NOTE FOR FILE

To: David Parker (Executive Director, Revenue Group)

Cc: Christine Barron, Jason McDonald, Ed O'Halloran, Christine Barron, John Gallagher, Rob Dalla Costa, Marek Mania, Graeme Davis, Geoff Francis, Neil Motteram and Neena Pai

This note for file was prepared for the information of David Parker. It considers conceptual issues of carbon pricing. More practical implementation issues are not explored in detail. The following people were consulted during the preparation of this note: Jason McDonald, Ed O'Halloran, Christine Barron, John Gallagher, Rob Dalla Costa, Marek Mania, Graeme Davis, Geoff Francis, Neil Motteram and Neena Pai.

Carbon Emission Reduction Schemes

The absence of a carbon price has led to greenhouse gas (GHG) emissions beyond a socially optimal level because emitters do not take sufficient account of the cost of their emissions on others. The ultimate goal of policy is to make emitters account for these social costs of emissions at least cost to the economy.

[s 22]

[s 22]

Carbon taxes versus cap-and-trade schemes

It is often considered that carbon taxes and cap-and-trade schemes are equally effective mechanisms to achieve a target level of emissions. In practice, however, there are several differences between the two alternatives, which become particularly significant depending on whether there is a binding international agreement. A cap-and-trade scheme is more effective when there is a binding international agreement and a carbon tax can be more effective in the absence of a binding international agreement, as explored below.

Benefits of cap-and-trade schemes

A cap-and-trade scheme enables price discovery because firms can purchase permits until the price of the permit is equal to their marginal cost of abatement. It is more compatible than a carbon tax for integration with other countries, thereby allowing greater opportunity for least cost abatement – firms with low abatement costs can abate and sell emission permits to firms with high abatement costs irrespective of jurisdiction.

A cap-and-trade scheme would be effective at controlling emissions. It would also reduce some of the risk from government of meeting a binding international agreement. Under a global trading scheme with binding international obligations, to meet short run emission targets, private polluters would be required to purchase international permits for emissions not covered by domestic permits. In contrast, under a carbon tax, taxpayers would bear the costs of purchasing international abatement units for short term deviations from emission targets.

A cap-and-trade system is desirable in the long term under a binding international agreement as it facilitates price discovery and international linking to further reduce the cost of abatement.

Benefits of carbon taxes

A carbon tax has a number of benefits over a cap-and-trade scheme, particularly in the absence of collective international action.

A carbon tax would provide price certainty, but allow emission levels to deviate from short term targets. Whereas, under a cap-and-trade scheme prices are likely to be volatile because short term targets are rigid.[1] Short term deviations from an emission target under a carbon tax have lower welfare costs than price fluctuations under a permit scheme. Short run deviations from an emissions target are unlikely to alter long run global warming (which is a stock rather than a flow problem), because there are no immediate environmental consequences for greenhouse gas emissions.[2, 3] To

[1] For example, since the introduction of the U.S. SO_2 trading scheme in the mid 1990s, the price for SO_2 has varied by over 40 per cent per year on average.

[2] Aldy et al. (2009), 'Discussion Paper – Designing Climate Mitigation Policy', Resources for the future, Washington DC.

be clear, there are scant environmental benefits from the price volatility associated with a cap and trade scheme. Due to the significance of carbon in Australia's economy, volatility in the carbon price could create inflationary volatility and negatively affect business confidence, and thereby stifle innovation. Unlike price volatility in goods markets, like oil and minerals, the cap-and-trade market is dependent on the government and contains elements of sovereign risk. Further, industry is likely to demand compensation for price volatility if a cap-and-trade scheme is introduced.

Where the government sets policy under imperfect information, a carbon tax would have a lower welfare cost from mistakes in setting a carbon tax than mistakes in setting quantity under a cap-and-trade scheme. Carbon taxes and cap-and-trade schemes would be equivalent under perfect information, but the government has imperfect information and must design policy based on estimates of the costs and benefits of abatement. Setting the permit level based on these estimates may result in greater deadweight loss than setting the carbon tax rate. The welfare costs of setting tax rates and permit levels based on inaccurate estimates of the marginal costs and benefits of abatement are illustrated in Box 1.

The Congressional Budget Office (2008) suggests that the estimated net benefits of pure carbon taxes could be around five times that of pure cap-and-trade schemes.[4] The differences in estimated net benefits arise because carbon taxes are able to accommodate for cost fluctuations and achieve a long term emission target at the same time. Flexible cap-and trade scheme arrangements, for example price ceilings and banking provisions, could increase estimates of net benefit.

Further, a carbon tax provides opportunity for additional voluntary abatement; whereas, a cap-and-trade scheme does not provide opportunity for further abatement because voluntary abatement will merely free up more permits and lead to an increase in emissions elsewhere in the economy for no reduction in Australia's emission level. This is particularly important where Australia makes a small commitment to carbon abatement in the absence of global collective action.

A carbon tax could be implemented as an indirect tax, which could be imposed using much of the existing tax legislation and measurement methodologies. Conversely, a cap-and-trade system would require the establishment of an allocation and trading mechanism, which may lead to higher implementation and administration costs. Furthermore, initial mistakes in setting a cap under a cap-and-trade scheme would impose a fiscal cost on future governments because emission permits are bankable and would need to be purchased from the market if abatement needs to be more intensive than initially forecasted. Future governments would therefore bear the fiscal costs of current decisions (akin to government debt).

Box 1: Welfare losses under imperfect information

The potential welfare costs of a carbon tax are lower than under a permit scheme where the government makes mistakes about the cost and benefit of abatement due to imperfect information.

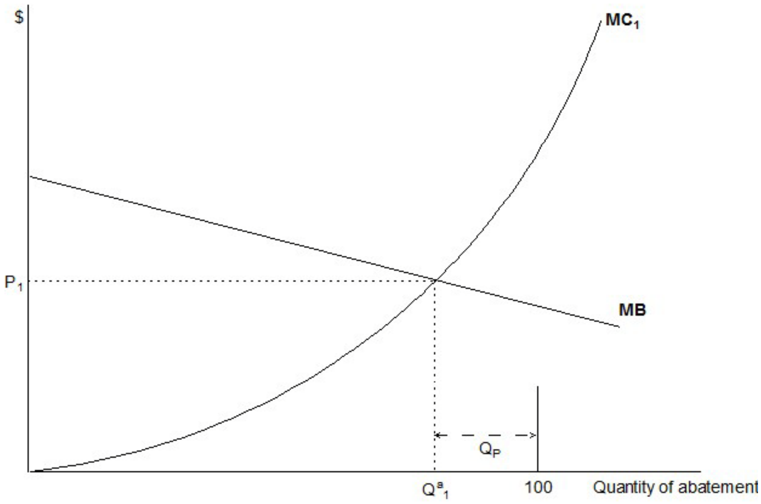
Consider the case where the government has perfect information about the marginal costs and benefits of abatement. Figure 1 shows a stylistic representation of possible marginal cost of abatement and marginal benefit of abatement curves.

[3] This is unlike sulphur dioxide (SO_2). Incremental emissions of SO_2 can cause immediate harm to the environment such as acid rain. Croker T. (2010) interview with The Washington Independent on 01/11/2010
[4] Congressional Budget Office (2008), 'Policy Options for Reducing CO_2 Emissions', Congress of the United States

The horizontal axis represents the quantity of abatement, where 100 is an index for the maximum possible amount of abatement (that is, no emissions at all). Q^a_1 represents the level of abatement undertaken and Q_p represents possible abatement that was not undertaken (that is, Q_p is the level of emissions, which equals 100 minus Q^a_1).

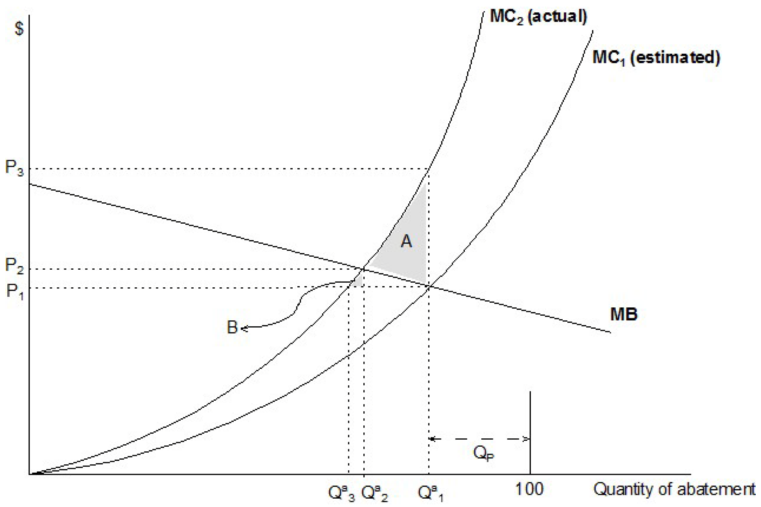
If the government has perfect information, a carbon tax would be set at P_1 or the number of emission permits issued would be Q_P (an abatement level of Q^a_1). With perfect information, both schemes would achieve equivalent outcomes.

Figure 1: Intervention under perfect information



Now consider the case where the government does not have perfect information. If the government incorrectly estimates marginal abatement costs to be MC_1 but later discovers it to be MC_2 (Figure 2), the socially efficient outcome is a price of P_2 and an abatement level of Q^a_2. But under an emission permit scheme, the government would incorrectly issue too few permits, Q_P (abatement of Q^a_1). If firms are required to abate to Q^a_1, the price of emission permits would be too high, P_3, resulting in a deadweight loss of area 'A'.

Figure 2: Intervention under imperfect information



Under a carbon tax scheme, the government would incorrectly set the carbon tax rate too low, P_1. If firms are required to pay a carbon tax of P_1, abatement would be too low, Q^a_3, resulting in a deadweight loss of area 'B'. This is less than the deadweight loss associated with an emission permit scheme (as area 'B' is less than area 'A').

Therefore, where the Government does not have perfect information, an emission permit scheme may lead to a greater welfare loss than a carbon tax. This outcome is a result of the relative slopes of the marginal benefit and marginal cost of abatement curves. The marginal cost curve is steeper (less price elastic) than the marginal benefit curve as firms move from low cost to high cost abatement measures. It is also widely argued that, in the short term, the marginal benefit of abatement curve is likely to be highly elastic and the marginal cost of abatement curve is likely to be inelastic.[5]

[s 22]

Although a carbon price will (potentially) increase wellbeing, its introduction is likely to cause output to fall due to increases in the cost of carbon-inputs.

In addition, a carbon price may reduce output further because it also alters labour supply decisions; albeit, potentially, in two opposing ways.[6]

- First, households may supply less labour to the market because real wage falls, as an hour of work is rewarded with less goods (this 'substitution effect' will decrease workforce participation).[7]
- Second, households may supply more labour to the market in order to restore their real income, which falls when a carbon price is introduced as the bundle of goods that households can afford shrinks (this 'income effect' is likely to increase workforce participation).

The reduction in output can be countered by using the proceeds of a carbon price in a way that promotes economic growth. If poorly spent, it could lead to further reductions in output and employment.

[s 22]

[5] Freebairn, J (2009), 'Carbon Taxes vs Tradeable Permits: Efficiency and Equity Effects for a Small Open Economy', *New Zealand Tax Reform – Where to Next?,* Wellington, New Zealand

[6] The overall impact on workforce participation is ambiguous – it depends on whether the income or substitution effect dominates. If the substitution effect dominates, the incentive to participate in the workforce will decrease. This will lower output further. Conversely, if the income effect dominates the incentive to participate in the workforce will increase.

[7] One way to think about this is the absence of a carbon price is a subsidy to labour force participation that masks the distortion of labour taxes on participation.

[s 22]

Thomas Abhayaratna and Keldon Pattugalan
Tax System Division
14 December 2010

Attachment A

[s 22]

[s22]

A.2 Carbon tax base

A consideration of tax base requires analysis of 'basis' (a source-based tax or a destination-based tax) and coverage.

A.2.1 Basis of taxation

Under a source-based tax, goods and services are taxed in the country where they are produced (regardless of where they are consumed). Under a destination-based tax, goods and services are taxed in the country where they are consumed (regardless of where they are produced).

A source-based tax is likely to have lower costs than a destination-based tax for four main reasons.

- A source-based tax is a direct way of targeting emissions in order for Australia to meet its international obligations. Under the international framework (such as the Kyoto protocol and United Nations Framework Convention on Climate Change) emission targets are based on where carbon is produced rather than where it is consumed.

- A source-based tax has fewer measurement problems and lower administration and compliance costs than a destination based tax.

  – <u>Measurement</u>: Carbon emissions can be measured on a source-basis using a well established (internationally accepted) methodology. Whereas, it is difficult to convert between destination-based and source-based measurements for traded goods because it would require border tax adjustments.

  – <u>Administration costs</u>: Border tax adjustments under a destination based tax are difficult to administer because the embedded carbon content of a traded good is not readily observable (this is unlike a VAT where the tax is levied on a directly observable price). As such, it requires information sharing between jurisdictions so that a carbon tax can be refunded on exports and imposed on imports. It also requires a verification process.

  – <u>Compliance costs</u>: A source based tax can be targeted to the most intensive emitters in order to reduce administration and compliance costs, while allowing better monitoring.[8] Whereas, a destination based tax requires that all producers attribute emissions to each good produced, so that the embedded carbon content can be tracked and used for the calculation of border tax adjustments. Unless this occurs, goods further down the supply chain would not receive a tax refund when they are exported and would be double taxed where they are exported to a country with a destination based carbon tax. This is particularly important as most carbon emission occurs during early stages of production (the production of fuels or conversion to energy).

[8] For example, the CPRS would have applied on a source-basis to only around 1,000 producers.

- Australia would receive a larger share of tax revenue under a source-based tax, compared to a destination based tax, because Australia is a net exporter of carbon intensive goods.[9] A destination-based tax would redistribute tax revenues to net importing countries.

- In the absence of collective action, a source-based tax is more likely to lead to technological advancements in Australia. It would provide an incentive for major emitters to develop cleaner technology. For example, under a source based tax, miners would have an incentive to develop cleaner technology; whereas, there would be little incentive under a destination-based tax because most mining output is exported (and Australia is a small consuming country). Without this, Australia would have to pay a higher price to meet emission targets.

There are, however, some downsides to implementing a source-based tax. Source based taxes impose additional costs on producers that may leave them less competitive in the international market where foreign producers do not face any tax on carbon. In particular, a source based tax may result in carbon leakage to countries with a lower carbon price.

A.2.1.1 Impact on international trade

The choice between a destination-based tax and a source-based tax could alter the competitiveness of Australia's export and import-competing industries (Table A.1). The outcome for Australian industry also depends on the actions of other countries.

Under global collective action, where there is a global carbon pricing scheme (uniform rate and uniform base), a carbon price would not impact the competitiveness of Australia's export and import-competing industries.

[9] Border tax adjustments for carbon taxes result in a redistribution of revenue among jurisdictions – under a global scheme there will be a redistribution of revenue from countries that are net exporters of carbon intensive goods to countries that are net importers. Whereas, border tax adjustments under a broad based GST/VAT have no net present value impact on tax revenues – this is because the present value of imports must equal to the present value of exports in the long run.

Table A.1 – Impact on trade: source based tax or destination based tax

		TRADING PARTNER		
		Carbon price – source based	**Carbon price – destination based**	**No carbon price**
AUSTRALIA	***Source based***	**No change** to competitiveness of *exports* or *imports* if implemented in pure form. In absence of global carbon price, incentive to produce carbon in country with lower carbon price – carbon leakage may occur.	***Exports* are disadvantaged** – there would be a **double tax** on exports, unless foreign jurisdiction recognises credit for carbon tax paid in Australia. ***Imports* are advantaged**, as they are not subject to charge for marginal social cost of carbon emissions.	***Exports* are disadvantaged.** ***Imports* are advantaged.** Carbon leakage where carbon production moves overseas.
	Destination based [10]	***Exports* are advantaged**, as they are not subject to charge for marginal social cost of carbon emissions. **Double tax** on *imports*, unless credit provided for tax in source jurisdiction (may be difficult to coordinate among jurisdictions).	**No change** to competitiveness of *exports* or *imports* if implemented in pure form.[11] No benefits of border tax adjustment if global carbon price. In absence of global carbon price, price of goods increases in price-taking countries with higher carbon tax.	**No change** to competitiveness of *exports* or *imports* if implemented in pure form. Tax on imports may be viewed as 'tariff' and sets bad precedence.

[10] A destination based tax is difficult to administer in a pure form because it requires the embedded carbon to be tracked so that it can be taxed for imports and refunded for exports. Due to this difficulty, exports further down the supply chain are likely to be input taxed.

[11] May lead to double tax on exports

In the absence of a global price, but where Australia chooses the same basis of carbon taxation as its trading partners, Australia's export and import-competing industries would be disadvantaged where the carbon price is higher than other countries. Conversely, Australia's export and import-competing industries would be advantaged where the carbon price is lower than other countries. Evidence suggests that the implicit carbon price in the electricity sector is low in Australia compared to its trading partners (Table A.2).

Table A.2: Implicit price of carbon in the electricity sector of six major economies

Country	Implicit Carbon price ($US)	
	Based on PPP exchange rates	Based on market exchange rates
Australia	**1.68**	**2.34**
China	14.22	8.08
Japan	3.11	4.22
South Korea	0.72	0.50
UK	29.31	28.46
US	5.05	5.05

Source: Vivid Economics, 2010

Australia's export and import-competing industries would be advantaged where Australia imposes a destination-based tax and its trading partners adopt a source-based tax. Exports are advantaged as they are not subject to a carbon tax. Import-competing industries are advantaged because imports are double taxed unless a credit is provided for tax paid in the source jurisdiction. Such a credit would be difficult to administer as it would require the embedded carbon to be tracked so that any tax paid in other jurisdictions could be credited for imports.

Australia's export and import-competing industries would be disadvantaged where Australia imposes a source-based tax and its trading partners adopt a destination-based tax. Exports are disadvantaged because they would be double taxed, unless the importing jurisdiction recognises a tax credit for carbon tax paid in Australia.

Australia's export and import-competing industries would be disadvantaged also where Australia imposes a source-based tax and its trading partners do not impose a carbon price. There would be an incentive at the margin for firms to move production to countries with a lower carbon tax (carbon leakage is particularly undesirable where global carbon emissions increase because production moves to countries that use more carbon to produce the same good).

Competitiveness considerations can be addressed by imposing a tax on the embedded carbon content of imports from non-action countries (with a low or no carbon tax) if other action countries currently considering this option (US and EU) do so. This would provide neutrality for Australia's import-competing industries, raise revenue more efficiently than many existing taxes, and provide incentive for those countries to impose a carbon tax (in order to gain tax revenue rather than see it being redistributed to Australia). It would, however, be impracticable to measure the embedded carbon of each imported good unless Australia receives information from the exporting jurisdiction. A proxy or average for goods imported from each country would be rough – important factors, such as quality of the raw material, the exact process and clean production technology, would not be taken into account – and, as such, the carbon tax may be viewed as a tariff and possibly lead to counter measures by other nations. One way to address such concerns is to reduce the tax where foreign producers can prove that the carbon content is lower than the average. This would, however, increase compliance cost for foreign producers to export to Australia and would lead to a selection bias where only producers of goods with carbon content higher than the average, are willing to accept the average charge.

[s 22]

This page was redacted under s 22

Attachment B

Abatement Models

This attachment outlines four topical abatement models.

B.1 Fixed price to cap-and-trade hybrid model

The fixed price to cap-and-trade hybrid model is a cap-and-trade scheme that sets a fixed price (carbon tax) for non-bankable permits in the short-term to address short-run price volatility. The rate on these permits can be adjusted to meet emission reduction requirements. After the fixed price period scheme moves to a cap-and-trade model where the price is be determined by the demand and supply of permits. In a scheme that allows for unlimited international trade, the domestic carbon price will be equal to the international carbon price and there will be certainty that Australia will meet its international obligations. This is because emitting firms will purchase permits from the international market for any uncovered emissions.

An advantage to this model is price certainty over the fixed price period, which is important for business over the short run. There is also emission certainty in the long run, which is important to Australia's international obligations and minimizes the fiscal risks of purchasing of international units. This model can be implemented quickly because of the simplicity of the fixed price period, but there will still be a lag before the cap-and-trade stage can be introduced.

One downside to this model is that the initial fixed price has an uncertain impact on emissions and the Government may need to purchase international abatement units to bring Australia into compliance. There is also a long term price risk for businesses due to price changes after the transitional period. The transition from fixed to flexible prices could also involve a spike in carbon prices, but this could be softened with gradual increases in the fixed price over time.

B.2 Baseline-and-credit scheme

Under a baseline-and-credit scheme firms abate to generate income, unlike carbon taxes and cap-and-trade schemes where firms abate to avoid a charge.

Under this scheme firms that reduce emissions below a baseline level are rewarded with credits that they can sell to other liable firms. The baselines would generally be 'intensity based' (that is, emissions per unit of production). This scheme can be combined with access to international units.

With this method, the incentives to reduce emissions are easy to understand (as long as crediting methodologies are not overly complex): the more abatement, the more credits provided to sell and earn money from. There is also downward pressure on some output prices as firms generate revenue and increase the costs of competitors through the sale of credits.

However, these advantages are outweighed by potential disadvantages of the scheme. Under a baseline-and-credit scheme there is uncertainty about emissions so Australia could fall short of its obligations and will need to purchase international abatement units. This creates fiscal risk as the Government will not gain any revenue from this scheme offset this purchase. Additionally, no revenue would be generated to provide transitional assistance for those that are heavily affected by the scheme. Finally, defining 'real' abatement could be problematic because abatement is credited against a hypothetical estimate of what emissions would have otherwise been.

B.3 McKibbon-Wilcoxen model

The McKibbon-Wilcoxen model offers both short term and long term emission permits simultaneously. Similar to the money market in Australia, short-term prices are set directly by the government (tax rate) and long term prices are set by the market.

The Government would issue an unlimited number of non-tradable, short term permits at a fixed price (carbon tax rate). These permits are only valid in the year of issue. Bankable, long term permits would be issued simultaneously that allow the holder to emit one tonne of CO_2-e[12] every year for the period of the validity. The quantity of permits would be determined by the Government's long-term emission reduction target. Unlike other permit schemes, this model does not propose any international trade in permits.

One advantage of this model is price stability in the short term as prices are set by the Government. Businesses can also hedge against long term price volatility by trading in long term permits. The up-front allocation of long term permits also gives low emission technology investors greater confidence that carbon pricing arrangements will be retained into the future.

One problem with this model is that total emissions are not capped in the short term and taxpayers face the risk of paying for international units to bring Australia into compliance. The distribution of long term permits also could reduce the flexibility of the Government to adjust long term targets.

B.4 Carmody (consumption based) model

Carmody proposes a destination based carbon tax model in which exports are exempt and taxes are applied to imports through a 'border tax adjustment'. As such emissions associated with production need to be measured to apply appropriate border tax adjustments.

There are some advantages of the Carmody model over a standard carbon tax regime. First, there is a reduced risk of carbon leakage as exporting firms are exempt and import competing firms are protected from untaxed firms overseas. Consumers also face clear price signals all domestic consumption is subject to a carbon price, creating incentives to make 'greener' choices across all goods and services purchased.

Administrative complexity is one disadvantage of this model as emissions need to be tracked throughout the production chain. This is particularly complex due to differing input qualities and production processes. There is also a fiscal risk that Australia will fall short of its international obligations because the Kyoto protocol is defined on production. Exporting countries have no incentive to reduce emissions as they are exempt from paying carbon taxes. Thus taxpayers bear the fiscal risks as exporting companies maintain 'dirty' production processes.

[12] Carbon dioxide or carbon dioxide equivalent