over 40% of national carbon emissions.[2] But if, in other countries, these emissions formed a significantly lower percentage of the national total, might this reduce policy-makers' interest in PCT? The first thing to establish is how emissions patterns vary by country. The International Energy Agency has published aggregate data on 14 of their member countries,[3] including the USA, the UK and Japan, which showed that in 2004, carbon emissions from total final energy consumption were as follows: 22% from passenger transport and 23% from household emissions – a total of 45% (international aviation is not included in these figures) (IEA, 2007). Thus, on average for these countries, personal carbon trading would cover a significant proportion of national emissions. This average is likely to hide variations and, for example in countries with low carbon intensity of electricity (e.g. France, Norway and Sweden), DPCE may be less significant. Unfortunately, the IEA does not publish data in this format for individual countries and is unwilling to release it (IEA, personal communication), it is not published in international statistics (e.g. EEA, 2008), and neither do national governments generally make this data available, so it has been necessary to look elsewhere for evidence.

One source of information about national carbon emissions from a householder or consumer perspective is the literature which uses 'input–output' models to understand aspects of household carbon footprints (e.g. Weber and Matthews, 2008; Druckman and Jackson, 2009). This research focuses on identifying the carbon emissions related to particular forms of consumption or societal functions (e.g. housing, clothing, food, healthcare) and extending the analysis to include international trade. While researchers are likely to have data which make it possible to determine emissions from household energy use and personal travel, this is usually not published in their articles. Contacting these authors and following up this possibility is a future research task.

The limited data on DPCE which are available have been compiled as Table 1. This demonstrates that, for the countries analysed, DPCE are typically 30–50% of carbon emissions. If a multiplier is used for the non-carbon effects of air travel, this percentage increases. So for Ireland, if a multiplier of 2.7 were used for air travel, DPCE would increase to 58% of national carbon emissions.[4]

The available evidence demonstrates that personal emissions in the UK do not account for a much higher percentage of national emissions than in a number of other countries. However, in some countries, personal emissions may make up a significantly lower proportion of the national total. More research is needed in order to establish the percentage represented by direct personal carbon emissions in a wider range of countries.

2.1.3. Distributional issues

As with any policy, if PCT were introduced there would be winners and losers. Within the UK PCT debate, the issue of equity has been very important, with particular concern about the extent to which PCT would further disadvantage the poorer and more vulnerable members of society. This

TABLE 1 Direct personal carbon emissions in various countries

Country	Year	Per capita DPCE (tCO_2/year)	% national fossil fuel emissions	Data sources	Notes
Denmark	2006	3–4	30–40	Fawcett et al., 2009	Estimate based on national statistics
Ireland	2006	5.6	50	Kenny and Gray, 2009 McGettigan et al., 2009	Sample of 103 households
UK	2006	4.2	42	Defra, 2008b DTI, 2007	Based on national statistics
USA	2006	8.5	43	[Q5]Hillman et al., 2007	Based on national statistics

concern comes from a long history of social equity being important in energy policy development, with particular concern for those in fuel poverty (Boardman, 1991). UK research shows that PCT based on equal per capita allowances is generally progressive, i.e. low-income households would receive allowances in excess of their emissions, while high-income households would not receive enough (Ekins and Dresner, 2004). Nevertheless, some low-income households would still be disadvantaged (Thumim and White, 2008) and this is of ongoing concern. Work in the USA which looked at both equal per capita and equal per household allowances for household energy in California (personal transport not being included) also concluded these allocations would be progressive (Niemeier et al., 2008). In the UK, the likely distributional impacts of PCT have generally been seen as a factor in its favour.

Whether the distributional impacts of PCT are crucial to its acceptability will depend not only on what these effects are, but the degree to which equity is an important criterion in policy-making. The author's expectation is that DPCE outside the UK would generally rise with income, and therefore that PCT would be generally progressive. However, further research is needed to establish this. There are considerable differences between EU countries in terms of income inequality (Eurostat, [Q1]2009), and this may influence the importance of equity considerations in policy-making. In countries with lower income inequality than the UK and few concerns about fuel poverty, the equity aspect of PCT – at least as it applies to the less well off – might be less important.

2.2. Household energy

2.2.1. Climate and geography

The UK, being a fairly small country, has a relatively uniform climate. There is little variation in average energy use between the warmer south and colder north, with per capita household energy consumption in Scotland (the most northerly part of the UK) being less than 5% above the national average (calculations based on DECC, 2009). Climate alone does not determine heating and cooling energy usage; other factors, such as building and heating/cooling equipment standards

and cultural norms around comfort, are also important. Regions with colder climates tend to build better-insulated homes. Average energy use per household in Sweden for space heating is very similar to that in the UK, despite Sweden's much colder climate (and bigger houses) (EEA, 2008). Nevertheless, in some countries, climate varies hugely, and so too may household energy use and consequent carbon emissions. Could large differences in regional household energy carbon emissions prevent PCT from being considered as a policy option?

Energy use in the USA shows considerable regional variations. In the more northerly states, energy demand is dominated by heating, whereas cooling is the primary energy use further south. Compared with the national average, energy use per household is 40% lower in Florida and 17% higher in New York state (EIA, 2009a: Table US9). Given that energy use in Florida is dominated by electricity (for cooling), energy-use figures provide only a partial understanding of subsequent carbon emissions. A study which looked at carbon emissions from 100 metropolitan areas in the USA showed that the per capita household emissions in the highest area were more than five times greater than in the lowest (Brown et al., 2008). The study combined local data on residential-sector fuel use with state-wide carbon intensity figures for electricity, which varied widely due to the different fuels used for generation. If national carbon intensity figures were used, less variation would be seen.

The US data makes it clear that a PCT scheme with a uniform national personal allowance could be problematic in countries where household energy use varies significantly with climate. For any country, regional variations in household emissions are very unlikely to be mirrored by variations in transport emissions, as transport choices are not primarily climate-related. Nevertheless, the issue of regional variations in PDCE, which is not an important issue in the UK, could be important elsewhere and may require a PCT scheme which features unequal personal allowances.

Brown et al.'s research (2008) raises the issue of how emissions from electricity would be accounted for in a PCT scheme. In a national scheme, it would seem appropriate to use one national figure for electricity carbon intensity. Not doing so could increase the apparent variation in personal emissions between households supplied by different regional suppliers or with access to low-carbon electricity suppliers, for no benefit in terms of carbon reduction. Requirements on producers to use lower-carbon fuels and methods for electricity generation (e.g. renewables, nuclear, combined heat and power) are already enshrined in a range of government targets at national and EU levels (within Europe). Reinforcing this requirement via the rules of a PCT scheme would be unnecessary, and could add to the complexity and perceived unfairness of the policy. The UK government uses a similar line of reasoning in its personal carbon footprinting tool '*Act on* CO_2', which uses a single carbon intensity figure for all electricity, even where 'green' electricity is used (Defra, 2008c). However, other countries may use different approaches which might give alternative insights into how PCT rules should best be designed in their context.

2.2.2. Availability of lower-carbon fuels

Space heating is the largest component of household energy use in most developed countries, including the USA, Australia and all EU Member States (except Malta) (EEA, 2008). In most countries, there is a choice of heating fuels, which may be restricted by geography, housing type, housing tenure and other factors. As heating fuels have different carbon intensities, the availability of different options leads to variations in household carbon emissions between those who have access to lower-carbon options, typically natural gas or combined heat and power, and those who do not. In the EU, access to a natural gas network varies from around 10% of the population in Finland and Sweden, to almost 90% in the UK, the Netherlands and Hungary (Eurostat, 2009a: Table 4.2). While, in the UK, discussion about those without access to the natural gas network

has formed part of the PCT debate, this only affects a minority of the population. In other countries there might be much more unequal access to lower-carbon fuels and this could challenge the perceived equity of an equal national carbon allowance. Similarly, how low-carbon electricity is allocated and accounted for, will impact the distributional effects of PCT.

2.2.3. District heating

In the UK and nine other EU countries, less than 1% of heating energy is delivered by district heating. However, in six EU countries, district heating supplies more than a quarter of final household energy consumption (Eurostat, 2009b). In Denmark, more than 60% of households get their heat and electricity from cogeneration plant combined with district heating pipes. Attaching carbon emission values to the heat and power produced in a district heating or combined heat and power scheme is problematic, and a suitable methodology needs to be developed. In addition, district heating systems require relatively large initial investments for the heat pipes. In Denmark, this cost structure could be a barrier to PCT because the present energy charging system includes a relatively large fixed amount to compensate for the initial investment costs (Fawcett et al., 2009). More research is needed on both these issues.

2.3. Transport

The issues of carbon intensity of fuel which affect the residential sector do not apply to transport because, with minor exceptions, oil is used for land, air and sea travel. However, cross-border emissions are of potential concern for transport. In addition, as with household energy, people have different access to transport systems which may lead to unequal availability of lower-carbon travel options.

2.3.1. Cross-border transport emissions

As mentioned in the Introduction, UK researchers may not have paid sufficient attention to the issue of cross-border transport emissions for geographical reasons. If PCT were introduced at the nation-state level, people would be able to avoid either using their allowances or buying additional allowances by cross-border buying of motor fuels and using international hubs for long-distance flights. The cross-border purchase of motor fuels is already an established phenomenon under the existing differential taxation rates in neighbouring countries. For example, an estimated 13% of the transport fuel sold in the Republic of Ireland is actually used across the border in the UK (Northern Ireland) (McGettigan et al., 2009). Some airports are currently used as international travel hubs by travellers from many countries (e.g. Heathrow, London and Schiphol, Amsterdam). The introduction of PCT could further encourage these cross-border activities, particularly in countries – such as Belgium – where a significant proportion of the population lives near an international border. There is a clear need to better understand the current extent of this activity by country, and what measures have been put in place to reduce it.

If countries did experience a large amount of cross-border fuel shopping, would this fatally undermine the enforceability of PCT? Given the experience of existing behaviour to avoid high national taxes or airline prices, the cross-border effects of introducing PCT in a single country could be modelled prior to implementation. Then detailed PCT rules and enforcement could be adjusted, if necessary, to compensate for avoidance behaviour. So the possibility of increased cross-border fuel/flight buying should not make PCT unworkable, but does require further investigation.

2.3.2. Accessibility

In the UK, the main concerns around PCT and transport have focused on the availability of lower-carbon transport options, and in particular the position of rural dwellers, who are more dependent on their cars. In the UK, rural residents travel 50% further by car and other private transport than people living in large urban areas (DfT, 2007). They may also face higher fuel costs (Bolton et al., 2000). Introducing PCT would add to pre-existing distributional issues, which vary between countries depending on their geography, population distribution, public transport networks and so on. Understanding existing national patterns of transport and accessibility issues will be a necessary part of understanding the distributional effects of PCT.

2.4. Summary of relevant factors

The discussion above has been summarized in terms of how each factor might affect interest in PCT as an idea (see Table 2). In this table, the factors have been categorized by issues of relevance to policy-making and to the design and implementation of a PCT scheme.

The judgements in the table are based on two assumptions: firstly, that PCT will be more attractive the higher percentage of national carbon emissions it covers (which may be debatable given the need of all countries to make deep medium- and long-term cuts in emissions); and secondly, that inequity of the outcome of a PCT scheme based on structural factors beyond individual control (e.g. highly unequal access to public transport or the natural gas network) will be very problematic. This assumption is based on experience of debates around PCT in the UK context. There are, of course, many other social/housing/transport/economic/policy-related factors which will influence both the distributional outcomes of PCT and the discussion around it.

TABLE 2 Summary of energy- and carbon-related issues which may affect national interest in PCT

Issue	Factor	More favourable to PCT	Less favourable to PCT
National policy priorities	Anticipated difficulty in meeting medium- and long-term emission reduction targets	High	Low
	Proportion of national emissions covered by PCA	High	Low
Distributional effects	Regional variation in energy demand	Low	High
	Access to lower-carbon fuels	Widely available	Restricted
	Variation in access to lower-carbon transport modes	Low	High
Technical measurement	Importance of district heating	Low	High[a]
Ease of enforcement	Cross-border purchase of fuels	Low	High

[a] Until methodology to account for carbon emissions from heat and electricity is developed.

For the UK, with the possible exception of equal access to lower-carbon transport modes, all the factors combine in the right way to make PCT a potentially attractive idea. For other countries, certain other factors could be a barrier – for instance, the cross-border purchase of transport fuels could be an issue of concern for many continental European countries. This (limited) analysis perhaps indicates that the greater interest in PCT in the UK is not just a function of the history of the development of the idea. However, it does not show that PCT would necessarily be unsuitable in other countries, but rather that more thought might be needed on particular aspects of policy design and regulation to fit circumstances different from those in the UK.

3. PCT and geographical scale

In most PCT research, the assumption has been that it would be a national policy. The ideas underpinning PCT are shared with a proposal for global emissions sharing, contraction and convergence, which is organized on a nation-state basis (Meyer, 2000). However, in theory, PCT could be implemented at the larger EU level or the smaller regional/subnational level, and these alternatives are explored below.

3.1. PCT at the EU level

Could or should personal carbon trading be implemented at the EU level? To explore this question, the grounds for introducing policy at EU level are first briefly considered. The EU is a very significant source of environmental policy within its Member States. With regard to traded goods and policy directed at industry and commerce, the main reason that environmental policy is EU-wide (rather than national) is to prevent competition distortions. This is unlikely to be a central concern with PCT. However, EU environmental legislation can also be adopted for other reasons. For example, the Energy Performance of Buildings Directive (2002/91/EC), which requires that Member States apply minimum requirements with regard to the energy performance of new and existing buildings, has been adopted in order to enhance energy security and reduce community-wide carbon emissions. Therefore, it seems possible that a case could be made for introducing PCT at the EU level.

PCT is often compared with an alternative proposal of carbon taxation with revenue recycling. It is useful to consider how carbon taxation is organized at the EU and nation-state level. In the EU Member States, household energy and motor fuels are very differently taxed, in terms of absolute amounts and in terms of purchasing power parity (Eurostat, 2009c). Member States can take different approaches to different types of fuel. In the UK, for example, there is very little taxation of household electricity and gas (largely due to concerns about the welfare of the fuel-poor), but the taxation on motor fuels is among the highest in the EU (CIOT 2009). Significant levels of taxation on energy or carbon at the EU level have never been agreed.[5] After trying, and failing, to introduce an EU-wide carbon tax as a principal means of tackling climate change during the 1990s, the EU switched to the alternative policy of an emissions trading system. Considerations of subsidiarity, legal and institutional structures, and the inherent political difficulties of the large-scale revenue transfers embodied in carbon taxation combined to make emissions trading more practical (Grubb, 2007).

Imagining that PCT were introduced EU-wide, it would be unlikely to be based on a uniform personal carbon allowance for all EU citizens. As mentioned earlier, individual countries have different current levels of personal emissions, varying national reduction targets, and may also have differentiated international obligations under a successor to the Kyoto treaty. The framework of personal carbon trading could be universal, while detailed rules and allowance levels varied between countries. The policy model could in some respects resemble that for EU ETS Phase 1, where there is

a community-wide framework within which national governments allocate emissions rights to industries within (EU-agreed) national carbon budgets. However, unlike in the EU ETS, it seems unlikely that personal allowances would be tradable EU-wide. While, in theory, it might be more economically efficient to have EU-wide trading, if there were likely to be significant monetary transfers between countries, the same political obstacles experienced in the case of proposals for EU-level carbon taxation would seem to be inevitable.

If PCT were introduced at the EU level, this would be because EU policy-makers thought that it would be effective at reducing emissions in Member States and not because it could only work on a multi-national scale. EU-level introduction of PCT would not resolve most of the issues raised in Table 2, with the possible exception of the cross-border trading of fuels. It seems most likely that EU-wide introduction could only happen after PCT had been shown to be an effective policy in one or more Member States, which is often the way in which Europe-wide environmental policy develops.

3.2. PCT at a subnational scale

Could or should PCT be introduced on a subnational level? In some countries, regional or state-level assemblies have considerable legislative responsibilities. In the UK, there are separate national assemblies/parliaments for Wales, Scotland and Northern Ireland, but none of these have tax-raising powers. Elsewhere in Europe (e.g. Germany), regional government is more powerful. In the USA, state assemblies have considerable power and the ability to set taxation levels, so that, for example, levels of gasoline taxation vary considerably across the country. Carbon cap-and-trade has been introduced at state level (for several states together) (Brown et al., 2008). In addition, there is a history of individual states taking an environmental leadership role. Therefore, in the USA there may well be a case for state-wide or multi-state introduction of PCT, something which would not seem feasible within Europe. However, regional or state-level schemes would create their own 'cross-border' problems which, depending on the economics and geography, might be more significant than national cross-border fuel/air-travel purchasing. Alternatively, the USA might choose to introduce a national scheme with regional carbon allowances, which could result in the same carbon savings as a series of independent regional schemes, but which would be very different in policy and political terms.

4. Discussion

Energy- and climate-related factors which would affect the applicability of PCT in different countries have been presented and discussed. The hypothesis is that together these factors will influence how PCT could operate and how it would be viewed by the public and policy-makers. For several factors, country-specific data are not yet available. From the widely varying carbon taxation rates in the EU, it is clear that some nations are prepared to accept more stringent policy instruments than others, and that this may vary depending on the detail of the policy and the broader context. Therefore, it would be too ambitious to claim an understanding of how PCT applicability would vary between countries. However, a start has been made on identifying important factors, gathering together the relevant data, identifying data gaps, suggesting new research directions, looking at issues of scale, and reflecting on how the implementation details of PCT may need to vary to adjust to national circumstances.

A number of research needs have been identified in this article, including:

- Calculation of average national direct personal carbon emissions for a wide range of countries. Methods for splitting transport between business and personal travel and allocating international air travel emissions will need to be developed;

- Learning from the existing household-focused research using input–output methods;
- Analysis of regional variations in energy use and personal carbon emissions;
- Analysis of variations of personal carbon emissions by income and other policy-relevant factors (e.g. rurality, age of householders, presence of children in household);
- Agreement on what (if any) multiplier to use when considering aircraft emissions;
- Development of a methodology for allocating carbon emissions to heat and electricity consumption in district heating systems;
- Understanding how the payment structure under district heating schemes would interact with PCT;
- Discussion of whether and how electricity carbon intensity figures are used regionally;
- Comparison between different national approaches for linking the purchase of low-carbon electricity to personal emissions calculations;
- Compiling current patterns of cross-border transport fuel purchasing and the use of airport hubs in other countries;
- Identifying policies which have been used to reduce leakage and gaming (for example, through cross-border transport fuel purchasing) and analysing their success rates.

Together these form a provisional research agenda for internationalizing PCT research. Importantly, most of these research needs are not specifically linked to PCT. The majority are focused on providing a better understanding of direct personal carbon emissions, how they can or should be calculated, and how they vary within a country and internationally. The information provided would inform any policy proposals around reducing personal carbon emissions.

The present lack of data focused on individuals reflects the current way in which policy is devised and delivered. Most policy does not address personal carbon emissions as one package – instead individual uses of energy are separately addressed with separate policies on transport, electricity, heating fuels, individual energy end-use equipment and so on. However, some areas of policy, particularly those engaging with behaviour, are beginning to look at an individual's energy and lifestyle choices as a whole (Defra, 2008d). The increasing proliferation of 'personal carbon footprint' tools indicates an increasing interest in this more holistic approach (Bottrill, 2007).

Considering different national circumstances has highlighted the importance of thinking flexibly about the design of PCT. It is a framework which could be interpreted in different ways to suit different national characteristics, and UK researchers' assumptions about PCT design may have narrowed its appeal. It is possible that outside the UK there is a stronger case for having differentiated personal allowances, particularly related to climate or other factors that are beyond individual control. There is a limited literature which could inform thinking about the implications of moving away from a system of equal allowances. For example, Starkey (2008) has used the philosophical literature on distributive justice to interrogate the proposition that equal per capita allocation of emissions rights is fair. Hyams (2009) writes about the trade-offs which may be necessary between simplicity and justice. With these starting points, there could be a more detailed consideration of the pros and cons of equal per capita allowances and other important PCT scheme rules which could vary with national context.

All countries will have winners and losers under PCT, and concern for distributional effects is likely to universally influence thinking on how PCT could be implemented, and what supporting policies would be needed to compensate vulnerable losers. Detailed PCT policy design could accommodate a range of different values and social priorities. For example, special arrangements could be made for vulnerable groups which may be defined differently in each country, e.g. the disabled, those living

in very rural areas, or those with no access to lower-carbon household fuels, either within the PCT design or via wider social policy.

Whatever policy is implemented to reduce personal carbon emissions (PCT/carbon taxation/increased upstream cap-and-trade), it will face similar challenges, which may vary from country to country, and it will need to adapt to work best in national (or regional) circumstances. Many of the issues raised here are not confined to PCT.

5. Conclusions

There are no unique UK characteristics which make PCT only of interest to this one country. However, of the energy- and carbon-related factors which intersect with PCT, all but one of those identified are positive in the UK. That is, those factors do not pose the same barrier to consideration of PCT in the UK as some of them may do in other countries. Contrary to the view of my Belgian colleague, the UK's (largely) island status is not the key reason why most PCT research has been UK-based. It instead seems likely that PCT has been developed most fully in the country where it was initially devised and has been relatively slow to spread to the wider academic and research community. In addition, a particularly favourable energy and carbon context has encouraged and facilitated the development of this idea in the UK.

This preliminary research suggests that different countries would be most likely to implement PCT differently. The variation in current national carbon emissions, personal carbon emissions, targets, the effectiveness of current policy, and concerns about equity and distributional effects of the policy, all suggest that specific national research and detailed national rules would be required. The UK assumption that equal per capita allowances are a vital feature of PCT design may not be valid for other contexts. It seems unlikely that PCT would be introduced EU-wide initially. More probably it would first be introduced in one or more Member States, and then adopted at the EU level if it proved successful. Subnational implementation might be of interest in the USA, with its very different governance arrangements and divisions of power between state-level and national governments.

Much more work remains to be done on understanding how PCT interacts with different national contexts. A provisional research agenda for internationalizing PCT research has been proposed, which details the data, methodological development and debates required in order to make progress. It is vital that researchers from outside the UK and from a range of disciplines are engaged with PCT, to further its development and analysis. This article aims to be part of that process.

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Notes

1. 'Social acceptability' was one of the key barriers identified by the UK government to adoption of PCT in the UK (Defra, 2008a) – although this can be contested (see Bird and Lockwood, 2009). The other barrier was the cost of

establishing and running a PCT system. Costs seem unlikely to vary considerably between countries given that the administration and technology issues would be common to all, and they are not discussed here.

2. This will differ from a comparison with emissions of all GHG gases, particularly in countries with a large agricultural sector, e.g. the Republic of Ireland, where methane and N_2O emissions can form a significant part of the national GHG total (McGettigan et al., 2009).
3. Austria, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, New Zealand, Norway, Sweden, the UK and the USA.
4. There is no agreed method of accounting for the additional climate warming effects of carbon emissions from aircraft. The multiplier developed by IPCC was 2.7 (RCEP, 2002). However, some more recent work suggests that this might be much too high and that the use of any multiplier is scientifically problematic (Jardine, 2009).
5. The EU has introduced minimum tax rates for petrol, natural gas, electricity and coal in the interest[Q2] (Directive 2003/96/EC). However, these minimum tax levels are very low and are dwarfed by many countries' national taxation rates on fuels, particularly motor fuels (Eurostat, 2009c). In addition, some countries have exemptions from this Directive.

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[Q3]Boden, T., Marland, G., Andres, R.J., 2009, 'Global, regional, and national fossil-fuel CO_2 emissions', in: *Trends: A Compendium of Data on Global Change*, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, US Department of Energy, Oak Ridge, TN.

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Queries

Q1	p.9	You cite Eurostat 2009. Should this be 2009a, 2009b or 2009c, or is it another reference?
Q2	p.23	In Note 5 you say “The EU has introduced minimum tax rates for petrol, natural gas, electricity and coal in the interest”. I do not understand what is meant by “in the interest”. Has something been left out here? Please amend this sentence so that it makes sense.
Q3	p.24	Boden et al. 2009 not found in text. Please either insert in text to delete from References.
Q4	pp.26/28	Please check the titles and add the page numbers for Eyre 2010, Fawcett and Parag 2010, and Parag and Eyre 2010 at proof stage. They are all in this Special Issue of *Climate Policy*.
Q5	p.29	Hillman et al. 2007 is included in Table 1 but is not in the References. Should this be Hillman et al. 2008 or is it another reference?