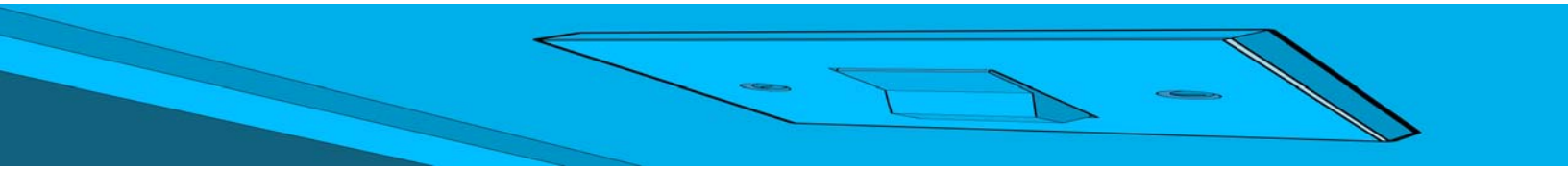

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PERSONAL CARBON TRADING: EXCLUDING PUBLIC TRANSPORTATION

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Introduction

Personal carbon trading (PCT) is a proposed quantity-based policy instrument for reducing the carbon emissions emitted by individuals. The aim of the scheme would be to deliver guaranteed levels of carbon savings in successive years in an equitable way. A PCT scheme would set a total cap on all carbon emissions generated from the fossil fuel energy used by individuals within the home and for personal transport, including those emissions from air travel. In the UK these personal emissions account for approximately half of all carbon emissions. A PCT scheme would be part of an economy-wide emissions trading scheme.

Each individual would receive a personal carbon allowance allocated on an equal per capita basis. Individuals would use their allowance when purchasing fossil fuel based energy for home energy and transport. If an individual exceeds his or her allowance then additional carbon units would need to be bought from the market and if an individual has surplus carbon units these can be sold. The scheme would be mandatory and administered electronically.

The intention of implementing a PCT scheme will be to motivate individuals to reduce those carbon emissions they can affect. Individuals use a variety of transport modes – private vehicles, trains, trams, coaches, buses, taxis, aeroplanes and ferries. For each mode of travel individuals have a different level of ability to reduce emissions. It is conceived that in the initial stages of implementing a PCT scheme only travel via private vehicle transport (i.e. car or motorbike) and aviation should require individuals to surrender carbon units from their allowance. Emissions from private vehicle and aviation travel need to be in the PCT scheme from the onset as they cover the majority of personal travel emissions and it is through individual decision-making that these emissions can be reduced.

It is argued in this note that for the effectiveness and simplicity of a scheme individuals should not be required to surrender carbon units when travelling on ground public transportation. This note explains the reasoning for excluding ground public transportation carbon emissions from a PCT scheme. Ground public transport is defined to be buses, coaches, minicabs, taxis, trains, trams, and the tube.

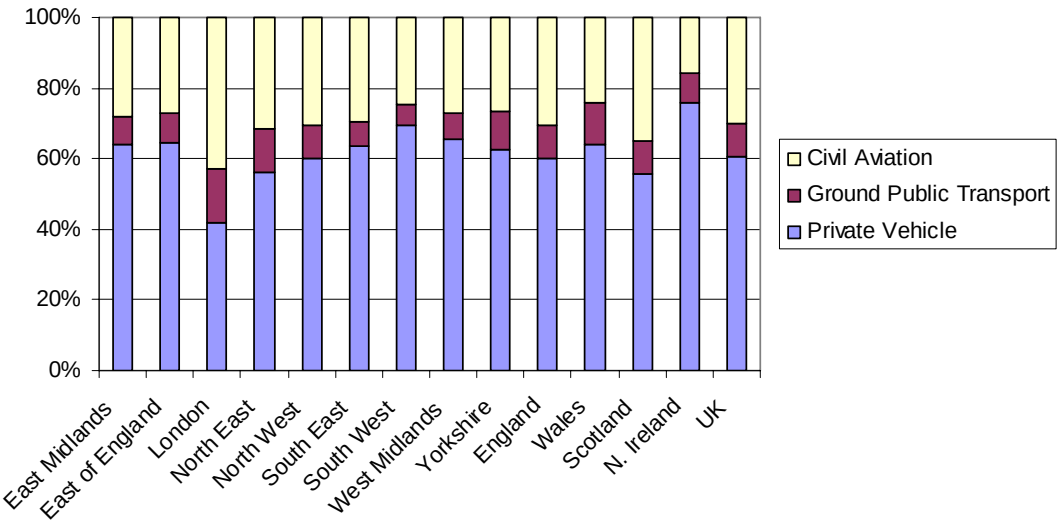
1. Only a small percentage of individuals' travel emissions are from ground public transport

Only 1.6% of individuals' total carbon emissions, which incorporates all energy use (transport and home energy) and final demand (i.e. goods and services), are from ground public transport. Even if we focus on the 40% of individuals' emissions due to travel and home energy, ground public transport accounts for only 4% of these emissions. London is the only region where the proportion of individuals' emissions from ground public transport is noticeably higher at approximately 17%, which is

largely due to the extensive public transport network low road speeds and congestion charging (ONS, 2004).

The largest proportion of transport greenhouse gas emissions, approximately 60%, comes from individuals' use of private vehicles. Individuals are directly responsible for private vehicle emissions because they make the choice to drive, therefore this is the most significant mode of transport to incorporate in a personal carbon trading scheme. The only region where private vehicle emissions are not the highest proportion of households' transport emissions is London. In London aviation emissions make up the highest proportion of household transport emissions, mainly because of the lower levels of private vehicle ownership due to high cost of owning and using cars (see figure 1 and table 1).

Figure 1: Per capita Greenhouse Gas Emissions from Transport by Region, 2001



Source: *Based on data from the Census (2001) & Office National Statistics (2004)*
Notes for figure 1: *Civil aviation: For the Office of National Statistics (ONS) report all aircraft emissions were allocated to UK residents. Ideally ONS wanted to separate aircraft emissions due UK households and foreign households but it was not possible for the report. Therefore, it was assumed in their calculations that UK residents travelling on foreign airlines and non-residents travelling on UK airlines go someway to netting each other off. Some attempt was made to separate freight and business travel using data from the national travel survey and the international travel survey.* ***Private vehicle****: road vehicles combusting petrol and diesel.* ***Ground public transport****: railways, tubes, trams, buses, coaches, minicabs, and taxis.*

There is a wide variation in CO_2 emissions depending on the mode travelled. The amount of CO_2 emitted per passenger kilometre will depend on a variety of factors including: the mode, fuel type, energy efficiency and occupancy level. Furthermore, there are often significant variations in the amount of CO_2 emitted per passenger kilometre within the same mode of transport, for example, an older diesel passenger

train emits 71g CO_2 and newer diesel emits 55g CO_2 per passenger kilometre (see Table 1). Therefore, a good argument could be put forward to include rail travel into PCT so as to encourage passengers to travel on train services that have lower emissions and thereby motivate rail companies to upgrade their fleets. However, as rail is such a small percentage of the average total distance travelled per passenger the emphasis of a PCT scheme in the first instance should be on private vehicle and aviation travel. At a latter stage it could be beneficial to include rail travel in a PCT scheme, particularly on the fast trains that are energy intensive.

Table 1: CO_2 emissions / passenger km & total passenger by transport modes 2005

Transport mode	**CO2 emissions per passenger km (g CO2/ passenger /km) based on AVER. passenger loads**	**CO2 emissions per passenger km (g CO2/ passenger /km based on Max. passenger loads**	**Total average distance travelled by each mode of travel (km)***	**The total Kg CO2 emissions per passenger by mode of travel (total grams of CO2 per passenger)****
Petrol cars (fleet weighted average)	110	43		
Diesel cars (fleet weighted average)	106	41		
All Cars (fleet weighted average)	109	43	9,194	1002
Modern petrol cars	104	41		
Modern diesel cars	100	39		
Bus	76	-	566	43
Mopeds	75	-	56	4
Motorcycles	94	-		
Passenger rail (fleet average - diesel)	41	-		
Passenger rail (fleet average - electric)	56	-		
Passenger rail (average UK - electric and diesel combined)	49	-	738	36
Older diesel passenger locomotive (Class 43 HST train set - London-Bristol route - Year in service: 1976)	71	31		
Modern passenger DMU (Class 180 Adelante DMU 5-cartrainset - London-Bristol route - Year in service: 2002)	55	26		
Older electric passenger locomotive (Class 91 locomotive set - London-Edinburgh route - Year in Service: 1988)	19	13		
Older electric passenger EMU (Class 318 EMU 3-car trainset - Glasgow-Ayr route - Year in service: 1985)	Not available	21		
Modern electric passenger EMU (Class 373 - Eurostartype - 16-car trainset - Year in service: 1993/1995)	22	15		
Air - long haul	110	-		
Air - short haul	180	-		

Source: *(Brennan et al., August 2005) and *Department for Transport (2005) **calculated by multiplying the CO2 emissions per passenger kilometre based on average passenger loads by the total average distance travelled for each main travel mode.*

2. Difficult to calculate individuals' ground public transport emissions

It is difficult to accurately calculate the emissions related to an individual's travel on ground public transportation due to the lack of accurate data on emissions factors, occupancy levels and distance travelled. First, the emissions factor will vary due to the fuel type use, for instance, the emissions factor will depend on whether it is a diesel bus or LPG bus as well as local conditions, for example, urban driving emits 50% more per kilometre than rural driving (NETCEN, 2003). Second, real-life driving conditions and auxiliary equipment on the vehicle will also affect the emissions factor. For instance, modern urban buses with air-conditioning have 21% higher emissions in congested conditions in Oxford than the national average (Go-Ahead, 2005; NETCEN, 2003). Third, people travel for varying distances on ground public transport. Public transport operators know where passengers board, but typically not where they leave, which as a result makes it difficult to calculate the passenger emissions for that trip. Given these accounting issues it will not be possible to calibrate ground public transport emissions for each individual's journey. As a result a standardised emissions deduction based on national or regional averages per kilometre would have to be applied and this is likely to reduce people's confidence in the scheme.

3. Significantly reduces the number of transactions

If carbon units have to be surrendered every time an individual travels on ground public transport this would greatly increase the number of transactions per year in the personal carbon trading scheme. An individual travelling on one mode of public transport to and from work would have upwards of 500 transactions a year*. This would increase even more if, as in many cases, the individual takes two modes of transport each way to get to and from work (i.e. a local bus and then a train). Including ground public transportation would result in 80% of the transactions in a personal carbon trading scheme targeting only 6% of those household greenhouse emissions that individuals themselves can directly affect.

Therefore, excluding ground public transport from a personal carbon trading scheme is important in terms of practicalities as it significantly lower the number of transactions in which people are required to surrender carbon units. For instance, if carbon units were only surrendered for gas (4/yr), electricity (4/yr), petrol (52/yr), aviation (4/yr) then the number of transactions is more in the range of 64 per year.

* Assuming the individual works 230 days per year.

4. Involves substantially less IT and infrastructure

If individuals had to surrender carbon units when travelling on ground public transport it would require a substantial expansion of the person carbon trading scheme's IT system as well as the infrastructure. For instance, administering the scheme would have to be able to calculate the traveller's carbon emissions per journey and interact with his or her carbon account. Across the ground public transport network infrastructure would have to be installed all entry and exit points of the transport system to register individual's carbon usage. In addition, the system would have to be flexible to manage travel for those people without a carbon account, for example foreign tourists visiting London for a week and wanting to travel on the underground.

The type of technology needed to include public transport in the scheme is available and already in use throughout Europe and London (i.e. the Oyster card). The SMART card infrastructure has been easier to implement in Europe and London because the public transport network is publicly owned whereas for much of the UK it has been privatised and therefore there is not the integration between modes of transport. Implementing SMART card technology throughout the UK's public transport network for the personal carbon scheme would mean the cost per tonne reduction in carbon emissions maybe expensive. The potentially prohibitive costs associated with implementing IT infrastructure for ground public transportation together with the limited carbon reductions means that including public transportation in the initial stages could make a personal carbon trading scheme unworkable. However, as SMART card technology becomes integrated into the transport networks and the proportion of emissions from public transportation increase, it will be important to consider including public transport into a personal carbon trading scheme. In addition, the SMART card technology would make it feasible for the scheme to cope with the hundreds of transactions if public transport were included, because carbon units would be deducted in real-time with a swipe of the card, as the individual enters the public transport system.

5. Motivates individuals to switch away from driving private vehicles

Emissions from private vehicles are the highest proportion of individuals' transport emissions, therefore a personal carbon trading scheme needs to be designed to encourage public transport use, the switch to higher fuel efficient vehicles, car sharing, biking and walking for short journeys.

Requiring individuals to surrender carbon units when filling their vehicles' petrol tanks but not when travelling on ground public transport will provide these

individuals with a financial incentive to switch modes of transport. Individuals will save carbon units and therefore money by travelling on public ground transport, especially if the private vehicle is used for one person and is a standard petrol car consuming 30 mpg. The ticket price for ground public transport may increase if the transport operator has to buy auctioned carbon credits from the non-personal carbon trading scheme, but the carbon cost on the ticket is likely to less than the cost of running a private vehicle.

To ensure the public transport network can manage the additional passenger capacity as people switch from using their private vehicles, the personal carbon trading scheme must be accompanied by other policies and measures to promote investment in sustainable transport modes. Alternatives to private vehicle use must exist in parallel before the scheme is introduced. Creating a greater demand for ground public transport will result in an expansion of the network and increase the viability of networks where passenger numbers have been low. In the long-term encouraging ground public transport use will mean urban developments give a high priority to ensuring individuals can readily access public transport networks from their home and work.

6. Puts the onus on transport operators

Individuals' are indirectly responsible for their ground public transport emissions because they do not have control over the energy use in these transport modes. Individuals are not in a strong position to make the decision to travel or not travel on ground public transport based on energy efficiency. For example, an individual is unlikely to wait at a bus stop for a fuel cell bus as they will take the first bus that comes along. The ability to improve the energy efficiency of ground public transport lies with the transport operator because they make all the equipment and fuel source decisions. Public transport is a competitive industry and as a result transport operators are reluctant to make investments if they are not guaranteed to be profitable. Financial incentives need to be in place to motivate transport operators to invest in improving their energy consumption and the related emissions. Therefore, ground public transport should be included in the mandatory non-personal carbon trading scheme, which will give the transport operators the incentive to make changes to the energy efficiency of their taxi, bus, coach, tram, or train fleets. The transport operator may past the carbon costs onto passengers by increasing ticket prices, especially if they have a monopoly on the route and no incentive to improve vehicle efficiency. It may be therefore that local authority giving a service contract to a bus operator, for example, requires a minimum standard in the fleet's fuel efficiency before the operator is allowed to increase the ticket price due to the incurred cost of paying for the auctioned carbon units.

When ground public transport becomes incorporated to the personal carbon trading scheme it could be argued that a personal allowance could incentivise the transport operator to improve the fleet's fuel efficiency. This is likely only to be the case where there is competing transport companies offering the same route. For example, if there are two bus companies competing for passengers on the same route, but one is more fuel efficient than the other so deducts less carbon units from passengers, it may encourage passengers to travel with the fuel efficient fleet and galvanise than other company to improve its performance. This is not likely to happen for the majority of public transport routes, as it is not profitable or practical to have multiple transport operators competing with each other along the same routes.

7. Increases public acceptability

Excluding ground public transport from a personal carbon trading scheme will reduce the hassle factor for individuals therefore increasing the likelihood the scheme will be more publicly acceptable. People can become easily frustrated if processing a transaction takes a long time and if equipment is faulty. Keeping the scheme to a limited number of transactions so that the energy uses requiring carbon units to be surrendered are easily identifiable uses will mean individuals are less likely to be confused by the scheme, believe in it more and better able to manage their carbon budget.

In summary, the case for initially excluding ground public transport greenhouse gas emissions from a personal carbon trading scheme are:

- Ground public transport currently comprises only a small percentage of individuals' total and transport emissions.
- It is difficult to accurately calculate the emissions associated with an individual's travel on different modes of public transport due to fuel choices, occupancy levels and distance travelled.
- Inclusion would greatly increase the number by as much as 80% per year with little impact in achieving emissions reductions.
- Inclusion would require the development of an extensive IT administration and infrastructure - making it likely that the cost per tonne of carbon reduction is expensive.
- It would create an incentive for individuals to switch from driving private vehicles using petrol and diesel, which will require carbon units to be surrendered whereas travelling on ground public transport won't. The scheme would thus be targeting the biggest source of transport emissions and increasing the demand for more investment in public transport networks.

- It would be included in the non-personal carbon trading scheme, where the onus would be with transport operators who are in the best position to make investment decisions to improve the energy efficiency of their fleet.
- It would reduce the hassle factor for individuals therefore making it easier for them to understand the scheme and manage their carbon budget.

Conclusions

To design a workable personal carbon trading scheme it is practical for the reasons discussed to exclude ground public transport emissions. However, once ground public transport emissions become a much great proportion of individuals' transport emissions it will be necessary to consider incorporating these emissions within a personal carbon budget to further motivate a reduction in transport emissions.

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