Designing emissions trading scheme for the transport sector – solutions and outcomes

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1 Introduction

Global warming is the increase of the average Earth temperature caused by Greenhouse gases (GHG). Human activities have caused significant increase of the amount of GHG in the atmosphere since the beginning of industrial era in 1800. If people continue their usual way of business and life, global warming will continue and by the end this century the average Earth temperature can increase by up to 6°C (IPCC, 2007a).

Currently, intense discussion in society occurs on how people should respond to global warming. A predominate view across scientists and politicians is that quick and effective actions are essential to prevent devastating environmental, economical, and social consequences with soaring costs (IPCC 2007b). One of the most complete and credible research study about the cost of global warming is Stern's report (Stern, 2006). The report places the argument for emissions reduction in terms of risk management and it concludes that cost of business as usual is much more expensive compared to the cost for GHG reduction. These research publications and public pressure has led to the current Labor government in Australia to declare serious commitments for future GHG reduction.

Achieving successful GHG reduction target requires spreading abatement efforts as much as possible across all non-sustainable activities. The most GHG intensive activities are the most targeted ones for reduction. At the moment in Australia most attention for GHG reduction is on the energy sector because this is the biggest emitter of GHG (AGO, 2005b). Less discussion is related to the effective reduction of GHG emissions from transport sector despite its significant share of 14% in emitted GHG and the increasing growth rate for the future (AGO, 2005b).

The main component of Australian Government strategy for reduction of GHG is the introduction of Carbon Pollution Reduction Scheme (CPRS) by 2010 (DCC, 2008b). In July 2008, the government published a Green Paper about the CPRS where it reveals its preferred positions regarding scheme's design and implementation (DCC 2008a). The foundations for Green paper are reports and publications from the National Emissions Trading Taskforce (NETT) (NETT 2004-2008), Task Group on Emissions Trading (TGET) (TGET, 2007), Garnaut Climate Change Review (GCCR) (Garnaut 2008) and consultations with businesses. Submissions to the Green Paper are due by 10 September 2008. At the end of September, Treasury will publish modelling of CPRS where more detailed information about the economical impact from the scheme will be provided. By the end of 2008 the government will unveil the design of the future ETS in the White Paper about CPRS.

The Green Paper expresses firm Government position that the future emission trading scheme should have as broad as possible coverage in order to achieve maximum effectiveness and to guarantee the lowest emissions reduction cost to the society (DCC, 2008a). The latest reaction of the trucking sector (McKinley, 2008) regarding broad sectoral coverage of scheme suggests that transport emissions are very likely to be covered from the future CPRS. This paper considers possible designs and scenarios for coverage of transport emissions by emissions trading scheme and it contributes to the very current discussion for Australian policies regarding GHG reductions.

The first section of the paper discusses the possible designs for transport coverage by ETS by analysing possible variations for ETS parameters such as emissions coverage, allocation method, and choice of trading entity. This section evaluates the appropriateness of different ETS models for Australian conditions. The second section discusses the impact of ETS on the transport sector. The conclusion suggests whether ETS should be part of policies for transport emission reduction.

2 Designing an Emission Trading Scheme that covers GHG emitted by the transport sector

When designing an Emissions Trading Scheme that includes transport answers to key questions are required and some of them are discussed in the following subsections.

2.1 Which GHGs emitted by transport activities should ETS cover?

Transport emissions are produced predominately from combustion of fossil fuels. The latest available data from National Greenhouse Gases Inventory (NGGI) shows that most of GHG emitted by transport activities is CO_2 (AGO, 2005b). These CO_2 emissions can be easily monitored because, they are accurately inferred from fuel consumption, and the reliable data for fuel consumption is available at various levels along the fuel supply chain.

Other emissions from fossil fuel combustion do not have such substantial share in total GHG emissions but they do have dramatic impact on global warming. For example CH_4 has global warming potential coefficient equal to 21 and N_2O has global warming potential coefficient equal to 310 (AGO, 2005a).

Currently NGGI methodology estimates all emitted transport GHG emissions and represents them as CO_2-e. It is contentious how accurately this methodology calculates non-CO_2 emissions due to lack of reliable data regarding condition of transport fleet, and the use of predominately old Australian or overseas data. It is most likely the government to adopt NGGI methodology to calculate emissions as per the current National Greenhouse Gas and Emissions Reporting Scheme (NGER). In this case the future scheme will have good control on fuel consumption and CO_2 emissions but will not have control on other emission problems that are not related to fuel consumption. However, since these are only a small share of transport emissions, the effect of these errors is negligible to the estimated total transport GHG emissions. However for some fuels such as LPG emissions of CH4 can be significant and so question the accuracy and reliability of the CO_2-e calculation. This is a good example of the many fuel sources for transport causing complications to the CPRS. However, the approach outlined in the Green paper for estimation of transport GHG emissions is sufficient for the purposes of emission trading but any improved accuracy on non-CO_2 estimation will increase scheme accuracy and reliability.

2.2 Should there be one integrated ETS which covers all economic sectors or a separate ETS for transport?

Integrated ETS is referred to as ‘open ETS’ and separate ETS for transport sector is referred to as ‘closed ETS’. The existing research does not provide clear recommendations about which model to apply (Holmgren *et al.*, 2006). There are different opinions about the strategies for GHG reductions when several economic sectors with substantial differences in their GHG abatement costs are considered. Transport has much higher GHG abatement cost than other industry sectors with Swedish research determined that it is 2.5 times more expensive to reduce GHG emissions in transport compared to the industry sector (Holmgren *et al*., 2006). The common nature of transport activities around the world suggests that the Australian ratio is within similar range. This fact implies that it is unlikely to make currently

expensive sustainable transport technologies attractive through market mechanisms alone. Also, it should be taken into consideration that the importance of transport for economy sets limits for realistic and affordable cost for transport services.

In closed ETS for transport sector, the society pays more because of higher permit price. However, (because of political and social factors) the permit price will not be allowed to reach levels that make current sustainable transport technologies competitive and there will be limited implementation of them. The dominate effect of closed ETS will be restriction of transport activities. (This is not attractive output – the society pays more and as a result receives more restrictions.)

Open ETS covers GHG emissions from all controlled economical sectors. The biggest advantage for open ETS is that the model provides the cheapest way for society to comply with emission targets. However, in a case of open ETS there will be limited incentives for GHG abatement in the transport sector. The permit price will be insufficient to stimulate introduction of sustainable transport technologies and their rapid implementation. Transport businesses will buy permits from industry sector to continue their usual practice. That scenario may put some extra pressure on carbon intense industries. Careful prediction of extra permit demand generated by transport inclusion in the scheme is necessary in order to avoid unwanted stress to important industries in the Australian economy. It is the authors' opinion that an open EST should be complemented with other measures for control of transport emissions because open EST alone does not provide the answer to transport sustainability.

The proposed design for CPRS is open ETS which includes transport GHG emissions. In the first three years of the scheme the government intends to compensate the effect of permit price on final fuel price by decreasing the fuel excise. That means that permit price will not influence transport demand for emission permits and total demand for permits will be higher than in the case with no compensation. The higher demand will set higher permit price. The higher permit price will allow more GHG abatement to occur in sectors other than transport. At the same time lower cost opportunities for GHG abatement in transport will be missed because of no pressure from permit price. Most likely the permit price increase and GHG abatement cost will be transferred to final products price. Therefore, the benefits for society from the proposed government compensation will be limited. (The saved money from cheaper fuel will be spent for other more expensive products.) Some positive effect for the society can come from making transition of carbon constrained economy smother. The true winners of proposed government compensation will be fuel suppliers and transport companies. The incomes from fuel sales will not be affected by the scheme and therefore the revenues for fuel suppliers are protected. If transport business is eligible for 100% compensation then its expenses for fuel will not increase. (The proposed cent per cent compensation only will postpone the adjustment of the economy to higher fuel price.)

2.3 Who should be liable to submit permits for transport GHG emissions?

When ETS is legislated, liable entities are responsible to submit permits equal to the amount of the released regulated emissions. If ETS covers emissions from fossil fuel combustion and if the released emissions are estimated by fuel consumption, then liable entities can be defined at any level of the fuel supply chain. This design of ETS differs from a usually applied and recognised design where the emitter is the liable entity.

Several approaches for covering transport GHG by ETS are possible depending on the position of liable entity in the fuel supply chain. In the upstream approach the trading entity is at the beginning of the supply chain, for example a refinery or a fuel supplier. In the midstream approach a liable entity is in the middle of supply chain, for example a filling station. In the downstream approach liable entity is at the end of the supply chain, for

example a vehicle owner. These approaches are well discussed and evaluated in the research literature (Holmgren *et al*., 2006) with the help of four criteria: possibility for reduction, level of coverage, monitoring procedures (feasible or not) and administrative (transaction) cost. The possibilities for reduction due to the permit price are similar for all approaches since the permit price will be transferred to final price.

The downstream approach is criticised in the majority of the research. Its weaknesses are a lack of complete coverage, difficult monitoring and enormous administrative cost (Bergmann *et al.,* 2005; Holmgren *et al.,* 2006). Conversely, some authors are overwhelmed by the fairness that the downstream approach delivers because of its ability to differentiate permit allocation (Raux, 2004). However they really underestimated its complexity. Also, researchers argue that downstream approach will put higher psychological pressure on the people because they are permit holders (Bergmann *et al.*, 2005). This argument is outlined as a serious advantage because authors see greater potentials for travel behaviour changes (when compared to other approaches). Nevertheless, it is hard to justify downstream approach based on psychological effect, which in itself is difficult to estimate. More realistic suggestions for travel change behaviour could be effective educational and informational campaigns.

Midstream and upstream approaches can guarantee close to complete coverage, relatively easy monitoring, and low administrative cost. It would not be difficult to implement them in Australia because the fuel suppliers or filling stations already have reliable data about their fuel sales. An increased fuel price will aim to reduce the turnover and consequently the profit for trading entities so they would not be eager to transfer the whole effect of the permit price on the final fuel (pump) price. Liable entities can try to compensate some of their losses by introducing bio- or alternative fuels. The presented arguments in this subsection make upstream approach most favourable for an Australian ETS. The upstream approach guarantees maximum effectiveness with minimum cost. That conclusion agrees with the preferred government position outlined in the Green paper.

One recommended option for road transport, which attracts substantial interest in the research publications and across politicians, is manufacturers of vehicles as liable entities (German *et al.*, 2007). This proposed model is to establish baseline-and-credit (B&C) ETS with relative average emission baselines for vehicles' manufacturers or dealers. The scheme will function relatively well in any combination with other trading schemes or regulations. It can be an additional separate scheme; part of the integrated ETS; or the only active trading scheme. According to some authors/researchers this B&C scheme has the greatest potential to intensify technical innovations, because of its direct incentives for manufacturers (Bergmann *et al*., 2005; Holmgren *et al*., 2006; German *et al.*, 2007). Other researchers argue that increased fuel efficiency of vehicles is compensated by increased vehicles usage (more VKT) and therefore no GHG reduction is achieved through B&C scheme for vehicles' manufacturers. This is fair and valid point but this scenario allows growth of transport activities in carbon constrained economy. The B&C scheme will not deliver results immediately but it sets the right conditions for change of unsustainable trends. Regrettably, the status of the Australian market cannot put pressure on overseas car manufacturers. The Australian market is a small portion of global manufacture sales and it is a rich and evenly distributed mixture of domestic and imported vehicles (ABS, 2007). Therefore, legislating of isolated domestic B&C scheme for vehicles sold in Australia is unrealistic and it is unlikely to deliver results. However, if such Australian scheme is coordinated with similar overseas schemes, than its outcomes could be promising. At the moment there are no indications that government considers any B&C scheme and the Commonwealth's Green paper does not discussed this topic at all.

2.4 What allocation method for permits should be used in the transport sector?

The permit allocation method plays an important role when society and business judge and accept ETS and therefore it is vital for scheme's success. The discussed permit allocation methods in the literature are grandfathering, benchmarking and auctioning. The first two are classified as free allocation methods because permits are distributed at no cost to trading entities. Free allocation methods are associated with extensive and difficult political negotiations, because they are seen as a technique that gives unreasonable advantages to some parties at the expense of others. Grandfathering allocation is based on historical emissions of trading entities. This is considered as unfair towards entities that committed GHG reductions in advance. The benchmarking method attempts to solve this problem by allocating permits 'on the basis of an indicator of the output, efficiency, or fleet characteristics' (UK DfT, 2007). In contrast, under the auctioning method permits are purchased and entities encounter the same permit price disregarding their background. The necessary historical emissions data and emissions trends analysis for grandfathering and benchmarking approaches are available.

The Green Paper recommends firstly that 70% of emission permits to be distributed by auctioning; secondly that only carbon intensive trade expose and strongly affected industries receive free permits. Transport cannot satisfy criteria for free permit allocation but in the first three years of the scheme the government will subsidise it through reduction of fuel excise. Free allocation can jeopardise scheme because it can be used to soak government subsidies and restrict fair competition.

2.5 What modes of transport to be covered by ETS?

In the research literature many variations of ETS transport modes coverage are considered (Holmgren *et al*., 2006; DCC, 2008b). These different architectures of ETS are analysed for performance effectiveness in a manner similar to this paper presentation – possible options of each design parameter are investigated. The architectures that receive particular attention in the research literature are different combinations of aviation and marine transport coverage (Morrell, 2007; Holmgren *et al*., 2006). For example, only one of these modes or both of them are included in ETS. ETS could cover aviation and marine transport by the downstream approach because the number of companies is manageable in these transportation modes. These options for Australia are questionable because of the large share of international transport in aviation and marine transport. The international transport inclusion in ETS is problematic because it involves negotiations with developing countries, which are far from any GHG reduction commitments. This is why aviation and marine transport are most likely to be excluded from future Australian ETS. Consideration of land transport is more important for Australia because it contributes 91% of transport GHG emissions (AGO, 2005b). Efforts to manage GHG emissions from land transport in the form of ETS coverage and other complementary policies will be required in order to reduce the environmental impact of transport. Any future ETS covering land transport emissions should consider all modes of land transport because any partial coverage would give unjustified privilege of non-regulated modes.

Given that the upstream approach can so easily achieve nearly full coverage of land transport the strongly recommended option for authorities is to implement ETS for all modes in land transport. That will provide to society the maximum environmental benefits and will avoid any possible complaints from businesses because of unfair biased decisions.

The Green Paper recommends inclusion of all transport modes in the CPRS. That probably will trigger unfavourable reaction from aviation and marine transport. These transport modes cannot qualify for carbon intensive trade exposed industries but they face serious competitions from their overseas competitors.

2.6 Should ETS in transport be combined with other mechanisms for GHG reduction in transport emissions?

The discussion in this subsection is about additional mechanisms for control of transport GHG emissions that could exist parallel to the CPRS. The discussion considers the fate of current mechanisms (for transport GHG reduction) and the need for additional ones.

What are the current (market and non-market) mechanisms for control of transport GHG emissions in Australia? The existing fuels taxes and in particular fuel excise are market mechanisms for control of fuel consumption. However, there are no legislative standards for CO_2 emissions from new vehicles and hence no fuel consumption limits. Currently in Australia they are only subject to voluntary standards.

What will be the fate of fuel excise? It is very unlikely government to abolish fuel excises because they generate significant income into the budget. Additionally the fuel excises can be used to adjust fuel prices when required. The government intends to use excise to ensure smooth transition of the economy to the CPRS (DCC, 2008a).

Should the current standards for emissions of new vehicle be extended to include CO_2? The significant impact of new legislative limits for CO_2 emissions from new vehicles will occur in approximately 10 years when these vehicles become dominant share in the fleet. (Average age of Australian car is around 10 years. (ABS - Australian Bureau of Statistics 2007)) Therefore these standards will not substitute or duplicate CPRS because the scheme regulates current vehicles' emissions (German *et al.*, 2007).

The suggested government strategy in the Green paper does not include fuel consumption standards for new manufactured vehicles. The government position is that CPRS will generate demand for fuel efficient vehicles and vehicles' manufacturers will be forced to satisfy it. This is very optimistic forecast in the prospects of 5 cent increase of fuel price due to CPRS. (Although running cost is major factor influencing vehicle's purchase, there are many other important factors for buyer with significant influence as well.)

The government could consider legislation of standards for fuel consumptions for new vehicles; however the influence this will have on overseas manufacturers is questionable. The long vehicle life suggests that the today manufactured vehicle should be able to answer to the challenges that CPRS will put in 10-15 and even more years. The society should acknowledge that the transition to the sustainable transport will take a long period and the actions to make the transition) should start from today.

3 Impact of ETS on transport

The previous section considers the options for coverage of transport GHG emissions by ETS. In respect to the transport sector it recommends the most acceptable, appropriate, and feasible Australian ETS model with the following features: integrated ETS, fuel suppliers as trading entities, all transport GHG emissions are regulated by ETS, permit allocation by auctioning, co-existence with emission standards and fiscal taxes.

It is appropriate to state what will be the realistic emission target for the transport sector before trying to answer the question about impact of the proposed model of an ETS on transport. Setting an emission target requires understanding of the current status of transport and its future role in the Australian economy. Some important facts for our discussion (regarding transport) are summarised as follows:

Firstly, the demand for transportation will be higher in the future because increased transport activity is essential for further economic development, and to improve the quality of peoples' lifestyle (BTRE, 2005). Secondly, the transport sector is highly dependent on fossil fuels (AGO, 2005b). Thirdly, no reliable and affordable alternatives for transport energy exist (Button, 2004). Finally, due to the Australian infrastructure the economy predominantly relies on road transport which has low GHG efficiency (ABS, 2004). Given these reasons not surprisingly GHG emissions from transport activities have demonstrated a steady growth trend in the past and their growth rate is projected to increase in the future (BTRE, 2005).

With respect to the outlined circumstances it is not recommended to set emission reduction targets for transport in the near future. However, emissions from transport activities should not be left without control. They will need to be maintained within the limits that guarantee national GHG emissions reduction. Initial emission targets for transport could aim to slow down the increasing trend in transport emissions and stabilise them. Main priorities in policy implementation for transport emissions should be to set a good foundation for future reductions. The prime component of that foundation is research for sustainable transport because this addresses the major problem for reduction of transport emissions – the lack of effective and affordable sustainable alternatives for transportation. In order to achieve possible emission reduction in the future, when they will be really required, the intensive innovative work should start now. Therefore, a truly effective policy for transport is one that provides efficient incentives for the development of sustainable technologies. Hence the argument exists that a portion of the revenue gained from an ETS should be used for research into sustainable transport systems.

So far the arguments presented in this section suggest that the main criterion for analysis of the impact on the ETS on transport should be the possibility that the scheme provides for intensive research and development, and for more rapid implementation of sustainable transport technologies. How well might the ETS stimulate research and development in transport? In order to make this evaluation the estimation/quantification of the incentives that ETS offer for transport is required. The treasury modelling of CPRS, which will be published in September, is expected to give more light on the expected market price. Meanwhile, the Green paper suggests that permit price will be around $20 and maximum increase of petrol pump price of $0.09. Earlier studies suggested expected price of a permit for 1 tonne CO_2e emissions around $40 with projected variation between $20 and $90. This transfers to $0.12 average increase in fuel pump price with maximum increase up to $0.27 (Stanley and Watkis, 2003). Even when accepting the highest prediction for permit price it is very unrealistic to expect such negligible changes in fuel price to generate demand for alternative technologies. Transport will continue its usual way of business, its demand for fuel will continue to grow and fuel suppliers will satisfy this demand by buying affordable permits from the emissions trade market. The worst consequence of the described scenario is how transport businesses will behave in the new situation. Most likely they will conclude that they can continue in the old way even under an ETS. This limits the opportunities for the road transport sector to move towards sustainable solutions. This is the worst possible result according to the inferred main criterion for evaluation of policy for the reduction of transport emissions.

The future strategy for reduction of GHG emissions from transport should not limit its scope with ETS implementation. In fact the ETS is likely to contribute very little to the transport emissions problem resolution. Other mechanisms could have a more central role in the strategy and they could provide results in the most critical area – i.e. stimulation of research. Other critical aspect of the strategy is to take care to avoid drastic economic crises from ill-planned reduction of transport activities. At the moment authorities in Australia could seriously consider every opportunity to effectively stimulate research and development for sustainable transport. One of these opportunities is to link a domestically established baseline and credit ETS for new vehicles sold in Australia with other similar schemes around

the world. That will put serious pressure on vehicles' manufacturers and is one example of how even small market powers in the global economy can contribute to the worldwide environmental problem by good cooperation with other countries.

4 Conclusion

The analysis in this paper demonstrates that ETS that covers GHG emitted by transport activities is possible in Australia. However, it justifies the view that although total emissions will be reduced to the aimed target the prospect for the transport sector would not be as favourable. Moreover, the proposed model of CPRS in Commonwealth's Green paper does not guarantee/promise/assure the reduction of the growth rate of transport emissions. The legislation of other effective mechanisms for productive stimulation of research and development of sustainable transport solutions is required.

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