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Personal Carbon Budgets for Transport

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Abstract

Australia's transport greenhouse gas (GHG) emissions are high and continue to grow, with current levels approximately one-third higher than in 1990 and increasing by around 1% annually. Efforts to curtail and reverse this growth have not been successful to date. In recent times, national policy development and debate has centred on market-based mechanisms to reduce GHG emissions, namely an emissions trading scheme (ETS) and carbon taxation. Potential limitations for such measures in the transport sector emerged during this debate, particularly arising from market failures in the ETS. Alternative, supplementary or complementary policy measures to these market-based approaches are needed to address transport emissions; one such measure could involve limiting emissions through a rationing system. Several prominent authors have raised the concept of personal carbon budgets (and personal carbon trading) as an approach to reducing GHG emissions. Potentially, such a measure could be applied to the transport sector or designed to include transport with other economic sectors, although there has been little consideration of this issue for Australian transport. This paper outlines Australia's transport GHG emissions and important trends, describes the carbon budget concept, considers how it could be applied to transport, and identifies key issues that will need to be considered in further formulation and implementation of public policy to apply the carbon budget concept, including the possible limits to its usefulness.

1. Introduction

1.1 Background

Australia's challenge in reducing its greenhouse gas (GHG) emissions from the transport sector has brought forward conflicting ideas about how this might be achieved through national policy. Although there have been many policies and programs addressing transport emissions, there has been interest in creating a central and unifying policy instrument, namely emissions trading. Over the course of the Federal governments of Howard and Rudd, a carbon emissions trading scheme (ETS) proposal was developed, and under the Rudd government became the centrepiece of the national response to climate change. Placed before the Senate in 2010, the Carbon Reduction Pollution Scheme (CPRS) legislation was rejected. Considerable effort had gone into this process, involving as it did, many years of public service activity and a national investigation conducted by Prof. Ross Garnaut—the Garnaut Climate Change Review (GCCR 2008, Garnaut 2011).

Earlier this year, the Gillard government announced the introduction of a price on carbon in July 2012 using a carbon tax (Gillard 2011), with an ETS to follow after three years. As part of the policy formulation process, the federal government initiated the Multi-Party Climate Change Committee for federal parliamentarians and an independent Climate Commission with its own Science Advisory Panel (Combet 2011).

National political controversy surrounds the proposed carbon tax, with the prospect of petrol price increases attracting criticism from the Gillard government's conservative opponents. In any event, it is unlikely that the direct impost of a carbon price will have much influence on transport emissions, partly because of the barriers created by urban form and land use planning and by infrastructure and services barriers to mode choice (GCCR 2008), specific characteristics of the transport sector (Ivanov & Zito 2008) and because of other market failures (Glover 2009).

Certainly, emissions trading is difficult in the transport sector, as recognised by the BTCE (1998) in response to the Kyoto Protocol and by Ivanov & Zito (2008), Glover (2009), and others. Transport comprises four vehicle-based modes (road, rail, air, and sea), is divided between passenger and freight tasks, and involves mobile emissions sources that can be difficult to monitor, posing a complex set of issues for emissions trading. BTCE (1998) pointed out the inconsistency of pricing across the transport sector; a further complication is that there are many and varied transport fossil fuel and vehicle subsidies (Reidy 2007).

One alternative to the top-down (i.e., 'upstream') ETS proposals, such as promoted by Stern (2006) and Garnaut (GCCR 2008), for the transport sector is setting individual emissions quotas for GHG emissions (i.e., 'downstream' approaches). To date, there has no pursuit of this measure in Australia's climate change policies (e.g., Australia 2008, DCC 2008, DPMC 2007) or as part of the recent national debate on reducing emissions from the transport sector, either under the former Coalition federal government (e.g., Allan Consulting Group 2001, 2004, BTRE 2002, SECITARC 2000) or the last and current Labour governments (e.g., ATC & EPHCVEFWG 2008, DAA 2008, GCCR 2008). A government discussion paper produced during the CPRS consultation process specifically considered that, for the transport sector, only the oil importers and refineries could be feasibly included in an Australian ETS (DCC 2008).

However, a prominent Australian urban scholar recently raised the concept of personal carbon budgets as an approach to reducing Australia's GHG emissions (Gleeson 2010). There has been considerable interest in national per capita GHG emissions estimations in international debates over climate change and concepts, such as the individual carbon footprint, have become common educational tools in state and Commonwealth climate change programs in Australia.

Although this might be considered an obscure topic in Australia and North America, there has been considerable interest in the UK in personal carbon trading (PCT) and to some extent, also in Europe (e.g., Roux 2004, 2005). There has been an inquiry by the UK House of Commons (Environmental Audit Committee 2008). Research programs on PCT have been conducted by the Centre for Sustainable Energy in the UK (e.g., Roberts & Thummin 2006), the Tyndall Centre for Climate Change Research (Starkey & Anderson 2005), the UK Energy Research Centre (e.g., Parag & Strickland 2009), and by Oxford University's Environmental Change Institute (e.g., Fawcett & Parag 2010). Some of this research activity was sponsored by the UK Department for Environment, Food and Rural Affairs, who conducted their own review of the feasibility of the scheme for the UK. In 2010, the leading climate change policy journal, *Climate Policy*, devoted a special issue to PCT (see Fawcett &

Parag 2010). It is not clear why there has been such little interest in this concept in Australia compared to that of the UK.

1.2. Aims

This paper outlines Australia's transport GHG emissions and important trends, describes the carbon budget concept, considers how it could be applied to transport, and identifies key issues that will need to be considered in further formulation and implementation of public policy to apply the carbon budget concept, including the possible limits to its usefulness.

2. Transport Fuels Rationing: Some Historical Precedents

Setting personal or household limits on goods consumption through government policy, such as with personal carbon budgets for transport, revives an older idea. Transport fuel rationing has occurred many times and in many places in response to both local and short-term interruptions of supply, national and longer-term losses of energy security, and for other motivations usually associated with periods of national or global turmoil. For developed nations, two periods are associated with widespread petroleum rationing: WWII and the global oil crisis of 1973/4.

Australia, along with many other nations during WWII, had petrol rationing; it began in 1940 with little effect and was then made increasingly more stringent, so that by 1942 the individual allowance was the equivalent of 800 miles annual driving per vehicle. Rationing was eased after 1944 (CBCS 1945) and ended in 1950 (Froudie 2002). These limits were quite significant, although the extent of motorcar ownership, use, and annual mileage in the 1940s was considerably less than in contemporary times. Setting rationing for commercial demands, such as for road freight, taxis, and agriculture, proved difficult (Froudie 2002). Rationing proved effective, for despite fuel supplies becoming very low in the early years of WWII, fuel consumption was cut considerably after 1942. There was no national rationing response in Australia in 1973/74, although for various reasons there were state-based restrictions on fuel sales several times around the nation in the 1970s.

A few insights can be drawn from these experiences. Firstly, although Australians have now not experienced national petrol rationing for a generation, it has been used extensively in the past, proving that it is viable. Secondly, the experience of petrol rationing in Australia and around the world shows that when properly designed, consumption can be significantly lowered. Thirdly, rationing is not undertaken lightly by governments given its unpopularity and difficulty of implementation, and therefore is carried out during impending or occurring crises of energy security. Australia's vulnerability to interrupted oil imports in WWII was forced into broader public awareness and into national political discourse. Petrol rationing—although rare—is of particular importance because it marks a point at which government intervention is a critical necessity; it is in some respects a policy instrument of last resort. Finally, perhaps because it is an aberration in a nation where energy is deemed to be abundant, energy rationing in Australia is a theme that has received little scholarly attention.

3. Australia's Transport GHG Emissions

GHG emissions from transport are significant and have proved reasonably unresponsive overall to earlier abatement efforts. Governments, firms, and non-government organisations have drawn attention to the problem of transport GHG emissions. According to the 2009 national greenhouse gas inventory, transport emissions have risen by 34.6% from the 1990 baseline of 62.1 MtCO_2-e to reach 83.6 MtCO_2-e by 2009 (DCCEE 2011a: x). Emissions from all sectors (excluding land use, land use change, and forestry) were 545.8 MtCO_2-e, of which transport contributed 15.3% (DCCEE 2011a: 37). These emission totals do not include those arising from fuels used in international travel as consumed by Australians travelling by plane or ship or from the export of Australian commodities and finished products (as arising from the so-called bunker fuels); in 2009, these were 12 MtCO_2-e (DCCEE 2011a: 37).

Broken down by mode, road transport is the source of 86.3% (some 72.2 MtCO_2-e), of the sector's emissions, with passenger cars (41.5 MtCO_2-e) and trucks and buses (30.5 MtCO_2-e) accounting for the bulk (DCCEE 2011a: 37). Domestic aviation (6 MtCO2-e), railways (2.4 MtCO_2-e), and domestic navigation (3.0 MtCO_2-e) are additional sources (DCCEE 2011a: 37).

As the national inventory states, transport has been one of the strongest sectors of emissions growth, with an average annual increase of over 1% (DCCEE 2011a: 37). Heavy-duty trucks and buses' emissions growth is of particular concern, being 66.7% since 1990, as are light commercial vehicles, with a 53.2% increase over the same period (DCCEE 2011a: 37). Passenger vehicle emissions increased by 17.6% over the same time (DCCEE 2011a: 37). *Australia's Emissions Projections* (DCCEE 2011b) forecasts that, under a BAU scenario, transport emissions will increase 29% over the year 2000 levels by 2020.

Theses emissions are high partially because of the scale of the motor vehicle fleet. Australia had 16.1 million motor vehicles registered in March 2010, comprising 12.2 million passenger vehicles, 2.5 million light commercial vehicles, 430,000 rigid trucks, 82,000 articulated trucks, 86,000 buses, and 660,000 motorcycles (ABS 2010). Motor vehicle ownership is high, with a rate of 721 per 1000 head of population (ABS 2010); i.e., one registered vehicle for over 9 out of 10 Australians of working age.

4. Setting a Transport Sector Emission Target

A transport sector emissions reduction target can be set at any level, but realistically this will be set in relation to the national target. Australia, under the Copenhagen Accord, has both unconditional and conditional emission reduction targets. Unconditionally, Australia has pledged to reduce its emissions 60% below the levels of 2000 by 2050 and 5% below 2000 by 2020. If other nations make commitments of a certain scale, Australia will revise upwards its short-term targets (i.e., 2020) to either 15% or 25% cuts to the 2000 levels.

Within the national debate, there are calls for more substantial reductions. In the Garnaut report, a target of 80% reduction is recommended for a (stabilised) atmospheric concentration of CO_2 of 550 ppm and a 90% cut for a target of 450 ppm (GCCR 2008). Others have suggested greater cuts: US climate scientist James Hansen (2009) has called for stabilisation at the current levels, i.e., around 350 ppm, implying even greater short-term emission reductions. Such high targets for the transport sector would amount to a 'de-carbonisation' over the next 40 years or so.

There are complex questions of setting interim (i.e., short- and medium-) term targets to achieve long-term targets, yet to achieve success setting such key performance indicators is essential. A question concerning such indicators is the extent to which individual economic sectors will contribute to collective national targets. It often assumed that each sector assumes an equally proportional burden, but some transport advocates may make the case for special consideration in light of the difficulty of the abatement task given the sector's current near total reliance on oil. Tickell (2008), for example, suggests a lower target for transport on the grounds of its comparatively greater difficulty in emissions reduction. Another common assumption open to question is that international transport fuels can continue to left out of national policy; an argument can be made that these are now a significant emissions surce and the nation should assume responsibility for those originating from Australia. A further question concerns the issue that commercial transport emissions have been a lower priority in national GHG emissions policy, but this now must contend with arguably freight being a major emissions source and light commercial vehicles being a rapidly increasing category of vehicles.

5. Personal Carbon Budgets

5.1 Concept Outline

An option for reducing GHG emissions is to directly limit personal or household consumption activities through means of an emissions quota or allowance. While this allowance might work as a simple rationing system, not unlike that imposed on petrol sales during WWII, nearly all of the research into the topic has involved personal carbon trading (PCT) schemes. As Fawcett (2010: 329) explains:

> PCT is a general term used to describe a variety of downstream cap-and-trade policies, which locate rights and responsibilities for the carbon emissions from household energy use and/or personal travel at the individual level.

PCT draws on several themes and concepts (Seyfang et al 2009). Firstly, there is carbon trading, such as Australia's proposed CPRS and the EU ETS, which essentially involves trading by corporations. Secondly, there are voluntary schemes employing carbon budgets at the community scale. In the UK, these are known as Voluntary Carbon Rationing Action Groups, in which targets are set amongst volunteer groups and monies from those fined for failing performance are paid to those who met their targets. Thirdly, PCT draws also on concepts from non-monetary currency schemes (i.e., complementary currencies), such as corporate loyalty programs.

5.2 A Brief History of PCT

During international debate on climate change in the formative years of the UN Framework Convention on Climate Change there was some interest in using per capita measures of national GHG emissions as a means to devise equitable strategies for emissions reduction, including the 'contract and converge' concept. Under this concept, there would be a common per capita target to which high-emitting nations would have to reduce and to which low-emitting nations would increase. From this basis, proposals developed to apply this concept to individuals by means of a personal carbon budget and other means to rational carbon emissions on personal/ household scales.

One development was fuel quotas using Domestic Tradable Quotas (Fleming, 1996), which subsequently developed into the Tradable Energy Quota concept that was to apply to the entire UK economy (i.e., covering households and firms). Another approach was put forward by Hillman (2004), based on a system of personal carbon allowances, but these were more narrowly cast, covering individuals (household energy use, personal transport, and personal air travel) but excluding firms, public bodies, and other organisations (that would be covered under national ETSs). At least two prominent international writers on climate change have promoted personal carbon budgeting: Monboit (2006) in *Heat* and Giddens (2009) in *The Politics of Climate Change*. This activity has given rise to a number of different personal carbon rationing schemes (as reviewed by Fawcett & Parag 2010). All these schemes tend now to be called PCT (although some obviously extend beyond the personal). Nearly all these schemes employ some form of trading of carbon allowances.

5.3 Basic PCT Design

There are many options for a PCT schemes, but all feature a personal carbon budget applied to all citizens and all have citizens receiving an equal allocation for carbon emissions annually and without charge. Conceptually, the guiding principle is that the individual allowance covers the emissions over which individuals can exert control, and therefore doesn't cover embedded carbon emissions in goods and services (these would be accounted for in national cap-and-trade systems).

A basic scheme would likely have many of the following features, starting with setting of an overall national emissions limit for the first year of the scheme and a target year for future emissions (In Australia's case, this would currently be 60% below the year 2000 levels by 2050). There would an allocation of the carbon budget, say between all adult citizens, and this would decline each year in order to achieve the future target. These allocations, which can take the form of carbon permits, could be equally distributed between individuals or according to some other rules.

When individuals purchase (carbon-based) fuels for personal transport they would surrender an amount of carbon permits equivalent to their purchases. This could occur at point of sale, when energy accounts are paid, or when airline flights are booked. Public transport trips are usually exempt in these proposals (see Bottrill (2006) for a rationale).

Most of the PCT proposals feature various permit trading facilities, allowing for individuals to sell excess permits or purchase additional permits for their use. Nominally, those who didn't need all their permits would sell their excess and those who had run out would purchase extra. These market transactions and the surrendering of permits for fuel purchases would be conducted through an electronic system of individual carbon accounts, using smartcards or similar technologies. Permit prices, therefore, would be determined by market activity.

Based on the PCT debate in the UK, it is worth noting some common design features to address the transport sector. Basically, the focus is on personal transport with commercial transport and freight being omitted; similarly, public transport is also omitted in some designs. However, there does appear to be considerable interest in including air travel in the proposed PCT schemes.

5.4 Rationales for PCT

Several reasons have been advanced in support of PCT schemes. Personal energy use accounts for a significant proportion of total GHG emissions in developed nations, so PCT schemes directly address this important emissions source. Personal transport is a major emissions source in Australia, as described above. Adding suasion to this point is the relative lack of success in reducing personal emissions and, again as stated above, under official forecasts Australia's GHG emissions are forecast to rise under a BAU scenario. Reducing personal GHG emissions could be seen as the 'final frontier' of GHG emissions abatement. PCT offers an overall approach to the highly disaggregated field of individual energy use choices, a feature that applies equally strongly to transport energy use and mobility behaviour. A unified PCT scheme brings energy use decisions into a single decision-making frame for individuals, encouraging consideration of energy consumption choices across the array of daily decisions (and encouraging perceptive and cognitive development in energy consumption behaviours).

Another set of rationales is based in economics with the argument that, as a market-based scheme, PCT is economically superior to government regulatory (and tax and information) policies. Further, as a quantity-based approach, the emissions limits set under PCT schemes offer certainly about the goals of GHG emissions abatement (as opposed to the uncertain abatement performance using carbon taxes). PCT allows and encourages individual responses to the task of cutting emissions, offering a degree of flexibility rarely possible in regulatory approaches. Equity is also advanced in the support for PCT as most proposals feature an equal allocation to all participants, so that on that basis everyone starts with an equal opportunity, as opposed to using pricing to reduce demand that has regressive effects. Some have argued further that low-income groups have low emissions and high-income groups have higher emissions, allowing those less well off to gain by selling unwanted allowances to those more wealthy.

Because PCT is applied universally, it brings the issue of GHG emissions abatement to the forefront as a social issue. Politically, PCT has the advantages of the fairness of its initial allowance allocations, and that for those who emit more have to pay accordingly.

6. Applying PCT to Australia's Transport: Barriers and Limitations

6.1 Market Failure Problems in Market-Based Transport Policies

Although PCT is a quantity-based approach to limiting emissions it is also a market-based approach through the trading of emission allocations and its effectiveness will be partially determined by the extent to which the market captures the major values entailed (i.e., the extent of market failures). Several potential market failures are likely to afflict PCT; some are in common with the price-based failures of emissions trading (GCCR 2008, Glover 2009, Ivanov & Zito 2008) and others are distinctive to PCT.

Potential ETS market failures for transport include:

- Weak ETS price signals in retail prices for transport fossil fuels at modest carbon prices (e.g., ≈AUD$25t$CO_2$-e), and
- Relatively small cost component of ETS price signals relative to total costs of private car ownership and operation.

Potential PCT market failures for transport include:

- Limited capacities of some individuals to make appropriate decisions, and
- Inadequate information about choices and costs of lower-GHG emission choices.

Potential market failures that apply to both the ETS and CPT include:

- Conflicts with the array of other pricing instruments and policies operating in transport

- Unavailability or expense of alternative technologies
- Provision of public transport choices (infrastructure and services) depends on public sector investment and policy which don't respond to ETS price signals, and
- Urban planning, transport planning, and urban design influence transport choices as these also do not respond to ETS price signals.

Having some understanding of the extent which these limitations and barriers might reduce the effectiveness of PCT schemes is necessary in evaluating its potential. In order to be effective, individual decision-making for lower carbon mobility has to be able to draw on knowledge of available choices, have sufficient skills and knowledge to be able to make such choices, have these choices available, and be able to achieve the desired mobility from these choices.

6.2 Personal Transport Emissions and the Transport Sector

PCT, by definition, is directed at personal transport and this accounts for the greatest share of Australia's transport emissions. Reducing emissions from personal transport is a major part to limiting GHG emissions from the sector, given the extent of private car use in Australia. For example, no Australian capital city had less than a 70% share for commuting by car for the journey to work in the 2006 census.

However, a strong case can be made for the importance of a more comprehensive approach to reducing the sector's emissions. Of road transport emissions, although the majority emanate from motor cars, some 42% are from trucks and buses (see Section 3, above). Heavy-duty trucks have shown the greatest increase in emissions since 1990 (see Section 3, above) and light commercial vehicles have increased in number considerably. Commercial vehicles (trucks, buses, and light commercial vehicles) are likely to account for almost one-half of the increase in emissions to 2020 (DCCEE 2010).

It follows that although emissions from private cars are the major problem, a national policy approach that neglects the other components of road transport risks having the reductions from personal transport being undermined by the BAU trends of non-personal transport use. In this sense, PCT strategies do not offer a comprehensive approach to the sector's emissions, but require support from policies addressing the commercial transport sector.

6.3 Eligibility for PCT Emission Allocations

A key issue in PCT schemes is how the allocation to households/ individuals is carried out: there are two basic choices, either they are given free or they are allocated by some economic means, such as being auctioned or sold. For the scheme to be effective, the ideal is for the users of all vehicles producing GHG emissions to be subject to an allocation. Anything less than universal coverage necessarily reduces the scheme's effectiveness. Economically speaking, it is usually deemed to be more efficient if allocations are auctioned, rather than given away. For a start, allocation sales provide revenue, one of the uses of which is compensation for those in need.

Another major issue arises when individual fulfil their quotas. Possible policy choices are to allow for the purchase of additional quotas either from the issuing authority or from other individuals. Obviously, the latter would be preferred if the system was seeking to cap annual emissions at a known target. Alternatively, quotas could be fixed, but this option could cause excessive social and economic hardships, especially for those with limited transport choices.

There are also difficulties in deciding on eligibility. As described, many of the proposed PCT were based on all citizens receiving an equal initial allocation (usually free). All adults could be made eligible for CPT allocations, but there is a question as to how adulthood is determined, such as whether it covers those deemed to be of working age (15 y.o. and older). Another question is whether there is a case for household allocations and as to whether there should be allowances for children in such household allocations. International visitors are another category that would need to considered, given that Australia receives in excess of five million annually.

6.4 Creating a Suitable Institutional Structure

Potentially, there are two or three major administrative functions involved in PCT: Firstly, a system for permit surrender at the point of fossil fuel sale is required, which once established, could be expected to reasonably straightforward. Secondly, there is a system for the administration of individual accounts, which could entail a number of separate functions. Thirdly, there is a trading market for buying and selling carbon allocations that may be part of the personal account system. Alternatively, a national PCT system could operate completely independently of the market-based instruments for addressing emissions currently being developed in Australia. There would need to be a single institutional structure operating across the nation.

An important design issue of the potential trading architecture is the relationship between the PCT system of trading and any other system of carbon permit trading, such as national ETS. If designed appropriately, these could be two aspects of the same system trading equivalent emission units. But if the corporate and personal emissions trading systems were designed separately, then trading between the two systems would be likely to be highly inefficient. Underlying these options is a difficult policy issue of whether it would be feasible or even advisable to operate a top-down and bottom-up ETS simultaneously. One design option could use PCT and have a separate ETS for corporations.

7. Applying PCT to Australia’s Transport: Discussion of Selected key Issues

7.1 Practicality and Efficacy

Taking the contemporary Australian efforts to build national consensus around pricing carbon emissions with the proposed national carbon tax as a guide, it is reasonable to conclude that establishing a national PCT would be politically challenging, albeit that it would not have to contend in political realms with corporate stakeholders. Although this paper does not directly address issues of political economy, studies in this area point to the political difficulties of implementing PCT (e.g., Parag & Eyre 2010).

As implied above, a national PTC could be too large and difficult to implement; certainly the transport sector would pose a number of challenges, given that the transport fuel consumers comprises the majority of adult Australians and the associated high number of annual fuel purchase transactions. Management of the allocation system and the surrender or permits at the point of sale appears to be well within the scope of the transactions already handled at the point of sale, such as the

GST, transfers of funds from banks, and credit card transactions. There would appear to be suitable technology available for this activity.

However, the scale of the institutional support for a national PCT scheme would be considerable. Operating and managing a system of, say the accounts of the 14.5 million Australians of working age, would the administrative equivalent of systems such as Medicare or the personal accounts held by the Australian Taxation Office. Such a national institution for PCT suggests the scale of the enterprise and would denote a far more extensive effort for reducing GHG emissions than has been officially contemplated in Australia thus far.

7.2 Equity

Social and economic status varies across society; a system that rations fossil fuels for transport is likely to have regressive effects, *ceteris paribus*. This is likely to occur for several reasons, bearing in mind that the focus of the PCT system would be car use by households. Households at a greater distance from city centres, compared with national averages, own more (and older) cars, drive them further, have fewer public transport opportunities, and are greater distances from places of employment and essential services. Such households are also of lower income, on average. For those living in peri-urban or rural areas, personal car travel is also higher than average. Restrictions on fossil fuel use for this group threatens the utility gained from their current travel choices.

A basic problem with rationing is that the burden will fall disproportionately on those less well able to avoid or lessen its costs. Compensation of some form will be necessary to avoid this outcome. However, a way must be found to ensure that the goals of rationing are not undone through any compensation. If the rationing scheme becomes riddled with exemptions and compensation, then it will have been an ineffective policy choice.

Equity is a major attribute claimed for PCT as all those deemed eligible are to be treated equally in the provision of emission permits. Lockwood (2010) identifies two issues that undermine this claim. Firstly, not all consumers start from the same position; for all sorts of reasons, some have higher emissions than others. An equitable allocation can penalise those with higher emissions for no fault of their own, producing an inequitable outcome. Secondly, while many households of lower socio-economic status will have a surplus of permits under a PCT scheme, some will not and this group's options for emissions reduction are likely to be comparatively weak and will be worse off as a consequence. As a result, governments would be forced to devise an appropriate compensation scheme for the poor, and as Lockwood describes, this add considerably to the overall administration costs. Although PCT may be equitable in allocating emission allowances, this does automatically translate into the outcomes of PCT being fair.

7.3 Efficiency

Advocates for market-based policy approaches identify the associated economic efficiencies as a major advantage over 'command and control' approaches. Lockwood (2010) reviews the potential economic performance of PCT schemes. Of the claims for the greater effectiveness of 'bottom-up' over 'top-down schemes', he notes the point frequently made in favour of schemes with caps, namely that there is certainty in the emissions saved. But, as he points out, such elements as a ceiling on permit prices, compromises the environmental effectiveness of the scheme. If the demand for household and transport energy is inelastic in the short-term (a reasonable assumption), then PCT permits are likely to suffer from price instability. Resulting price spikes are prejudicial to the welfare of the poor, raising the prospect of fuel poverty and mobility disadvantage. A liability of PTC schemes is that, unlike carbon taxes, the future price can't be anticipated thereby negating (or at least making very difficult) pre-emptive policy interventions to alleviate these regressive effects. Various design options are available to provide a 'safety valve', but these can only be enacted at the cost of reducing certainty of the emissions cap. Governments are left, therefore, with an uncomfortable prospect that the effectiveness of the PCT scheme and welfare protection being oppositional goals.

Assessments of the economic efficiency of PCT will depend on many factors, but the magnitude of its operating costs is likely to be highly influential in determining any relative advantage over regulatory policy approaches (i.e., the transaction costs of the entire system). On basic logic, the costs of running a PCT scheme for, say the almost 15 million Australians of working age, as against those for the nominal 1000 firms that would have been covered under the proposed CPRS (Australia 2008), would be considerably higher. Indeed, on the grounds of economic theory, some economists rule out using bottom-up approaches for emissions trading because of excessive transaction costs (e.g., Hepburn 2006).

Lockwood (2010) reports on the findings of a UK government study (and that caused the government to reject PCT) that the scheme would cost between £700 million—£2 billion, with annual running costs of £1—2 billion; by comparison, top-down emissions trading would cost £50—100 million with £50 million per annum running costs. He reports the major source of these costs arose from managing 50 million individual PCT accounts. However, Lockwood thought the cost estimates too high and calculated them at almost one-half as much as those quoted by the government (i.e., £1.4 billion as against £2.6 billion annual costs over 10 years). It appears that the administration costs (including dealing directly with customers) that are the problem here, not the communication and trading components, which can be handled electronically. Notwithstanding this research, assessing the economic efficiency of PCT is difficult without knowing the costs of future GHG emission cuts and the likely PTC administration costs. A broader evaluation of PCT could consider the PCT costs against the costs of inaction on climate change resulting from harmful climate change impacts.

Restricting PCT to the transport sector exclusively would also be a source of potential economic inefficiency. Under the rationale of emissions trading, the benefit of an economy-wide approach is that the price signals attached to carbon encourage behaviours and choices to lower emissions are exercised across all sectors and resources are invested in those options offering the greatest emissions reductions per unit of expenditure. Limiting PCT to the transport sector would therefore be likely to make emission reduction investments more expensive than otherwise because the range of emission reduction choices would be reduced considerably and many low-cost options excluded. As Garnaut (GCCR 2008) pointed out, such restrictions introduce inefficiency and create cross-subsidies between economic sectors.

8. Conclusions

Assuming that Australia continues to take macro policy directions for climate change policy from the UN Framework Convention on Climate Change and remains committed to the path of neo-liberalism in public policy, then it seems likely that it will continue to pursue the goal of using market-based public policies as the central means for addressing GHG emissions. Regardless of the outcomes of the contemporary national political debates over pricing carbon, the underlying momentum for market-based policies is such that this approach will probably remain on the policy landscape for the foreseeable future. But a weakness of the proposed ‘upstream’ approaches is that they have poor prospects for reducing transport GHG emissions unless there are considerable complementary public policies and public investment.

A major consideration of the viability of the PCT concept, therefore, is the extent to which it could address the limitations facing the ETS for transport. PCT could fix at least one major failing of the current upstream proposals. Placing a limit on the personal consumption of fossil fuels for individuals and households resolves the problem of whether or not the price signal is effective in changing behaviour. Pricing carbon at AUD$25/tonne, a widely discussed price point (see, e.g., Garnaut, 2011), produces a weak price signal for Australian motorists—about 5 to 10 cents a litre of petrol (Glover, 2009). Imposing a limit on total fuel purchases though a PCT, which is the greatest potential effect of PCT in the Australian transport sector, would unavoidably reduce national fuel consumption (presuming that the scheme operated effectively). PCT could reduce transport sector emissions arising from the personal use of carbon-based fuels to a pre-determined level decided through a public policy process. Given the extent of market failure in the reducing transport emissions through carbon pricing approaches, such an outcome would be of considerable importance.

In the coming decades, there is likely to be a major economic signal to reduce fuel use arising from peak oil. If a part of the high level of transport GHG emissions is the result of relatively low-cost of motor fuel, then peak oil will bring mark the end of this era (Campbell & Leherrere 1998). As Dodson & Snipe (2008) have shown, the social and economic costs of this rise in the price of outer suburban mobility in our capital cities will be significant and a source of increased social disadvantage. Any influences of PCT would be overlain of the impacts of peal oil and there would be considerable risks to social welfare of the transport disadvantaged with higher car use from the combined effects of PCT and the rising price of oil.

Further, if PCT were to be implemented, it is unlikely to promote an extensive reduction in GHG emissions without greatly reducing mobility. In other words, PCT could limit motor fuel use, but without a corresponding public investment in public transport, active transport, and appropriate land use and transport planning, there will be inadequate opportunities for alternative low-carbon mobility to replace motorised mobility. Therefore, although an effective PCT could restrict GHG emissions, it suffers from the same weakness as other market-based approaches because it does not address the inadequate supply of low-carbon mobility options because these are collective goods. PCT can create the demand for low-carbon mobility, but the supply of the low-carbon options will require governments to invest (in the broadest sense) in these services. One way to address this shortcoming, at least in part, is to design PCT systems to yield net public revenue and for governments to invest this in low-carbon transport.

This paper can only identify a small portion of the issues arising from this highly sophisticated policy tool. There are considerable barriers facing PCT schemes as a means for reducing transport GHG emissions and reasons why it should not be pursued as public policy, but there is at least one good reason for considering the role and utility of PCT as a future policy measure. Bottom-up approaches, such as the PCT, bring the immediate attention of individual consumers to the implications of transport choices in ways that top-down pricing of carbon emissions cannot. Carbon budgets and the individual rationing of the rights to pollute connects individuals with the implications of their choices in those daily decisions about mobility in an inescapable way. Instituting such a radical policy would entail governments enacting a novel and fundamental approach to restricting carbon emissions in transport and in doing so might find the government and the community challenging some of the fundamental beliefs over mobility in modern states and the role of government.

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