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Competitiveness and Carbon Pricing
Border adjustments for greenhouse policies

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Summary

The Australian Government has justified its failure to ratify the Kyoto Protocol by arguing that the Protocol's legally-binding cap on greenhouse gas (GHG) emissions would have an unnecessarily adverse and disproportionate impact on the Australian economy. This would occur because of Australia's heavy dependence on emissions intensive industries. As a result, it is argued, the Protocol would cause emissions intensive industries to be moved from Annex B (industrialised) to non-Annex B (developing) countries, a phenomenon known as carbon leakage.

The extent and nature of the competitive disadvantage, if any, actually suffered by Australian industry would depend on the policy measures adopted. The two key market-based policy measures that have been proposed are a carbon tax and emissions trading. Each of these measures would increase the costs of emission-intensive activities.

The Government's argument for not ratifying the Kyoto Protocol is based on the assertion that such cost increases would be large, relative to the value of production, and widespread across the economy, so that many sectors of the economy would be significantly damaged if such costs were imposed.

If, on the other hand, it is found that there is no unique or disproportionate disadvantage, the Government's argument for not ratifying the Kyoto Protocol would be undermined. Even if Australian industry as a whole is no more disadvantaged on average than that of other industrialised countries, there are some particular industries and companies that would be disadvantaged. Determining the likely extent and nature of competitive disadvantage and the industries where it is strongest is an empirical task, one undertaken in this paper.

Impacts on competitiveness

Because the majority of Australia's energy is derived from fossil fuels, a carbon tax or emissions trading would increase the cost of producing goods that use energy (or energy-intensive materials) as an input to production. These increases in production costs could negatively affect industries that either compete in export markets with producers not similarly affected, or face competition in the domestic Australian market from imports from such unaffected producers.

To be more precise, a company or industry may be particularly disadvantaged by the imposition of a carbon tax or emissions trading scheme if the following three conditions apply:

- the industry is particularly emissions intensive;
- the industry is particularly trade exposed; and
- this trade exposure is in particular to competition from countries that do not have to meet emissions caps under the Kyoto Protocol (non-Annex B countries plus the USA).

The analysis starts by examining the emissions intensity of the various sectors of the economy. It shows that the most emissions intensive sector is Basic non-ferrous metals (including the production of alumina, aluminium, nickel and other primary metals), which produces 18.4 tonnes of carbon dioxide equivalent (CO_2-e) for each $1,000 of value added. Other emissions intensive sectors are Iron and steel (7.87), Cement and lime (4.85), and Ceramics (mainly bricks and tiles) (3.70).

The effect of high emissions intensity is particularly clear from estimates of the total direct cost increases that would occur in each sector as a result of a notional emissions cost of $35/t CO_2-e, the price of carbon in the European emissions permit market at the time of carrying out the data analysis. For most sectors the effect of a $35/t CO_2-e cost is comfortably less than one per cent of the value of production. However, for six of the sectors the effect is very much greater, ranging from 3.2 per cent for Glass and glass products up to 14 per cent for Basic non-ferrous metals - see Table S1. It is these sectors of the economy that could potentially be most severely affected by the imposition of a price on GHG emissions.

Table S1 Increase in cost of production of a $35/t CO_2-e cost on GHG emissions, by economic sector

Economic sector	Increase in production cost
261 Glass and glass products	3.2%
262 Ceramics	6.4%
263 Cement, lime, concrete etc	9.8%
264 Other non-metallic mineral products	4.8%
271 Iron and steel (part)	7.3%
272-273 Basic non-ferrous metals	14.1%

Trade exposure

The next step in the analysis requires determining the industry sectors that are particularly trade exposed. Basic non-ferrous metals, Iron and steel, coal, LNG and gold are all significantly trade exposed, with exports accounting for well over half of total production for all the listed commodities except steel. Australia has no significant export trade in the other emissions intensive sectors, i.e. Glass and glass products, Ceramics, Cement, lime, concrete etc. and Other non-metallic mineral products.

With respect to import-competition, only steel and oil refining are import-competing industries that would suffer significant competitive disadvantage through the imposition of a price on GHG emissions.

In addition to examining the impact of a carbon price on sectors, a bottom up analysis of commodities confirms that, with the exception of coal, all the commodities listed would be significantly affected, in terms of competitiveness and profitability, by the imposition of a price on GHG emissions.

Sources of competition

The final step in the analysis is to identify the main sources of competition faced in export markets. Setting aside the special case of the USA, it is only if competitors are located in non-Annex B (developing) countries, which do not have binding greenhouse gas emission commitments under the Kyoto Protocol, that Australian companies would be disadvantaged in overseas markets.

For most of the commodities for which data are available, non-Annex B countries account for 40 per cent or more of total exports. This is most strikingly the case for LNG. The data for aluminium suggest that non-Annex B countries provide significantly less than half of all exports.

In summary, the analysis of this paper shows that the international competitiveness problem is much smaller than has often been claimed. However, some industries would be significantly adversely affected by the imposition of a price on GHG emissions in Australia; they include aluminium, alumina, steel, other non-ferrous metals, LNG and gold. These industries currently account for about 1.5 per cent of GDP and 19 per cent per cent of merchandise exports. It seems unlikely that any other industries would be appreciably affected.

Policy responses

The current policy of staying outside Kyoto and not pricing carbon carries substantial economic risks. First, it locks us out of the emerging carbon markets, limiting both foreign investment in Australian clean technologies and plantations (through the Joint Implementation mechanism of the Kyoto Protocol) and participation by Australian companies in developing country projects (through the Protocol's Clean Development Mechanism). Second, by insulating our economy from a carbon price, it retards the development of new clean industries and increases our future dependence on imported technology and expertise. Third, it fails to preserve the competitiveness of Australia's coal exports (considerably greater in both export earnings and jobs than aluminium production), which will be subject to the emissions policies and taxes of importing countries. Fourth, it exposes our exports of coal and emissions-intensive products to likely consumer and government preferences against climate 'free-riders'.

How could the competitiveness problem best be deal with? The Australian Government has claimed for some years that seeking legally binding emissions limits for the major developing countries is the best response. This strategy failed in Kyoto and has not borne fruit since. It has seen the Government backed into a corner where Australia now, alone with the United States, refuses to ratify the Kyoto Protocol.

This paper proposes a different approach: that Australia ratify the Kyoto Protocol and implement a carbon tax or emissions trading, incorporating offsets that preserve the competitiveness of the industries at risk. Ideally, the offsets would be designed so that they might form the basis of a future multi-lateral solution to carbon leakage. As a full and more respected participant in the international climate negotiations, Australia would be better placed to pursue a multi-lateral approach.

Border adjustments to protect competitiveness

Most existing and proposed carbon tax and emission trading schemes incorporate some kind of special provision for energy-intensive industries. The main approaches are: wholesale exemptions of industry sectors; negotiated agreements; offsetting tax reductions; and financial incentives for energy efficiency improvements. We are, however, particularly interested in another approach, that of border adjustments.

A border adjustment would preserve the international competitiveness of energy-intensive producers while maintaining the carbon price signal within the domestic economy. Under the type of border adjustment most appropriate to Australia's circumstances, a rebate would be paid to aluminium exporters, for example, to offset the increase in production costs resulting from a carbon tax or emissions trading. The rebate would only be paid for exported product. Aluminium consumed domestically would remain subject to the price signal. A similar adjustment, in this case a levy, could be applied to imported energy-intensive goods to offset any significant carbon price disadvantage faced by competing local producers.

Border tax adjustments are a common feature of tax systems, including Australia's goods and services tax and European value added taxes. Border adjustments have been proposed as a solution to carbon leakage in the United States and Europe. The United States has implemented border adjustments for two environmental taxes, the ozone-depleting chemicals tax and the Superfund chemical excises.

Assessed against a range of criteria - including effectiveness in offsetting competitive effects, maintaining environmental integrity, minimising economic costs, ensuring administrative simplicity, maintaining fairness and contributing to an international solution to the problem of carbon leakage - border adjustment is the most promising policy option for Australia.

1. Introduction

The 1997 Kyoto Protocol to the 1992 United Nations Framework Convention on Climate Change (UNFCCC) establishes legally-binding caps on the anthropogenic emissions of greenhouse gases (GHGs) by 39 developed nations (listed in Annex B to the Protocol), with the caps applying over the years 2008-2012. Australia's GHG emissions cap under the Kyoto Protocol is set at 108 per cent of Australia's 1990 level of emissions.[1]

A key principle of the UNFCCC, agreed by world leaders at the 1992 Rio Earth Summit, is that developed countries should take the lead in combating climate change.[2] Accordingly, the Kyoto Protocol does not impose legal limits on the emissions of developing countries. The Protocol was intended as a first step that would pave the way for subsequent agreements seeking deeper cuts and imposing caps on a wider range of countries.

The Kyoto Protocol entered into force in February 2005, but without the participation of either Australia or the USA. These are the only two Annex B countries that have refused to ratify the Protocol, and hence are not bound to achieve the emissions cap. Australia's federal government has repeatedly justified its failure to ratify the Kyoto Protocol by arguing that the Kyoto Protocol's legally-binding cap on GHG emissions would have an unnecessarily adverse and disproportionate impact on the Australian economy because of Australia's particularly heavy dependence on industries that are inherently emissions intensive.[3]

The Government has argued, as has the Bush Administration, that the Protocol will cause emissions intensive industries to be moved from Annex B to non-Annex B countries (thereby causing a phenomenon termed carbon leakage). This could involve existing plants being closed, but recently the Government has focused more on the prospect of future investment being diverted away from Australia to non-Annex B countries.

The extent and nature of the competitive disadvantage, if any, actually suffered will depend on the policy measures that Australia might adopt, were it to comply with its commitment to limit emissions under the Kyoto Protocol. Moreover, the Intergovernmental Panel on Climate Change has estimated that global greenhouse gas

[1] In effect, the Kyoto Protocol would require Australia to cap its total GHG emissions over the 5 years 2008-2012 to 540 per cent (i.e. 5 x 108 per cent) of the 1990 level of emissions.
[2] Article 3.1 of the UNFCCC states: 'The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof'. Developed countries are largely responsible for the increase in greenhouse gas emissions in the atmosphere over the past century and continue to emit considerably more per person (Turton 2004)
[3] For example, on 13 September 2002, the Federal Minister for the Environment and Heritage, Dr David Kemp, issued a press release which stated that 'Australia does not want to give future investors in Australia who make decisions under long time frames, the message that we're prepared to impose legal obligations on them which they wouldn't face if they invested in many of our competitor countries. We don't want to drive jobs overseas or industries overseas'.

emissions will need to be cut by 60-80 per cent of 1990 levels in order to stabilise greenhouse gas concentrations in the atmosphere. Australia's 108 per cent Kyoto Protocol target (which it may come close to reaching under the current set of climate change programs, mainly by virtue of large reductions of emissions from land clearing during the 1990s) should therefore be viewed as only a first step.

If Australia is to make the further and more substantial reductions in GHG emissions that are necessary, broader mandatory policy measures will need to be introduced. The two key forms of such measures are regulatory and market-based.[4] It is generally agreed that market-based measures are a more efficient (i.e. less costly for the same outcome) means of achieving emissions reduction than regulatory measures. This is because they provide individuals and firms with the maximum degree of flexibility in deciding how and when to achieve emissions reductions (Ekins and Barker 2001). The two key market-based policy measures that have been proposed to assist Australia to reduce its GHG emissions are a carbon tax and emissions trading. Section 2 of this paper examines those two market-based measures in detail.

Either of these measures would increase the cost of activities and materials which give rise to or are associated with greenhouse emissions that are covered by the tax of trading scheme. This is likely to include, in particular, emissions associated with fossil fuel based energy. The Government's argument for not ratifying the Kyoto Protocol is based on the assertion that such cost increases would be large, relative to the value of production, and widespread across the economy, so that many sectors of the economy would be significantly damaged if such costs were imposed. If this assertion is correct, then any means that may be available to offset the competitive disadvantage would be of potentially great policy significance. In the best case, implementation of such offsets might provide a means by which Australia could ratify the Kyoto Protocol, with the associated benefits to such industries as environmental services and renewable energy, while avoiding the damage to industries that would be disadvantaged in the absence of offsets.

If, on the other hand, it is found that there is no unique or disproportionate disadvantage, the Government's argument for not ratifying the Kyoto Protocol would be undermined. Nevertheless, even in the case that Australian industry as a whole is no more disadvantaged, on average than that of other Annex B countries (other than the USA), it is certain that there will be some particular industries and companies that would be disadvantaged. Determining the likely extent and nature of competitive disadvantage and the industries where it is strongest is an empirical task, which is addressed in section 3 of this paper.

In terms of policy development, there are good reasons beyond economic and employment concerns to examine ways in which such disadvantage might be offset or avoided. The political reality is that, unless the disadvantage issue is addressed, any proposal for the introduction of a carbon tax or emissions trading will be strongly opposed by lobby groups representing the industries that may be disadvantaged.

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[4] A requirement that every company has to reduce its GHG emissions by 20 per cent would be an example of a regulatory measure, while taxing GHG emissions and allowing each company to either emit and pay the tax or reduce emissions and not pay the tax would be a market-based example.

Indeed, not only in Australia and the United States, but in every Annex B country, the threat of carbon leakage and associated job losses to developing countries is a significant barrier to the implementation of effective climate protection policies.

It is also important to note that shifting emissions intensive production does not help protect the climate system. Greenhouse gases have the same impact wherever they are emitted. In some cases, a small reduction in global emissions may result if efficient new greenfield plants in developing countries displace ageing developed country production (more likely for the USA and Europe than Australia). But, in other cases, displacement may involve greater utilization of existing inefficient power plants or manufacturing capacity in a developing or transition country, resulting in a net increase in global emissions. More importantly, though, the relocation option greatly weakens the economic incentive for developing more efficient production technologies and substitute low-emission products. The UNFCCC's goal of stabilizing atmospheric greenhouse gas concentrations at safe levels can only be achieved through a transition to sustainable production and consumption patterns. Simply shifting emissions around the world puts off the task of undertaking this transition.

Fortunately, there are various means of offsetting any economic disadvantage that may arise from the imposition of a carbon tax or emissions trading system. A range of possible offset measures is examined in section 4 of this paper. The measures include complete exemption of selected industry sectors, negotiated agreements between government and individual businesses, free allocation of permits in an emissions trading system, offsetting tax reductions, financial incentives for energy efficiency improvements, and border tax adjustment. We conclude, on the basis of a number specific effectiveness and efficiency criteria, that border tax adjustment is the most promising of these measures.

The paper concludes, in section 5, with a discussion of how border tax adjustment might be implemented should either a carbon tax or an emission trading scheme be introduced in Australia.

2. Carbon taxes and emissions trading

This section provides a brief overview of policies that Australia may introduce to make further reductions in its GHG emissions. In particular, it examines carbon taxes and emissions trading.

2.1 What are they?

A pure carbon tax is a tax that is levied on fossil fuels in direct proportion to their carbon content (or the amount of CO_2 that will be emitted when the fossil fuel is combusted). A carbon/energy tax is a more broadly-based tax that includes a carbon tax component. A carbon/energy tax may apply to non-carbon energy sources such as nuclear and hydro-power, and may include tax rates that reflect additional non-greenhouse policy concerns (e.g. waste disposal in the case of nuclear power).

An emissions trading scheme requires entities (such as firms) to hold permits in order to carry out certain activities that lead to the emission of CO_2. In 1999, the Australian Greenhouse Office (AGO) released a series of four discussion papers on the issues and options that arise in relation to a national emissions trading system.[5] In 2000, a follow-up paper on the options for allocations of permits under emissions trading was released (Allen Consulting Group, 2000). In late 2002 the Council of Australian Governments (COAG) released a report *Towards a Truly National and Efficient Energy Market* (COAG 2002). The report recommended the introduction of a national emissions trading system.

The most common form of emissions trading is cap and trade, under which a maximum amount of emission is determined by a regulatory authority and a number of permits that is equivalent to that amount of emissions is distributed. The permits may be allocated by auction (to the highest bidders) or 'grandfathered' (given to current emitters according to a fixed ratio that reflects their historical emissions). An auction is the emissions trading equivalent of a pure carbon tax. It allows those who can afford to pay to continue (or increase) emissions. Grandfathering is the emissions trading equivalent of a carbon tax combined with tax exemptions granted according to entities' historical emissions. Grandfathering favours current or historical emitters, and may make it difficult for new producers to enter the market.

2.2 Where have they been implemented?

From the late 1990s a number of European countries including Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Slovenia, Sweden, and the UK began introducing carbon/energy taxes covering selected sectors of their economies (European Environment Agency 2000, p. 46). In January 2005 the European Union emissions trading scheme (ETS) came into effect, supplementing or partly superseding the previous carbon tax system in member countries (the details vary between countries).

[5] The four papers were: *Establishing the Boundaries*; *Issuing the Permits*; *Crediting the Carbon*; and *Designing the Market*, all published by the Australian Greenhouse Office in 1999.

Norway has retained its carbon tax system, meaning that Switzerland is now the only country in western and central Europe without either emissions trading or a carbon tax.[6]

The first stage of the scheme covers carbon dioxide emissions from major industrial plants in four sectors of each member country's economy: energy production (including electricity generation), iron and steel, minerals processing, and pulp and paper. Member states are required to set an emissions cap for all plants covered by the scheme. For the first period covered by the scheme most permits were allocated free to emitting businesses under a National Allocation Plan prepared by each government. It is estimated that emissions covered by the scheme amount to about 46 per cent of total EU carbon dioxide emissions.[7]

There is more extensive experience with emissions trading as a policy instrument to control other forms of pollution. Two of the best known examples are the sulphur and nitrogen oxides trading schemes in the USA. The sulphur dioxide scheme, which began operation in 1995, caps emissions from electric power stations in the lower 48 states at just below half 1980 levels. Emissions allowances equal to the cap are distributed to power plant operators through a grandfathering approach and can be traded or banked for future use. The scheme is credited with substantially reducing acid deposition in the eastern United States at lower-than-expected costs.[8]

In Australia, the main experience with trading schemes for environmental entitlements has been with issues affecting the quality and availability of water. The Hunter River Salinity Trading Scheme in NSW is a well known example, as are the growing web of trading arrangements for access to irrigation water.

2.3 The Australian legal context

A carbon tax could be implemented by the Commonwealth, pursuant to section 51(ii) of the Australian Constitution (which gives the Commonwealth the power to impose customs duties and excise). An important proviso on this power is that Commonwealth must not introduce taxes which have the effect of discriminating between States or regions of Australia. A uniform tax that applies equally to each State but in fact has differential impacts (e.g. in States that are more reliant on fossil fuels) would not be regarded as discriminatory (Hatfield Dodds 2002).

Emissions trading could be implemented by the Commonwealth, pursuant to its external affairs power under the Australian Constitution. It is possible that the Commonwealth would have to ratify the Kyoto Protocol prior to implementation of national emissions trading.

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[6] Switzerland has legislation and advanced plans for a carbon tax on heating fuels with full revenue recycling, by means of offsetting reductions in other forms of personal taxation, such as health fund or social security levies, and is currently debating when the new tax should come into effect.
[7] For a general discussion of the EU emissions trading scheme, see Kruger and Pizer (2004).
[8] For a description of the US sulphur dioxide and nitrogen oxides programs, see www.epa.gov/airmarkets. For an evaluation of the SO_2 scheme, see Burtraw and Palmer (2003), and for a comparison with the EU Emissions Trading Scheme, see Kruger and Pizer (2004).

Notwithstanding the substantial amount of policy development work undertaken, it became clear by early 2002 that the Howard Government had decided not to proceed with implementing an emissions trading scheme and would not ratify the Kyoto Protocol, decisions that are made explicitly in the Energy White Paper of 2004 (Department of Prime Minister and Cabinet 2004).

In the absence of Commonwealth action, all States and Territories agreed in 2004 to a proposal by the NSW Premier to establish a working group to develop a model for a multi-jurisdictional emissions trading scheme for consideration by State and Territory Governments. Following an initial report from the working group, the Premiers and Chief Ministers released a joint communiqué in March 2005 outlining ten principles as a basis for further investigation, including acceptance of a 'cap-and-trade' design. In late 2005, the working group issued a consultation paper on these principles and conducted a series of stakeholder workshops (Interjurisdictional Working Group 2005). Notably, the consultation paper sought comments on mechanisms to address adverse effects on energy intensive and trade exposed sectors. A green paper outlining a proposed model for emissions trading is due to be released in mid-2006.[9]

2.4 What is the difference between a carbon tax and emissions trading?

A key difference between a carbon tax and emissions trading is in their allocation of environmental and economic risk. A carbon tax fixes the price of emissions and allows the market to adjust the quantity of emissions. It therefore provides certainty in the level of economic cost of reductions, at the risk of potentially high emissions (i.e. poor environmental outcome) if the market is slow in developing emission reduction measures. Emissions trading fixes the quantity of emissions and allows the price of emissions to adjust accordingly through the market price of emission permits. It therefore provides certainty in the level of emissions (i.e. environmental outcome), but there is a risk that high economic costs will be incurred if the nation is slow in developing emission reduction measures.

However, these risks can be mitigated by adopting slightly more complex administrative structures. With a carbon tax, for example, the government could introduce the tax at a relatively low level, with an explicit statement that the rate would be increased if insufficient emissions abatement were achieved. With emissions trading, the government could reserve the power to issue additional permits in the early years of the scheme if the market price of permits rose above a predetermined level.

2.5 Additional policy approaches

A carbon tax or emissions trading may be viewed as the most important tool in a climate change policy tool kit (Hoerner and Muller 1996). This is because either of these policy measures provides explicit information, in the form of a price signal, to every person who is undertaking actions that lead to emissions of greenhouse gases from the emission sources that are subject to the tax or the scheme. The costs of greenhouse pollution will therefore automatically have to be taken into account in every

[9] See www.cabinet.nsw.gov.au/greenhouse/emissionstrading for details of the State and Territory investigations, including the consultation paper and First Ministers' communiqué.

decision about such actions. The strength of market based policy instruments is that they can provide this information about the costs of actions in such a comprehensive and instantaneous manner.

The weakness of market instruments if used as the only tool is that they depend for their effectiveness on market participants, i.e. greenhouse gas emitters in this case, being able to turn immediately to a diverse range of alternative options for achieving the services they desire (transport, winter warmth, process heat etc.) that have lower emissions and hence lower costs when the carbon tax or permit cost is included. The range of available options will be determined by the pre-existing market structure. In some cases this range will be very limited. For example, public transport is less emissions intensive, and thus less sensitive to an increased cost of emissions, than private car transport. However, most households living in the outer suburbs of Australian cities do not have an adequate (or any) public transport alternative to which they could turn. Similarly, households that rent a poorly insulated, badly oriented house in one of the cooler parts of Australia would have few options to which they could turn if the cost of their heating fuel is increased by a carbon tax.

It is therefore imperative that a carbon tax or emissions trading system is supported by a comprehensive policy tool kit that is explicitly designed to help energy consumers reduce their emissions by using energy more efficiently or switching to low emission energy sources. Such policy measures include: public funding of research (e.g. development and commercialisation of renewable energy); public investment in infrastructure (e.g. public transport); energy efficiency standards (e.g. for appliances or vehicles); eco-labels (e.g. the Greenhouse Friendly label); government procurement policies; and land use policies (e.g. restrictions on land-clearing).[10]

2.6 Why might a carbon tax or emissions trading system disadvantage Australian industry?

As with any major policy change, the introduction of a carbon tax will have both positive and negative effects on the economy as a whole, and amongst the population of individual economic agents there will be both winners and losers. Some of the potential benefits include securing a first mover advantage through the establishment of strong new industries supplying low emission products and services, and better managing risks of exposure in future to high emission reduction costs, that could arise from investments today in long-lived, emissions-intensive capital equipment and infrastructure. This paper does not examine these potential benefits; it is solely concerned with dealing with what is widely perceived to be the largest potential cost of a carbon tax or emissions trading to the Australian economy.

A carbon tax or emissions trading system would raise the price of fossil-fuel based energy in Australia. Because the majority of Australia’s energy is derived from fossil

[10] It is noted that Council of Australian Governments Energy Market Review Report (COAG 2002) recommended the abolition of a number of subsidiary policy measures, such as the Mandatory Renewable Energy Target (MRET) measure, in favour of a national emissions trading system. This paper maintains that a comprehensive national GHG emissions reduction strategy would include targeted measures that are complementary to either a carbon tax or emissions trading, though such measures would not necessarily include the MRET.

fuels, a carbon tax or emissions trading would increase the cost of producing goods that use energy (or energy-intensive materials) as an input to production. These increases in production costs could negatively affect industries that either compete in export markets with producers not similarly affected, or face competition in the domestic Australian market from imports from such unaffected producers. Such competition could come from non-Annex B countries, i.e. developing countries, or the USA, which, like Australia, has not ratified the Kyoto Protocol.

To be more precise, a company or industry may be particularly disadvantaged by the imposition of a carbon tax or emissions trading scheme if the following three conditions apply:

- the industry is particularly emissions intensive;
- the industry is particularly trade exposed; and
- this trade exposure is in particular to competition from countries that do not have to meet emissions caps under the Kyoto Protocol (non-Annex B countries plus the USA).

In section 3 each of these conditions is examined in turn to determine which sectors of the Australian economy and which particular industries are especially emissions intensive. The analysis then proceeds to determine which of these emissions intensive industries is strongly trade exposed, and whether this exposure is to non-Annex B countries. The section concludes by identifying the industries which, on the basis of these criteria, would be especially disadvantaged by a carbon tax or emission trading scheme, and the proportion of the economy constituted, in total, by these industries.

2.7 Won't there be many more winners and losers?

It is important to distinguish between the competitiveness issue for trade-exposed industries, as outlined in the previous section, and the creation of winners and losers within the domestic economy. A well-designed carbon tax or emissions trading scheme will change the relative prices of many of the goods and services that we all consume. They are intended to do so. Goods and services that can be produced and supplied with few emissions (including emissions in the production of inputs) will gain an advantage over higher-emission alternatives. Timber, for example, may gain an advantage over concrete and steel in construction. Aluminium may lose out to steel in some applications, but become more heavily used in vehicles where its lighter weight reduces fuel consumption. Over the longer run, consumers may spend less on energy- and material-intensive goods and more on lower emission goods and services like telecommunications, entertainment and software.

Such shifts in production and consumption patterns will be necessary to achieve the deep emissions cuts over coming decades that scientists tell us are required to avoid dangerous climate change. It is a common fallacy to imagine that we can get there just by shifting to lower emission fuels and making existing production processes more efficient. That would be a more costly and less effective path than one that also allows for broader economic changes. Facilitating such changes is a key attraction of a well-designed carbon tax or emissions trading scheme that provides an economy-wide price signal. Insulating particular sectors or industries from this price signal to avoid competitive disadvantage, as is often proposed, defeats the purpose of the tax or trading scheme.[11] The focus of this paper is on the much narrower issue of international competitive disadvantage for trade-exposed industries.

[11] For an example of how this has happened in Finland see Vehmas (2005).

3. Identifying affected industries

3.1 Analytical approach

In this section we examine the factual basis for the three propositions that provide the foundation for the Government's decision not to ratify the Kyoto Protocol: that the Australian economy is unusually emissions intensive, is especially trade exposed, and is particularly exposed to trade competition from countries that do not have to meet emissions restrictions.

Almost all kinds of economic activity give rise to GHG emissions. However, some emission sources, such as methane emissions from cattle and from wet rice cultivation, are unlikely to be directly financially penalised by a carbon tax or emissions trading system, because of the practical difficulties of measuring these emissions. It is generally accepted that the emission sources most likely to be affected by these policy measures are fuel combustion, fugitive fuels (together constituting energy related emissions), and industrial process emissions. Almost all emissions from these sources can be either measured or accurately estimated at the point of emission. The combined emissions from these sources accounted for 74 per cent of Australia's total emissions in 2003 (Australian Greenhouse Office 2005a). The main emission sources not included are agricultural activities (other than fuel use), land use change and forestry, and waste.

Our analysis therefore starts by examining the emissions intensity, in terms of energy and industrial process emission sources, of the various sectors of the economy. All other sources of emissions are excluded from the analysis, for the reasons given in the previous paragraph. Emissions associated with transport of raw materials, products and people, even though such transport may be an integral part of the economic activity in a particular sector, are also not included. From this we identify those sectors that are particularly emissions intensive. It is important to appreciate that, to the extent that the Australian economy may be more emissions intensive than the economies of other developed countries, it is because the structure of the Australian economy differs from that of other countries. In general, particular activities in Australia, such as the manufacture of motor vehicles or steelmaking, are not more emissions intensive than the same industries in other countries. But making steel is always and everywhere much more emissions intensive than making cars. If the Australian economy is more emissions intensive, it is because activities such as steel making are relatively more important and activities such as car making less important than in other countries.

The objective of this paper is not to examine the truth, or otherwise, of the Government's argument about Australia's relative disadvantage, although the cost is often overstated.[12] The objective is to determine how important the emissions intensive sectors are to Australia's economy as a whole, i.e. to estimate the share of Australia's GDP contributed by these sectors of the economy.

The next step in the analysis is to determine the extent to which these emissions sectors are trade-exposed. Trade exposure may take the form of export competition. All

[12] See, for example, Hamilton (2001), Chapter 2.

businesses that export will face competition from export businesses in other countries, and any business that relies on exports for a large proportion of its turnover and profits is particularly trade-exposed. It is export-competing industries that are usually thought of when the issues being considered in the paper are discussed. However, businesses, and whole economic sectors, that confine their activities to supplying domestic Australian markets may also be exposed to competition from imports. We therefore also examine the extent to which emissions intensive industries supplying domestic markets may be exposed to import competition.

Having identified trade-exposed emissions intensive industries, the final step in the analysis is to determine the source of the competition. It is only if the main sources of competition are from non-Annex B countries that it can be argued that an Australian industry would be disadvantaged by Australia ratifying the Kyoto Protocol.[13] We conclude this section by identifying those economic sectors that may be disadvantaged in this way and estimating their importance to the Australian economy as a whole. In doing so we try to take account not only of the present circumstances of these industries but also of possible changes in the future. It has been suggested, for example, that the entry into force of the Kyoto Protocol will cause new investments in emissions intensive industries to be moved from Annex B to non-Annex B countries (thereby causing carbon leakage).

Finally, we point out that this analysis is concerned only with the possibility of adverse changes in the international competitive position of Australian industries. Any such adverse changes may be offset by policy measures implemented at Australia's border, which we discuss in sections 4 and 5 of this paper. The analysis is not concerned with changes in the relative competitive position of Australian industries in Australian markets, such as an improvement in the competitive position of natural gas, relative to coal, in the market for electricity generation fuels. Border adjustment offset measures are irrelevant to such a change. In such cases, some forms of adjustment assistance, e.g. additional social security or training programs for affected workers, may be justified for affected communities or individuals.

3.2 Emissions intensity of economic sectors

Greenhouse gas emissions related to the use of energy by various economic sectors of the Australian economy have been taken from George Wilkenfeld & Associates and Energy Strategies (2002). These emission estimates are, for the most part, ultimately derived from the national statistics of energy use by fuel type and economic sector, compiled by ABARE (Donaldson 2005), and the level of sectoral disaggregation is that available from the ABARE data. The sectoral emission totals are calculated on the

[13] It might be argued that, strictly speaking, the argument should be pitched in terms of being unfairly disadvantaged. Australia's negotiating position at the Kyoto conference, and the outcome it achieved, were based on the assertion that it would be more costly for Australia to achieve a given emissions reduction than other Annex B countries. If this were correct, a trade exposed Australian exporting industry would be disadvantaged even if all its competitors were located in Annex B countries that have ratified the Kyoto Protocol. However, any such argument is contradicted, so far as the Protocol emissions caps are concerned, by the observed fact that Australia seems likely to have relatively little difficulty achieving its cap, largely by virtue of land clearing reductions, whereas many European countries may have considerable difficulty, notwithstanding extensive use of carbon tax/emissions trading measures.

basis of allocating all 'upstream' emissions arising from extracting, processing and transporting fuels to the end user of the fuel concerned. In economic terms, this is equivalent to assuming that fuel suppliers pass through to fuel consumers the full cost of any carbon taxes, emission permits or other GHG costs they may bear. This is particularly important in the case of electricity, where all the emissions occur before the point at which the energy is used. In other words, the assumptions used in this analysis mean that we are calculating the maximum possible greenhouse cost that could fall on each sector (other than transport costs, as noted above). It is possible that, in practice, some of the cost of emission abatement falling, for example, on an electricity generator may be absorbed by the generator and not passed on in prices charged for electricity.

Where applicable, we have added to these energy related emissions the relevant industrial process emissions. Industries where these emissions are significant include cement, iron and steel, aluminium smelting and chemicals. Total emissions attributable to each sector are then related to the value added and the total value of production for each sector, sourced from ABS data. Note that we were unable to obtain value of production data for the same year (1998-99) as that for which the emissions and value added data apply, and for that reason, the absolute sectoral intensity figures are indicative rather than a precisely accurate measure of intensity in any particular year. However, this will have a negligible effect on the relativities between sectors, since emissions intensity is determined by the intrinsic characteristics of each sector and by the characteristics of the technologies employed, all of which change only gradually over time.

The various energy supply industries, such as electricity generation and oil refining, are excluded from the analysis at this stage. Coal mining, natural gas processing and electricity generation are effectively protected from import competition by virtue of Australia's energy resource endowment and geographical isolation. Oil refining is not protected in this way, and is discussed later in this section. The export components of energy supply industries, of which the two most important are coal mining and LNG, are also excluded because the data are not disaggregated to the level that would allow these industries to be shown separately as end use industries, so they are excluded from this stage of the analysis. They also are examined using a 'bottom up' commodity by commodity approach later in the section.

The results of this analysis are shown in Tables 1 and 2. Table 1 shows that the emissions intensity of the various economic sectors varies across a wide range. The most emissions intensive sector is Basic non-ferrous metals (which includes the production of alumina, aluminium, nickel and other primary metals). Other emissions intensive sectors are Iron and steel, Cement and lime, and Ceramics (mainly bricks and tiles). The effect of high emissions intensity is particularly clear in Table 2, which shows the total direct cost increase that would occur in each sector as a result of a notional emissions cost of \$35/ t CO_2-e, and also expresses this cost increment as a fraction of the total value of production. The cost increase is of course directly proportional to the assumed cost of emissions; a cost of \$70/t CO_2-e, for example, would result in twice the cost impost shown in Table 2. An emissions cost of \$35/ t CO_2-e (22.13 Euros/t CO_2-e) was used in the analysis since this was the price of carbon in the European emissions permit trading market at the time of carrying out the data analysis (20 October 2005). It should be noted that this analysis is concerned only with direct effects of the imposition of a price on emissions, and makes no allowance for possible indirect effects of revenue recycling to the industries in the table, e.g. through reducing company tax or payroll tax.

Table 1 GHG emissions intensity and employment by economic sector

Economic Sector	Emissions 1998-99, kt CO_2-e	Value added 1998-99 $m	Emissions intensity, t CO_2-e/$1,000 value added	Employment Feb. 2005	
				Number ('000)	Share of total
Div A Ag, Forestry, Fishing	7,621	$15,816*	0.48	360.3	3.6%
11 Coal mining	*na*	*na*	*na*	27.0	0.3%
12 Oil and gas extraction	*na*	*na*	*na*	7.1	0.1%
13-15 All other mining	12,801	$10,492*	1.22	85.2	0.8%
21 Food, beverages, tobacco	8,988	$14,299	0.63	156.5	1.6%
22 Textile, clothing etc	2,928	$3,268	0.90	43.8	0.4%
23-24 Wood, paper and printing	7,462	$10,924	0.68	153.1	1.5%
252-256 Chemical industry (part)	12,452	$8,542	1.46	82.7	0.8%
261 Glass and glass products	960	$460	2.09	*na*	*na*
262 Ceramics	2,323	$628	3.70	*na*	*na*
263 Cement, lime, concrete etc	8,993	$1,856	4.85	*na*	*na*
264 Other non-metallic mineral products	1,487	$458	3.25	*na*	*na*
26 Total Non-metallic mineral products	13,762	$3,402	4.05	32.1	0.3%
271 Iron and Steel (part)	22,382	$2,843	7.87	*na*	*na*
272-273 Basic non-ferrous metals	52,042	$2,829	18.4	*na*	*na*
274-276 Fabricated metal products	1,893	$5,243	0.36	*na*	*na*
27 Total metal products	76,317	$10,915	6.99	142.5	1.4%
28 Machinery and equipment	4,622	$13,996	0.33	199.4	2.0%
29 Other Manufacturing	77	$2,325	0.03	110.9	1.1%
Div C Manufacturing	126,606	$67,671	1.87	1043.0	10.5%
Divs F-H, J-Q Commercial/Institutional	46,536	$338,531	0.14	7,052	71%

Sources: ABS (2001), ABS (2005a), George Wilkenfeld & Associates and Energy Strategies (2002).

na not available
* estimate only

Table 2 Effect on costs of a \$35/t CO_2-e cost on GHG emissions, by economic sector

Economic Sector	Value of production 1996-97 \$m	Emissions intensity, t CO_2-e/\$1,000 output	\$35/t CO_2-e cost increase	
			\$m	% of production value
Div A Ag, Forestry, Fishing	\$ 34,081	0.22	\$ 268	0.8%
Div B (part) All other mining	\$ 41,767	0.31	\$ 448	1.1%
21 Food, beverages, tobacco	\$ 46,523	0.19	\$ 315	0.7%
22 Textile, clothing etc	\$ 11,302	0.26	\$ 102	0.9%
23-24 Wood, paper and printing	\$ 26,737	0.28	\$ 261	1.0%
252-256 Chemical industry (part)	\$ 35,130	0.35	\$ 436	1.2%
261 Glass and glass products	\$ 1,056	0.91	\$ 34	3.2%
262 Ceramics	\$ 1,261	1.84	\$ 81	6.4%
263 Cement, lime, concrete etc	\$ 3,304	2.72	\$ 315	9.8%
264 Other non-metallic mineral products	\$ 1,093	1.36	\$ 52	4.8%
271 Iron and Steel (part)	\$ 10,595	2.11	\$ 783	7.3%
272-273 Basic non-ferrous metals	\$ 12,875	4.04	\$ 1,821	14.1%
274-276 Other metal products	\$ 23,681	0.08	\$ 66	0.3%
28 Machinery and equipment	\$ 41,111	0.11	\$ 162	0.4%
29 Other Manufacturing	\$ 6,395	0.01	\$ 3	0.0%
Div C Manufacturing	\$ 196,565	0.64	\$ 4,431	2.3%

Sources: As for Table 1; ABS (2000).

For most sectors the effect of a \$35/t CO_2-e cost is comfortably less than one per cent of the value of production. For the economy as a whole, a tax of this amount on all energy and industrial process emissions in 2002-03 would have been equivalent to one per cent of GDP. However, for six of the sectors shown in Tables 1 and 2 the effect is very much greater, ranging up to 14 per cent for Basic non-ferrous metals. These six sectors accounted in 1999-2000 for only 14 per cent of the total value added in the manufacturing sector and two per cent of total GDP. All else being equal, it is these sectors of the economy that would be most severely affected, in terms of competitiveness and profitability, by the imposition of a price on GHG emissions.

The magnitude of the impact on competitiveness will depend on the ability of these sectors to manage the additional cost of the price on GHG emissions. It is not rare for industry to absorb sudden cost increases; export industries in particular are constantly faced with a fluctuating exchange rate, which directly affects their competitiveness. In 2003-04 for example, the aluminium industry suffered a seven per cent fall in earnings from the combined effects of an appreciation of the Australian dollar relative to the US dollar, in which world aluminium prices are denominated, and a fall in export volumes, only partly offset by a rise in the US dollar world price of aluminium (ABARE 2004a).

The sectoral differences in emissions intensity within manufacturing are readily explained in terms of the nature of the manufacturing activities involved in the various sectors. In some sectors, generally referred to as process industries, materials undergo chemical transformation; such transformation almost always involves the use of high temperatures (or sometimes very low temperatures), or high pressures, or both, which requires the use of large quantities of energy. In some cases, such as cement and aluminium metal production (smelting), the processes also involve chemical reactions that result in further GHG emissions. Process industries include the manufacture of metals, cement, glass, bricks, chemicals and paper, and it will be seen that these are the emissions intensive economic sectors.

Other types of manufacturing activities involve moving materials around in space, cutting, bending, mixing, assembling, disassembling and so on. Such industries as the production of fabricated metal products, machinery, textiles, clothing and printed materials have these characteristics. These industries, sometimes termed elaborately transformed manufactures, involve inherently much less energy intensive activities and also usually lead to the production of higher value products. Consequently, they are much less emissions intensive.

However, if the material being produced has a high value and low volume, then the emissions intensity per dollar of output or of value added can be quite low, even though the manufacturing processes involved are inherently emission intensive. Many high value chemical products, such as pharmaceuticals and adhesives, have these characteristics. This is why the emissions intensity of the chemicals sector as a whole is quite low, even though the intensity of some parts of the sector is very high.

It will be noted that the agricultural sector is shown as having a relatively low emissions intensity, although other studies, such as that by Foran *et al.* (2005), report agricultural commodities as having high emission intensity. The difference arises from the fact that use of energy accounts for only a small proportion of GHG emissions from agriculture. As already noted, the present analysis excludes emissions directly arising from agricultural activities because they cannot be measured with sufficient accuracy to allow their inclusion in any scheme which involves putting a direct financial cost on emissions.

3.3 Identifying trade exposed industries

The next step in the analysis requires determining the industry sectors that are particularly trade exposed. Trade statistics are compiled in terms of the commodities (and services) that are traded, rather than the economic sectors that participate in trade. It is therefore necessary to start by relating the economic sectors identified above to individual commodities or groups of commodities. Export oriented industries are considered first, followed by industries which may be exposed to competition from imports,

Table 3 shows the export value in 2002-03 of the major export commodities produced by the Basic non-ferrous metals and the Iron and steel sectors. Note that the figures shown for copper, lead and zinc exclude exports of ores and concentrates, which are substantial in the case of these metals. Production of ores and concentrates is classified under ANZSIC in Division B Mining and mainly involves separating particles of metalliferous minerals from surrounding rock. It requires much less energy input than the production of refined metal, which is a subsequent step in the processing of these mineral products, requiring chemical changes to the minerals, and is classified under Basic non-ferrous metals.

Table 3 Principal emissions intensive export commodities, 2002-03

ANZSIC sector	Commodity	Export value ($m)	Export share of total production volume	Share of total merchandise exports
272-273 Basic Non-ferrous metals	Alumina	$3,655	82%	3.2%
	Aluminium	$3,426	82%	3.0%
	Copper (refined metal)	$956	67%	0.8%
	Lead bullion	$165	83%	0.1%
	Lead (refined metal)	$203	76%	0.2%
	Nickel[1]	$2,687	95%	2.3%
	Zinc (refined metal)	$757	85%	0.7%
271 Iron and steel	Steel	$1,682	49%	1.5%
11 Coal mining	Black coal	$11,896	76%	10.3%
12 Oil and gas extraction (part)	Liquefied natural gas (LNG)	$2,607	100%	2.3%
13 Metal ore mining (part)	Gold	$5,551	94%	4.8%

Note: 1 Includes nickel content of both refined nickel and intermediate products requiring further refining.
Sources: ABARE (2004); ABS (2005b).

The table also shows the value of exports of coal, LNG and gold. Production of these mineral commodities is classified under ANZSIC Division B Mining, but all are relatively emissions intensive. In the case of coal, this is mainly because of the fugitive emissions of methane that are released when coal is mined; mining itself is not a particularly energy or emissions intensive activity. The level of emissions varies quite widely between coal mines and there are technologies commercially available (and used in some Australian mines) that can greatly reduce emissions from mines with high methane levels.

In the case of LNG the high emission intensity is a consequence of both the relative energy intensity of processing and liquefying the gas and also of fugitive emissions of CO_2, which occurs in association with methane and other hydrocarbons in many gas fields. The emissions intensity of gold production arises from the consumption of energy needed to extract small quantities of gold from the very large volumes of rock in which it is found.

It is clear that the industries producing these commodities are all significantly trade exposed, with exports accounting for well over half of total production for all the listed commodities except steel. Exports of these commodities accounted for 29 per cent of the total value of merchandise exports in 2002-03 and 23 per cent of total exports. If coal is omitted (see below), these proportions fall to 19 per cent and 15 per cent respectively.

The other emissions intensive sectors shown in Table 1 are Glass and glass products, Ceramics, Cement, lime, concrete etc, and Other non-metallic mineral products. As noted above, the Chemicals sector, although as a whole not particularly emissions intensive, includes some parts which are very emissions intensive. These include the manufacture of ammonia, which is the key energy intensive material used to make nitrogenous fertilisers and blasting explosives (used in the mining industry), and of plastics and related compounds, including polyethylene, polypropylene, polystyrene and polybutadiene synthetic rubber. The manufacture of cardboard, paper and newsprint is also relatively emissions intensive in most cases.

The imposition of a price on emissions incurred by any of these industries would increase their cost of production and damage their competitive position of their products, relative to other goods and services being supplied n the Australian economy. All else being equal, it is likely that consumers will use less of these products, for example by building smaller houses or shifting from brick to all timber construction. By doing so, they would induce structural change in the Australian economy, away from more and towards less emissions intensive industry sectors. In so doing they would help to make the economy as a whole less emission intensive. As explained in section 2, that is precisely what the policies are intended to achieve, and such structural change within the domestic economy should not be confused with a loss of competitiveness relative to producers in other countries. The significance of any such international loss of competitiveness will depend on how trade exposed these industries are.

Australia has no significant export trade in these commodities. Table 4 shows the major emissions intensive commodities for which both domestic production and imports are significant, and for which at least some relevant data are available. It can be seen that for most commodities imports are a fairly small proportion of total sales, especially when account is taken of the fact that domestic production is significantly under-stated for nitrogenous fertilisers and cardboard. No domestic production figures are available for newsprint and non-fertiliser grade ammonia and nitrates. For the plastic and synthetic rubber products neither production nor import figures are available in a form that can be used for this analysis, which is why these products are not shown in Table 4.

Table 4 Principal emissions intensive commodities exposed to import competition

Commodity	Value in 2002-03 ($m)		Imports as proportion of total domestic sales
	Domestic production sold in Australia	Imports	
Newsprint[1]	n.p.	$274	na
Paper and cardboard [2]	$3,264	$460	12%
Nitrogenous fertilisers[3]	$906	$372	27%
Non-fertiliser grade ammonia and nitrates[1]	n.p.	$27	na
Window glass	$769	$170	18%
Cement	$1,075	$48	4%
Steel	$3,003	$1,959	39%
Refined petroleum products	43,583 ML	10,542 ML	19%

Notes 1 Value of production of these commodities is n.p. (not for publication) on commercial-in confidence grounds.
2 Some domestic production of paper is not for publication, so the “true” ratio of imports to production is less than shown here.
3 A significant proportion (almost certainly more than half) of the total production of nitrogenous fertiliser is not for publication, so the ‘true’ ratio of imports to production is much less than shown here.
na Not available
n.p. Not for publication

Sources: Commodities other than steel and petroleum products: ABS, data provided on request.
Steel: Authors’ calculation from ABS and ABARE data.
Petroleum products: ABARE (2005).

There are a number of commodities within the relevant industry sectors where imports account for a higher proportion of consumption; examples include many types of higher value glassware and specialised ceramic products. However, because of their high value these are in fact not particularly emissions intensive, and it is other production costs, such as labour, which mainly determine the competitive position of Australian producers.

For most of these industries, the relationship between domestic production and imports is mainly explained by either natural protection (by virtue of geography) or economies of scale in manufacture and the size of the Australian domestic market. For example, products such as clay bricks and tiles have a high volume or mass and low value, which affords them appreciable natural protection, given Australia’s relative geographical isolation. In the case of window glass, Australia has just one major manufacturer, with the capacity to supply most, but not all, of the current domestic market. The residual demand is not large enough to support a second world-scale manufacturer, and is therefore supplied by imports.

Australia has six ammonia production plants, producing ammonia from natural gas for two distinct major markets: fertilisers and mining explosives. All relevant information about the Australian ammonia industry is commercially confidential, so our analysis relies on international data. From data published by the European Fertilizer Manufacturers’ Association (2000) it can be calculated that best practice ammonia plants emit 1.67 tonnes of CO_2 per tonne of ammonia produced. Market data published by PotashCorp (2006) indicates that over the past four years the price at Russian Black Sea ports (the reference pricing point for world ammonia trade) has averaged a little over US$200 per tonne, though in recent months it has been very much higher. A carbon price of A$35 per tonne CO_2 represents about 20 per cent of revenue if the ammonia price is US$200 per tonne.

At the moment Australia imports very little ammonia or products derived from ammonia (urea, ammonium nitrate etc.). However, anti-dumping protection is currently provided against imports from Russia (Australian Customs Service, 2002), on the ground that the Russian ammonia is produced from natural gas that is priced substantially below its opportunity cost. Renewal of this protection is currently being negotiated; it has been reported that, while the ammonia/ammonium nitrate producers are seeking renewal, their largest customers, the mining companies, are opposed (Brenchley, 2006). There is a significant international trade in ammonia and its derivatives, so it is possible that in future Australian producers could be disadvantaged by exposure to stronger competition from imports, notwithstanding the substantial shipping costs that importers would incur. On the other hand, construction, by Burrup Fertilisers, of an export oriented world scale ammonia plant is nearing completion in the Pilbara region of WA. It will use the abundant natural gas resources of the region to produce ammonia for sale to Asian markets. On the basis of the above information, there is no clear current evidence that businesses producing ammonia for either the domestic or export markets would be significantly disadvantaged by the imposition of a price on emissions, though their circumstances could change in the future.

In the case of the various plastic products, Australian demand is currently supplied by one or, in the case of polypropylene, two manufacturing plants, the output of which more or less matches domestic demand. By world standards, the Australian plants are both old and less than optimally sized. While it might be argued that the added impost of a price on carbon could tip these plants into unprofitability, there has been speculation for some years about the longer-term future of these plants because of their age and size. The largest manufacturer, Qenos, was recently (October 2005) sold to a Chinese company.

On the basis of this preliminary analysis, steel and petroleum products are the only emissions intensive commodities which at present appear to face significant competition from imports. It is noteworthy that Australia is both a large exporter and a large importer of steel. This is explained by the fact that there are many different grades and types of steel and basic steel products, not all of which are made in Australia, combined with the complex and dynamic relationships between steel industry and its large customers, both within Australia and internationally. That said, it is certainly the case that some imports compete directly with Australian made steel in the Australian market. Clearly, further and more detailed information would be needed to establish the extent to which Australian steel manufacturers would be disadvantaged in this competition by the imposition of a price on greenhouse emissions.

In the case of refined petroleum products, Australian refiners compete directly with product imported from the large export oriented refineries in Singapore. Although the seven Australian refineries have recently undergone substantial upgrading to allow them to meet new, higher fuel quality standards for petrol and diesel, most of their other equipment is quite old and they are small by world standards. In 2003 the refinery in Adelaide, which was at the time Australia's smallest and least sophisticated, was closed by its owner, Exxon-Mobil. Extensive world wide trade in petroleum products (as well as in crude oil) means that Australian refiners are in most respects price takers. Over the past four years, the refinery margin achieved by Caltex, Australia's largest petroleum refiner, has varied from just under three cents to just over six cents per litre of petroleum products.[14] In 1998-99 the emissions intensity of Australian petroleum refining was 0.13 kg CO_2-e per litre of products. This means that an emissions cost of $35 per tonne CO_2-e would have represented between seven per cent and 16 per cent of the refining margin, which is clearly a very significant addition to the cost of refining.

It can be concluded that steel and oil refining are probably the only import-competing Australian industries that would suffer significant competitive disadvantage through the imposition of a price on GHG emissions. It is of course possible that an increase in the costs of production faced by producers of cement, petrochemicals and possibly other commodities may, over time, reduce their ability to compete with products imported from non-Annex B countries and lead to loss of market share. It would always be open to these industries to make a case to government that they are being disadvantaged, if and when that occurs. The remainder of this paper is therefore largely confined to considering the case of export competing industries, because these would be disadvantaged immediately. Detailed consideration of the oil refining industry, which has a number of unique features in terms of both its own economics and its role in the national economy, is beyond the scope of this paper.

3.4 Emissions intensity of individual commodities

In order to identify the industries with inherently high emission intensity characteristics, it is necessary to look within the sectors using a bottom up approach that analyses the individual commodities produced within each sector. Hence a commodity-oriented approach is again used.

In recent years some major companies have started to publish detailed information about their environmental performance, including their greenhouse gas emissions, and have disaggregated the information to show emissions from individual sites or per tonne of commodity produced. A range of such sources has been searched to assemble the commodity emissions intensity data shown in Table 5.

The alumina and aluminium figures represent the performance of the whole Australian industry, as compiled and published by the Australian Aluminium Council. For other commodities the data are from individual producers and so will not be precisely representative of the whole industry. For most of the metal commodities, however, emissions intensity will not vary greatly between producers. Nickel is an exception, as Table 5 shows. The emissions intensity of gold also varies depending mainly on the ore grade; data are for only one producer, and so may not be representative.

[14] Refinery margin is defined as the difference between the weighted average price realised for petroleum products produced and the weighted average cost of crude oil purchased. It is the best measure of the price received for refining crude oil.

Table 5 Emissions intensity of selected commodities

Commodity	Emissions intensity t CO_2-e/t	Average export price, 2002-03 ($/t)	Emissions intensity, t CO_2-e/$1,000 production value	$35/t CO_2-e cost increase as % of price
Alumina	0.78	$271	2.88	10.1%
Aluminium	16.9	$2,242	7.54	26.4%
Copper (refined metal)	4.5	$2,667	1.70	5.9%
Lead bullion	4.0	$1,097	3.65	6.4%
Lead (refined metal)	4.0	$756	5.29	9.3%
Nickel (lateritic ore)	46.0	$14,783	3.11	10.9%
Nickel (sulfide ore)	12.6	$14,783	0.88	3.1%
Zinc (refined metal)	4.0	$1,558	2.57	6.7%
Steel	2.5	$517	4.84	16.9%
Black coal (1)	0.12	$57	2.06	7.2%
Black coal (2)	0.064	$57	1.12	3.9%
Black coal (3)	0.016	$57	0.28	1.0%
LNG (1)	0.58	$333	1.74	6.1%
LNG (2)	0.36	$333	1.08	3.8%
Gold	0.81 [1]	$560 [1]	1.45	5.1%

Note: [1] per ounce
Sources: ABARE (2005); Various sources and authors' calculations (see text)

For coal mining and LNG production, the main cause of the variation in emissions intensity between producers is the different levels of fugitive emissions of methane and CO_2. These depend on the intrinsic characteristics of individual coal seams and gas fields. In the case of LNG, emissions intensity also depends on the vintage of the plant, as there have been rapid technical advances in the energy efficiency of LNG production.

The three figures presented in Table 5 for black coal are averages, covering several export coal mines in each case, from three of Australia's largest coal mining companies. The first two figures, which are higher, include fugitive methane emissions, while the lower third figure excludes fugitive emissions and includes only emissions attributable to the use of energy, mainly as diesel fuel and electricity, to mine the coal. The figures show that, if fugitive methane emissions are included, coal mining is relatively emissions intensive. However, if they are excluded, coal mining is no more emissions intensive than most other mining and manufacturing activities, and thus would not be greatly affected by the introduction of a carbon taxation or emission trading system.

This distinction is important, because it is uncertain whether it will be technically possible to include coal mine methane emissions within the scope of such a scheme. In particular, it is impractical to measure methane emissions from an open cut mine with the level of precision that would be expected if the measurement were to determine the level of financial costs to be imposed. Open cut mines account for well over half of all

Australian production of export coal, and the proportion is growing. For this reason, export coal mining as a whole is not an industry that would be disproportionately penalised by a domestic carbon tax. Of course, it would be affected by the imposition of a price on emissions in the export destination country, where the coal is burned, just as the approximately 25 per cent of Australian production that is used in Australia would be affected by an Australian carbon tax or emissions trading system.

The two figures presented for LNG are estimates of the emissions intensity of the original North West Shelf plant and of the most recent addition to the plant. Several new LNG plants are currently being built or are likely to be built in the next few years. Available data suggest that some of these new plants will have somewhat higher emissions than shown here, and others will have lower emissions. The fugitive emissions of CO_2 from natural gas processing are measurable and routinely measured by the producing companies. Therefore, in contrast with coal, there is no technical reason why they could not be included within the scope of a carbon taxation or emission trading system. This is already the case with natural gas production in Norway, where it has stimulated the construction of the world's first large scale CO_2 re-injection (geosequestration) project, at the Sleipner gas field. One of the prospective new Australian LNG projects, Gorgon, is being designed to incorporate CO_2 re-injection and has received environmental approval from the WA Government on that basis.

In summary, the data for individual commodities in Table 5 are consistent with the sectoral data presented in Table 1. They confirm that, with the exception of coal, all the commodities listed would be quite severely affected, in terms of competitiveness and profitability, by the imposition of a price on GHG emissions. They also show that production of aluminium would be the most severely affected, followed by steel.

3.5 Exposure to non-Annex B countries

The final step in the analysis is to identify the main source of competition faced in export markets by the industries listed in Table 4. Putting aside the special case of the USA, it is only if competitors are located in non-Annex B countries, which do not have binding greenhouse gas emission commitments under the Kyoto Protocol, that Australian companies would be disadvantaged in export markets.

For the purpose of this analysis, it is the likely sources of competition over the next few decades that are more important, rather than current sources of competition or those in the recent past. Unfortunately, determining future sources of competition requires detailed study of the outlook for each commodity individual, combined with the exercise of specialised professional judgment. This would be a difficult and time consuming task. For the purposes of this paper, we have simply examined data for 2002-03, with the aim of providing a broad indication of the current situation.

The results are shown in Table 6, in terms of Australia's relative position with respect to both total production and exports. It can be seen that, for most of the commodities for which data are available, non-Annex B countries account for 40 per cent or more of total exports.

Table 6 Shares of total world production and exports of selected commodities, 2002-03

Commodity	Share of world production 2002-03		Share of world exports 2002-03	
	Australia	Non Annex B	Australia	Non Annex B
Alumina	29%	na	na	na
Aluminium (net exports)	7%	45%	24%	23%
Copper	3%	55%	7%	68%
Lead	5%	44%	18%	41%
Nickel	11%	27%	na	na
Steel (2002 exports)	1%	44%	1%	25%
Coal (energy content basis)	7%	54%	29%	42%
LNG	6%	93%	6%	93%
Natural gas (total)	1%	36%	2%	36%
Gold	7%	78%	na	na

Sources:
Metals - ABARE (2005); Coal, LNG, natural gas - *BP Statistical Review of World Energy* (2004) *;* Steel - International Iron and Steel Institute (2004a; 2004b).
na not available

This is most strikingly the case for LNG. It should be noted that for the purpose of this analysis, LNG has been treated as a distinct commodity (distinct from gas transported by pipeline), on the grounds that Australia's geographical isolation will mean that, for the foreseeable future, all natural gas exports will be in the form of LNG. However, in actual or potential export markets such as the USA, China and even Japan, LNG currently competes with gas imported by pipeline or is likely to be faced with such competition within a decade or less. Nevertheless, it will remain true that, in the markets which Australia is geographically best placed to supply, most of the competing suppliers will be non-Annex B countries in the Middle East and central Asia.

The data for aluminium suggest that non-Annex B countries provide significantly less than half of all exports. However, this result is a legacy of the historical development of the industry, with most capacity linked to hydro-electric supplies in western Europe, North America and Russia. New capacity is most likely to be located in developing countries, so this is where future competition to Australian producers will come from.

3.6 How large a problem is loss of competitiveness?

Are there other emission intensive industries or commodities that this analysis has overlooked? This can be checked by multiplying the emissions intensity figures from Table 5 by the production volume of each commodity in 1998-99, to give an estimate of total emissions attributable to each commodity. The results are shown in Table 7. When the sub-totals for Non-ferrous metals and steel are compared with the emissions estimates in Table 1 for the relevant sectors, it will be seen that the two sets of figures are very similar. This suggests that it is most unlikely that any major commodity has been overlooked, and that the list of commodities in Table 7 covers all the important industries that can legitimately claim to fear appreciable competitive damage should Australia introduce a carbon taxation or emissions trading system.

Table 7 Estimated energy and industrial process related emissions from production of selected commodities, 1998-99

Commodity	Estimated emissions 1998-99 (Mt CO_2-e)	
	Total emissions	'Exported' emissions
Alumina	11.3	9.3
Aluminium	29.0	23.8
Copper (refined metal)	1.9	1.3
Lead bullion	0.3	0.3
Lead (refined metal)	0.5	0.4
Nickel (lateritic ore)	1.5	1.4
Nickel (sulfide ore)	1.9	1.8
Zinc (refined metal)	1.0	0.9
Sub-total: Non-ferrous metals	47.4	39.2
Steel	21.4	10.5
LNG	4.5	4.5
Gold	8.6	8.0
TOTAL all listed commodities	**81.8**	**62.1**

Sources: As per Table 5.

The 'exported' emissions, i.e. the emissions embodied in the output from these industries that is exported, were around 62 Mt CO_2-e. This is equivalent to about 12 per cent of Australia's total emissions in 1998-99 and 17 per cent of energy and industrial process emissions that, on technical grounds, could feasibly be included within the scope of such a system. However, these industries represent a much smaller proportion of the Australian economy. The combined value added of the iron and steel and non-ferrous metals sectors (ANZSIC 271-73) in 2002-03 was $5.7 billion, equivalent to just 0.8 per cent of total GDP. While value added data are unavailable for the LNG and gold industries by themselves, it seems unlikely that adding them to the total would increase the contribution of all the identified industries to more than 1.5 per cent of GDP. Of course the contribution of these industries to exports is much larger; they accounted for 15 per cent of total exports and 19 per cent of merchandise exports in 2002-03.

In summary, the analysis presented in this section shows that the international competitiveness problem is much smaller than has often been claimed. Some industries would be significantly adversely affected by the imposition of a price on GHG emissions in Australia; they include aluminium, alumina, steel, other non-ferrous metals, LNG and gold. These industries currently account for about 1.5 per cent of GDP and 19 per cent of merchandise exports. It seems unlikely that any other industries would be appreciably affected by loss of competitiveness, relative to equivalent industries in other countries. The rest of this paper discusses how best to deal with the problem that would be faced by the adversely affected industries.

4. Preserving Australia's competitiveness

4.1 What is the competitiveness problem?

In section 3 we show that a carbon tax or emissions trading scheme would impose only a very small cost burden in most sectors of the Australian economy, including most of manufacturing. Significant increases in production costs, however, would result for a limited number of emissions-intensive commodity products. Some of these Australian products compete with production in countries not subject to emissions caps under the Kyoto Protocol. In such cases, the competitiveness of Australian producers could be significantly eroded by the introduction of a carbon tax or emissions trading scheme. This is most likely to be the case for exporters of LNG, aluminium, alumina, steel, and possibly some other primary metals.

In this section, we consider options for introducing a carbon price signal while preserving the competitiveness of these industries. Many factors besides energy costs affect competitiveness, including labor costs, workforce skill levels, taxes and infrastructure provision. We are only concerned here with the competitive impact of a carbon tax or emissions trading scheme.

The term competitiveness is sometimes used in discussing the impact of greenhouse or other policies on the economy as a whole. Many economists question whether competitiveness is a meaningful concept at this national level (Krugman 1994). The term is used more narrowly in this paper to describe changes in competitive advantage at the industry and company level.

Accordingly, we do not assess the common argument that Australia's economy is especially vulnerable to carbon constraints because of its reliance on coal for electricity generation, substantial exports of fossil fuels and carbon intensive products and significant trade with non-Annex B countries. However, the border adjustments proposed in this and the next section would, if implemented, obviate much of the potentially negative effects of carbon pricing on trade exposed industries. We note, moreover, that a complete analysis would need to consider not only losses in carbon intensive sectors, but also gains in emerging clean industries, including those in which Australia has significant natural endowments or technological capacity. Opportunities for Australia in Asian carbon and clean technology markets also would need to be considered, as well as the risk of carbon leakage that is the focus of this paper. We are not aware of any such comprehensive analysis having been undertaken.

The analysis in section 3 suggests that a number of emissions-intensive export industries face competitiveness risk. This does not seem to be the case for import-competing industries, with the exception of steel, and possibly ammonia and petroleum products. This conclusion should be distinguished from the claim sometimes made that Australia is a significant net-exporter of embodied carbon (i.e. that emissions in Australia from the production of our exports significantly exceed emissions overseas from the production of our imports). We do not assess the embodied carbon balance of Australia's trade, but other studies suggest that imports and exports may roughly balance each other.[15] In any case, the competitiveness risk we identify for emissions-intensive exporters applies, whether or not Australia is a net exporter of embodied carbon.

Our analysis suggests that the industries at risk represent just 1.5 per cent of the Australian economy and about 1.0 per cent of employment (ABS employment statistics are not sufficiently disaggregated to allow an exact estimate). Looking at the mining and manufacturing sectors only, the industries at risk represent about nine per cent of total production value and nine per cent of employment. Australia has experienced declines in equivalent industries over the past two decades, partly due to economic reform and trade liberalization policies. For example, between 1980 and 1990 the share of value added in the Australian economy contributed by the TCF industries fell from 1.4 to 0.9 per cent (a fall of 40 per cent) and the share of machinery and equipment manufacturing value added fell from 5.9 to 4.1 per cent (a fall of 30 per cent), making a total of 2.3 per cent of the economy for the two industries together. However, the losses were more than made up by gains elsewhere in the economy (Productivity Commission 1998). Why in this case is it so important to overcome this competitiveness risk when it affects just a few industries?

The most direct reason is that aluminium and steel plants, for example, provide good, well-paying jobs and contribute significantly to key regional economies. The economy as a whole might easily weather their decline, but considerable hardship would be imposed on affected workers and communities. These are serious concerns with which we have sympathy. But in addition to these direct economic and social effects, there are strong climate policy reasons for finding a solution to the competitiveness problem.

The first such reason is that competitiveness is clearly a major barrier to Australia introducing a carbon price signal and joining the international effort under the Kyoto Protocol. The industries that believe they are at risk (including some that are not) wield sufficient political influence to block adoption of effective climate protection policies. The competitiveness argument is frequently used by the present Coalition Government to defend its greenhouse policies.[16] But the Labor Government before it also rejected a proposal by its environment minister for a very modest carbon charge, largely for competitiveness reasons (Muller 1996).

Second, competitiveness concerns are a barrier to effective climate policy not just in Australia. In the United States, widespread concerns that jobs in import-competing, energy-intensive industries could be lost to developing countries underpin the opposition of Congress and the Bush Administration to the Kyoto Protocol and the introduction of a domestic carbon price signal.[17] In Europe, competitiveness concerns

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[15] For example, the Bureau of Industry Economics estimated that around 56 Mt of carbon dioxide (CO_2) from fuel combustion was embodied in Australia's exports and around 53 Mt CO_2 was embodied in imports to Australia in 1989-90 (Bureau of Industry Economics, 1995, Appendix 3).

[16] See for example Minister for the Environment and Heritage, Dr David Kemp, and Minister for Foreign Affairs, Alexander Downer, Joint Media Release, 15 August 2002.

[17] The most influential expression of this concern was Senate Resolution 98 of the 105th Congress, known as the Byrd-Hagel Resolution, which was adopted in July 1997 prior to the signing of the Kyoto Protocol. The McCain-Lieberman Bill of 2003 proposed to introduce a national cap and trade system to limit US

have led to substantial compromises in the design of carbon taxes and emissions trading, reducing their environmental effectiveness and increasing their economic cost (see section 4.3).

Third, as discussed in section 1, shifting emissions-intensive production to developing countries delays the development of effective, long-term solutions to climate change. Achieving deep emissions cuts over coming decades will require more sustainable production and consumption patterns as well as more efficient and lower-emission energy systems. While the carbon leakage door remains open, the incentive for such changes is greatly diminished.

Finally, dealing with the carbon leakage problem may help to advance discussions on a post-Kyoto regime. At the Montreal Conference of the Parties to the Kyoto Protocol in November 2005, it was agreed to begin negotiations on emission reduction commitments beyond 2012. Dealing separately with carbon leakage may make it easier to forge agreement on a system of emissions limits after 2012 that go well beyond those of the first commitment period. It also eliminates one of the obstacles to the US and Australia rejoining international efforts.

4.2 What can Australia do about it?

The Australian Government has claimed for some years that seeking legally binding emissions limits for the major developing countries is the best way to address the competitiveness problem. This strategy failed in Kyoto and has not borne fruit since. This strategy has seen the Government backed into a corner where Australia now, alone with the United States, refuses to ratify the Kyoto Protocol. We believe it is time to explore alternative approaches that would allow Australia to re-join the Kyoto regime.

The current policy of staying outside Kyoto and of not pricing carbon carries substantial economic risks. First, it locks us out of the emerging carbon markets, limiting both foreign investment in Australian clean technologies and plantations (through the Joint Implementation mechanism of the Kyoto Protocol) and participation by Australian companies in developing country projects (through the Protocol's Clean Development Mechanism). Second, by insulating our economy from a carbon price, it retards the development of new clean industries and increases our future dependence on imported technology and expertise. Third, it fails to preserve the competitiveness of Australia's coal exports (considerably greater in both export earnings and jobs than aluminium production) which will be subject to the emissions policies and taxes of importing countries. Fourth, it exposes our exports of coal and emissions-intensive products to likely consumer and government preferences against climate 'free-riders'.
It is not even clear that adoption of legally-binding emissions limits by major developing countries would solve the competitiveness problem. Any likely system of differentiated commitments would at best involve emissions cuts for developed countries and limits to future growth for developing countries. Such growth caps would be likely to leave room for expansion in emissions-intensive, export-oriented

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GHG emissions from 2010. The Senate vote on the Bill was lost 43 to 55, showing how close the USA is to having majority bipartisan support for a mandatory market based emissions control program.

production, perhaps at the expense of domestic consumption. In the absence of a borderless global carbon market and universal price, carbon leakage would continue.

A modest shift from current policy would be for Australia to develop and seek support for a multilateral solution to carbon leakage in key industries. Such a proposal could be advanced both bilaterally and through meetings of the parties to the UNFCCC. The narrow problem of carbon leakage in a few industries may prove easier for countries to resolve than the much broader and more complex issue of when and in what form developing countries should accept binding emissions limits.

It is unlikely, however, that agreement would be reached for some years, if at all. In the meantime, Australia will continue to face the economic risks of staying outside Kyoto and insulating its economy from a carbon price. Our environmental credentials and international standing also would continue to be questioned, weakening our ability to advance a multilateral solution. The view of those countries that believe that Australia's interests already have been addressed, through its generous target and the special provisions on land clearing, might prevail.

This paper explores a third approach: that Australia should ratify Kyoto and implement a carbon tax or emissions trading scheme, incorporating offsets that preserve the competitiveness of the industries at risk. Ideally, the offsets would be designed so that they might form the basis of a future multi-lateral solution to carbon leakage. As a full and more respected participant in the international climate negotiations, Australia would be better placed to pursue a multi-lateral approach. In the meantime, with a carbon price signal in place, our economy could begin adapting to emissions constraints, while Australian businesses would be able to participate in international emissions trading through Joint Implementation and the Clean Development Mechanism.

4.3 What are the possible competitiveness offsets?

Most existing and proposed carbon tax and emission trading schemes incorporate some kind of special provision for energy-intensive industries. In this section, we identify and briefly describe the main approaches.

Wholesale exemptions of industry sectors

Tax exemptions are a common feature of most tax systems. In simple terms, entities that meet certain criteria are exempted from a requirement to pay tax or are made eligible for a lower rate of tax. For example, European countries with carbon taxes have typically exempted (either wholly or partially) certain industry sectors, due to concerns about international competitiveness (Muller 1996).

Particular industries could also be exempted from an emissions trading scheme. The COAG Energy Market Review (COAG 2002), for example, recommended the introduction of an economy wide national emissions trading system, with the traded goods sector excluded until Australia's international competitors also introduce similar schemes.

The simplest and least-cost way of implementing a carbon tax is to levy it on upstream fuel suppliers (e.g. oil refiners, gas pipelines, coal users). Most emissions-intensive producers, therefore, would not pay the tax directly, but rather experience increased energy costs. Instead of an exemption, they would have to be given a financial rebate equivalent to the increase in energy costs that they had experienced as a consequence of the carbon tax. A similar arrangement would be required for emissions trading, which would probably also be implemented upstream for petroleum fuels and natural gas. Rebates would be required under either a tax or emissions trading for large electricity users like aluminium smelters.

It is important to note that the exemption approach benefits entire industries or industry sectors, not just the specific emissions-intensive, traded goods for which there is a risk of competitiveness loss.

Negotiated agreements

A variation of the exemption approach is to link tax relief with improvements in greenhouse performance that are agreed between government and industry. These agreements can be negotiated with individual companies or on an industry-wide basis with peak bodies.[18]

The United Kingdom, for example, incorporated negotiated agreements into its Climate Change Levy, a downstream tax on non-household and non-transport energy use. A total of 44 industry-level Climate Change Agreements (CCAs) were negotiated, providing an 80 percent reduction in the tax rate in return for industry-specific energy efficiency targets that are legally binding for individual firms (Pearce 2005).

The New Zealand Government recently dropped a proposed carbon tax as part of a broad review of climate change policy triggered by a blowout in New Zealand's greenhouse emissions. Detailed plans had been released for a system of Negotiated Greenhouse Agreements (NGAs) to reduce the risk of the tax resulting in carbon leakage. The Government has indicated it may continue with this initiative, presumably as a stand alone measure. Under the original plans, companies that risked loss of competitiveness relative to producers in countries with less stringent greenhouse policies could apply to negotiate a NGA. Full or partial relief from the carbon tax would have been provided in return for moving to 'world's best practice' emissions performance. In some instances, NGAs could be established at the industry rather than company level.[19]

To be eligible to negotiate a NGA, a company would have been required to demonstrate that it competes with producers in countries with less stringent policies, that the tax had a significant financial impact, and that an exemption would provide net national benefits. Specific quantitative tests were established to assess whether applicants met these criteria. Successful applicants had to commission a World Best Practice

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[18] Negotiated agreements can be used as a stand alone measure or in conjunction with emissions taxes or permit schemes. For a brief review, see Beck (2002).

[19] The carbon tax proposal is outlined in Cullen and Hodgson (2005). Details of the NGAs and recent developments, including the abandonment of the carbon tax, are outlined at www.climatechange.govt.nz.

emissions study by an independent consultant that would subsequently be assessed by a validator appointed by the Government. This study was to be used to establish emissions targets that are included in the NGA.

While these two examples relate to a tax, similar arrangements could be established to provide exemptions or relief from an emissions trading scheme.

Gratis allocation of emissions permits (grandfathering)

A third approach that is sometimes proposed – free or concessional allocation of emissions permits – is available for emissions trading, but not for a carbon tax. A key design issue for emissions trading is the method by which the government allocates permits. The two main options are to auction permits or to allocate them administratively according to a set of rules.[20]

The most frequently discussed form of administrative allocation, known as grandfathering, involves the free allocation of permits to emitters on the basis of historic emission levels. The case for grandfathering is mainly advanced on the grounds of 'fairness' and political realism: to compensate the owners of power plants and other emitting assets for the financial impact of emissions limits and/or to 'buy' industry acceptance of emissions trading. However, these objectives are sometimes conflated with the quite separate goal of preserving the competitiveness of trade-exposed industries.[21]

Under the European Union's Emissions Trading Scheme at least 95 per cent of permits must be allocated free of charge in the 2005-2007 period and then at least 90 per cent during 2008-2012 (EC 2003). Concerns about loss of competitiveness (largely by import competing firms) to the United States and developing countries contributed to this choice.

Grandfathering is not the only option for gratis allocation. Permits could be allocated, for example, on the basis of a firm's output (according to an industry specific emissions benchmark), the growth in a firm's output (rapidly growing industries receive more permits), or the cost of reducing emissions (sectors facing higher costs receive more permits). Notably, however, most EU member states chose grandfathering in allocating permits for 2005-2007 (German Emissions Trading Authority 2005).

As with exemptions, special arrangements are necessary for emissions-intensive producers downstream of the point at which permits are acquitted. Large consumers of electricity (e.g. aluminium smelters), natural gas and petroleum products would probably fall in this category. They could be given either a financial rebate or possibly

[20] For a detailed discussion of permit allocation, including auctioning and grandfathering, see AGO (1999).

[21] For example, see Inter-Jurisdictional Working Group on Emissions Trading (2005); Allen Consulting Group (2000) clearly distinguishes between possible reasons for compensating a business (loss of international competitiveness) and the choice of free permits as an instrument for providing compensation (rather than other instruments).

permits (which they might then sell) based on the level of production that the government wanted to protect.[22]

Offsetting tax reductions

Carbon taxes and permit auctions can raise substantial revenues, whereas grandfathering provides an equivalent windfall gain to shareholders. Various revenue recycling schemes have been proposed linking a carbon tax or permit auction with reductions in existing taxes on business or individuals. The economic gain from such tax reductions can partly offset the costs associated with the economy's adjustment to emissions constraints. Revenue recycling can also be designed to offset the impact of higher energy prices on low income families.

One example of revenue recycling is the UK Climate Change Levy (CCL), discussed above, which applied only to business energy use. Most of the revenues are returned to business by way of reductions in employer contributions to social security taxation. While the scheme is largely revenue-neutral across industry as whole, the impact on individual sectors and companies can be positive or negative (Pearce 2005). Similar green tax reforms have been undertaken in other European countries, including Germany and Sweden. Typically, however, tax reductions are designed to achieve economy-wide or industry-wide benefits, not offset specific competitiveness impacts.

Financial incentives for energy efficiency improvements

Another possible approach is to provide subsidies or tax concessions for investments that improve energy efficiency. In theory, the competitive burden of an energy price increase can be offset through the adoption of more efficient technology that lowers energy consumption per unit of output by an equal or greater percentage. In practice, cost effective efficiency improvements may not be available, even with financial subsidies.

Denmark adopted an energy efficiency subsidy in combination with its carbon tax and proposals for energy efficiency investment tax credits are often discussed in the United States, where tax incentives are a common policy tool (Hoerner and Muller 1996). A key issue in designing such schemes is determining what constitutes an energy efficiency investment, especially as efficiency improvements typically will be just one benefit of plant upgrades that are undertaken for multiple reasons.

Border adjustment

A border adjustment would preserve the international competitiveness of energy-intensive producers while maintaining the carbon price signal within the domestic economy. Under the type of border adjustment most appropriate to Australia's

[22] The amount of the financial rebate or number of permits could be calculated objectively by introducing a system of tax invoices similar to the GST system whereby suppliers of energy and energy-intensive products would estimate the proportion of the price that was attributable to meeting any emissions trading obligations. Alternatively, standard figures could be calculated and used to represent the proportion of price which is assumed to have been incurred in meeting any emissions trading obligations.

circumstances,[23] a rebate would be paid to aluminium exporters, for example, to offset the increase in production costs resulting from a carbon tax or emissions trading. The rebate would only be paid for exported product; aluminium consumed domestically would remain subject to the price signal. A similar adjustment, in this case a levy, could be applied to imported energy-intensive goods to offset any significant carbon price disadvantage faced by competing local producers.

Border tax adjustments are a common feature of tax systems, like Australia's goods and services tax (GST) and European value added taxes (VATs). GST, for example is payable on most goods that are imported into Australia, either at the border or the point of sale.[24] Exported goods are generally GST-free.[25] In the same vein, many Australian travellers will be familiar with the opportunity on departure from European airports to obtain VAT refunds for major purchases. Border adjustments are not tariffs or export subsidies, but an integral part of consumption and production tax systems that serve to clearly define the tax base and protect the revenue.[26]

Border adjustments have been proposed as a solution to carbon leakage in the United States and Europe,[27] but have not yet been adopted for this purpose by any country. The United States, however, has implemented border adjustments for two environmental taxes, the ozone-depleting chemicals (ODC) tax and the Superfund chemical excises (Hoerner and Muller 1993; Hoerner 1998).[28] These border adjustments were applied not only to the target chemicals, but also to certain other traded products that are manufactured using these chemicals. They applied regardless of whether the target chemicals were consumed in the manufacturing process or physically incorporated into the traded good.

Most energy tax systems, such as fuel excises, are structured to apply border adjustments to exports and imports of fuels. For example, petrol produced at Australian refineries is subject to excise of just over 38 cents per litre under the Excise Act, if sold into the Australian market, but is excise exempt if exported. But petrol imported from refineries overseas, e.g. in Singapore, is subject to an exactly equal import duty under the Customs Act if consumed in Australia. A border adjustment designed to avoid carbon leakage would extend this approach to the emissions resulting from the manufacture of energy-intensive, traded products. These emissions are commonly called 'embodied' carbon. A border adjustment exempts this embodied carbon from the domestic carbon price. This is the same principle as the United States applied in the cases of the ODC and Superfund chemicals taxes.

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[23] See section 5 for a discussion of alternative types of border adjustments.
[24] GST is payable to the Australian Customs Service on goods above a threshold value that are brought into the country by individuals. Goods that would have been GST-free if supplied within Australia (e.g. 'basic food' and certain 'medical aids and appliances') are exempt.
[25] Section 38-185 of *A New Tax System (Goods and Services Tax) Act 1999*. A business can claim input tax credits for the GST that it paid on goods and services that the business used to produce the export goods, even though the business did not include any GST in the price of the exported goods.
[26] Depending on the tax base and point of collection, border adjustments may need to be explicitly applied or may inherent in the operation of a tax (Hoerner 1998).
[27] See, for example, Hoerner and Muller (1996), Hoerner (1998), and Biermann and Brohm (2003).
[28] The Superfund chemical excises raised revenue for a trust fund for toxic waste cleanup

While border adjustments are primarily a taxation device, it would not be technically difficult to design and implement an equivalent approach for emissions trading.

Other approaches

We have selected these six approaches for further evaluation because at face value each of them offers the potential to fully offset the competitive burden of a domestic carbon price signal. Other strategies such as participation in the Clean Development Mechanism or Joint Implementation under the Kyoto Protocol can lower any carbon cost disadvantage faced by Australian producers and provide other benefits. However, they cannot fully offset competitiveness impacts. Such approaches, therefore, should be seen as complementary to a competitiveness offset mechanism.

4.4 How do these options compare?

This section undertakes a brief comparison of the six approaches outlined above. Our goal is not to provide a full assessment of costs and benefits, but rather to identify the most promising approaches for further consideration.

We assess the options against the following six criteria:

- Is it likely to be effective in offsetting the (international) competitiveness impact of a carbon tax or emissions trading in the industries that are at risk?
- Does it maintain an environmental incentive consistent with the need to achieve deep cuts in Australia's greenhouse gas emissions over coming decades?
- What are the relative economic costs compared to other options?
- Can it be administered simply and transparently?
- Is it fair and likely to meet community acceptance?
- Could its adoption by Australia contribute to the development of an international solution to carbon leakage?

Effectiveness in offsetting competitiveness impact

A properly designed *sectoral exemption* that takes into account upstream price impacts would insulate relevant producers from a domestic carbon price signal and therefore preserve their international competitiveness. An exemption that was granted as part of a *negotiated agreement* would provide the same protection, so long as the agreed environmental improvements did not themselves impose significant net costs on producers.

A *border adjustment* would insulate energy-intensive producers from cost increases resulting from a carbon price signal, but only for the share of their production that is exported. Products destined for local consumption would be subject to the full carbon price signal, but so would any competing imports. A border adjustment, therefore, preserves competitiveness as effectively as an exemption, while maintaining the price signal for domestic consumption.

The *grandfathering* of emissions permits and other forms of gratis allocation serve a different purpose. Exemptions and border adjustments benefit shareholders, employees and local communities by maintaining competitiveness and hence production. Gratis allocation provides a valuable, but transferable, asset – a licence to emit – to shareowners.[29] Whether or not production is maintained and other stakeholders benefit depends on who receives the permits, how many they receive and how they use them.

Where permits are granted to power plant owners, for example, economic theory and experience to date with EU emissions trading suggest that their market value will be substantially reflected in the price of electricity (Sijm *et al.* 2005; Nind 2005). Aluminium smelters and other electricity consumers would still experience increased costs and the associated loss of competitiveness. Where permits are granted directly to a trade-exposed emitter, such as a basic steel plant, production costs will increase only to the extent that the number of free permits falls short of the plant's requirements. As the overall emissions cap is tightened over time, this shortfall is likely to increase. More importantly, however, the permits continue to have a market value and the owner can choose at any point to scale back or even close the plant and sell some or all of them, or to use them at an alternative location, if this best serves the interests of shareholders.[30]

Targeted tax relief would need to provide tax concessions which at the level of individual firms roughly equalled the burden imposed by a carbon tax or emissions trading. However, as outlined in section 3, the carbon price burden will be very unevenly distributed – with only a modest burden on most businesses, but a substantial one in a few key sectors. General cuts in existing Commonwealth or State business taxes (e.g. company tax, payroll tax) funded by carbon tax or permit auction revenues would not adequately compensate the high-burden industries. A more practical way of targeting relief to these industries would be through the mechanism of the carbon tax or trading scheme itself or through direct payments, which effectively brings us back to the exemption approach. Revenue recycling, therefore, is better viewed as a means for achieving broader economic efficiency or equity goals than for addressing the competitiveness problem.

Energy efficiency incentives are most likely to be an effective policy tool for those firms that have paid little attention to their energy costs and can achieve substantial energy savings at modest investment cost. By definition, however, energy is a major production cost and management priority in industries at risk from a carbon tax or emissions trading. Typically, firms in these industries utilise state-of-the-art energy-

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[29] As noted earlier, grandfathering is usually justified either as a means of 'buying' industry support for emissions trading or as a form of compensation for the impact of an emissions cap on the value of emitting assets. U.S. research, however, suggests that the gratis allocation of only a small fraction of required permits would fully compensate the owners of power plant and other emitting assets (Goulder 2005; Burtraw *et al*. 2002).

[30] Under the EU emissions trading scheme, permits are withdrawn in the event of plant closures, but this approach is economically inefficient and provides a perverse environmental incentive (Ahman *et al*, 2005).

efficient technologies when building and upgrading plant and constantly look out for opportunities to reduce energy costs in plant operation. In the case of aluminium production, for example, Australian smelters are amongst the most energy efficient in the world (Australian Aluminium Council 2000).[31] Opportunities for cost-effective technology to further increase energy efficiency at existing plants are therefore very limited, at least to achieve the quantum leaps in efficiency that would be required to fully offset the burden of a carbon tax or emissions trading. Most of the other emissions intensive, trade exposed industries are in a similar situation. Additional incentives may assist companies to bring forward marginal improvements in plant efficiency, but would be most unlikely to drive quantum changes in production technology. Energy efficiency incentives, therefore, may be a suitable tool for overcoming barriers to improved energy performance in general manufacturing, but are not a solution to the competitiveness problem in energy intensive industries.

Environmental incentive

An *exemption* covering our list of at-risk industries – non-ferrous metals (including aluminium and alumina), steel, LNG and gold – would insulate from a carbon price signal nearly one sixth of Australia's total emissions (see Table 7), equivalent to leaving out the entire transport sector. The share of emissions excluded will be even higher if import-competing or additional export industries are added. As approximately one third of Australia's emissions,[32] for technical reasons, cannot be included in a carbon tax or trading scheme, a generous exemption would ensure that less than half of Australia's total emissions were subject to a price signal.

With a straight *exemption* there is effectively no incentive for reducing emissions in the excluded sectors. It would be preferable, from an environmental perspective, if exemptions were only available to companies through *negotiated agreements* that require, for example, world best practice energy efficiency. However, as previously noted, Australian industries like aluminium smelting may already be achieving world best practice, or be close to doing so, it is uncertain how much additional emissions reduction could be required without significantly raising costs and defeating the purpose of the exemption. Moreover, such an approach would still provide no incentive for continuous technological improvement (i.e. beyond current best practice) nor substitution to lower emissions materials in downstream manufacturing and construction.

A *border adjustment* would also insulate a significant fraction of Australia's emissions from a carbon price signal, but differs in three important ways from an exemption. First, a border adjustment only exempts the products actually exported, not entire industries. The tax or trading scheme would still cover, for example, the emissions associated with the half of Australia's steel production and the one fifth of aluminium that is not exported.

[31] However, because they use coal fired electricity, including electricity from particularly emissions intensive brown coal power stations in Victoria, they are responsible for more greenhouse emissions per tonne of aluminium than smelters elsewhere in the world; see Turton (2002).
[32] This includes agriculture, land clearing, waste management and certain industrial process and fugitive emissions. See Australian Greenhouse Office (2002), section 2.

Second, a border adjustment would maintain the carbon price signal for any import-competing industries that were judged to be at risk and added to our list, whereas an exemption would insulate them. These two features together mean that a border adjustment maintains the incentive for Australians to shift to more sustainable consumption while an exemption allows existing consumption patterns to continue by sourcing energy-intensive products from wherever emissions are not priced.

Third, if border adjustments are replicated internationally, the emissions associated with energy-intensive production will eventually be covered as countries adopt carbon pricing policies. However, if exemptions become the norm, energy-intensive production globally will remain insulated from a carbon price signal.

Under emissions trading, the *grandfathering* of permits provides the same incentive to reduce emissions as other forms of allocation. Recipients can acquit permits against their own emissions or reduce those emissions and sell the ‘freed-up’ permits. However, as noted above, because permits could be freed-up by simply closing down or scaling back production, grandfathering does not appear to be an effective tool for preserving competitiveness.

As noted above, *targeted tax relief* and *energy efficiency incentives* offer environmental benefits as complementary policy measures, but do not appear to be effective mechanisms for preserving competitiveness.

Economic cost

Detailed economic modeling comparing the different offset mechanisms is beyond the scope of this paper and we are not aware of any Australian studies that undertake such a comparison. A recent international study suggests that *border measures* impose lower costs on the countries imposing them than do exemptions, but that there are tradeoffs between preserving competitiveness and reducing economy-wide costs (Babiker and Rutherford 2005). A study of the steel industry, using partial equilibrium modeling, found that border taxes on steel products are potentially useful instruments for achieving a given reduction in global emissions with less restructuring of the domestic steel industry in the industrialized countries, and hence at lower cost to these countries (Mathiesen and M? sted, 2004). However, both studies focus on multi-lateral rather than unilateral measures and do not provide results for Australia, except as part of a broader grouping.[33]

From a theoretical perspective, an *exemption* seems likely to be more costly than approaches with narrower exclusions. Excluding some sectors of the economy from a carbon price signal requires that other sectors achieve a greater level of abatement in order to meet the overall national emissions target. The greater the exclusion, the more necessary it becomes to pursue higher cost abatement options in the covered sectors.

Various Australian and overseas studies suggest that the economic cost of a carbon tax or emissions trading can be substantially reduced if tax or permit auction revenues are recycled through reductions in existing taxes (Hamilton *et al*. 2000; Burtraw *et al.*

[33] The study also treats import levies and export rebates as separate options, whereas we consider a conventional destination type border adjustment that combines the two approaches (see section 4.5).

2001). All else being equal, therefore, *grandfathering* will be more expensive than approaches that can be implemented in conjunction with revenue recycling. Firm conclusions, however, on the relative economic costs should await detailed modeling of the different possible combinations of carbon price signal and offset mechanisms.

Administrative feasibility

An *exemption* should be relatively straightforward, but would need to include a mechanism to compensate eligible energy-intensive users for higher energy prices in cases where the tax or permit scheme are implemented upstream (e.g. electricity). US experience with the Superfund chemicals excises and ozone-depleting chemicals tax suggest that a *border adjustment* would be manageable, especially if limited to a small number of products (see section 5 below). Like an exemption, the need to include indirect burdens adds complexity.

Experience to date with the European emissions trading scheme covering more than 11,000 installations, suggests that *grandfathering* is a complex and administratively burdensome approach.[34] Australia may be able to devise a simpler approach for the electricity sector, with its uniform product and good historical data, but implementation for other sectors is likely to remain complex. *Negotiated agreements* have been implemented in various countries, but by their nature require a substantial commitment of government resources to a company by company process. This process is necessarily less transparent than an exemption or border adjustments, which are based on objective eligibility criteria.

As discussed above, it does not seem feasible to design *efficiency incentive* or *targeted tax relief* schemes that would be effective as a means of addressing industry competitiveness concerns.

Fairness

Exemptions are a common feature of European carbon and energy taxes. However, experience in the United States with President Clinton's 1993 energy tax proposal suggests that exempting the biggest emitters can help undermine support for carbon pricing measures. This especially may be a problem in Australia where energy-intensive industries account for a comparatively high share of emissions. A *border adjustment* would lessen such fairness objections, by limiting the exemption to export-related emissions.

Grandfathering raises particularly strong fairness concerns because it violates the widely supported polluter pays principle. Indeed, the free allocation of anything more than a small fraction of permits provides a windfall economic gain to the shareholders of companies which receive them (Goulder 2005). Yet, producers are able to pass through most but not all of the carbon price to consumers – just like they do with other costs of doing business – so that economic modelling indicates that prices to consumers rise to much the same level with or without grandfathering. Consumers, therefore, face higher energy prices, but unlike with a carbon tax or permit auction, government does

[34] A summary of the allocation plans of member states is provided in German Emissions Trading Authority (2005) and Betz (2006) discusses transaction costs.

not receive revenue that can be used for compensating reductions in other taxes.[35] *Negotiated agreements* inevitably raise concerns of special deals for individual companies because of the lack of transparency and difficulty of comparing the abatement effort required in different agreements.

International solution

Only a *border adjustment* offers the potential for a multi-lateral or international solution to carbon leakage. The widespread adoption of *exemptions* would avoid industry migration into pollution haven countries. In theory, *negotiated agreements* could be pursued with major industries on a global basis. But, as noted earlier, this approach is already very resource intensive and lacking in transparency at the national level. An effective environmental outcome would seem very unlikely from negotiations at the global level that necessarily would involve hundreds of governments and companies with widely divergent circumstances and interests.

We argue in section 5 that Australia could adopt unilaterally a border adjustment that does not violate international trade rules under the World Trade Organisation. There are numerous other countries where a border adjustment would make it easier to adopt a carbon tax or emissions trading by overcoming economic and political barriers. Unlike an exemption, as more countries took this path, the greater would be the share of global energy-intensive production that would be subject to a carbon price signal.

However, the border adjustment solution could also be pursued through multi-lateral negotiations. A multi-lateral agreement could provide an explicit acceptance of the right of individual countries to adopt border adjustments and set design parameters. Alternatively, a coalition of developed country Kyoto participants could adopt a scheme across their economies.

The unilateral adoption of a border adjustment by Australia, or any other developed country, would clearly elevate the carbon leakage issue on the international climate agenda. Accordingly, the unilateral and multi-lateral approaches might well be pursued simultaneously.

Table 8 summarises our assessment of the six offset options against our six criteria. A border adjustment is the most promising option and in the next section we will examine this approach in more detail.

[35] The distribution impact of grandfathering is discussed in Parry *et al*. (2005) and Parry (2003).

Table 8 Summary comparison of competitiveness offset mechanisms

	Effective-ness	Environmental incentive	Economic cost	Administrative complexity	Fairness	International solution
Exempt sectors	✓	✗	✗ ?	✓	✗	✗
Grandfather permits	✗	✓	✗ ?	✗	✗	✗
Targeted tax relief	✗	✓	?	✗	?	✗
Company agreements	✓	✗?	?	✗?	✗	✗
Efficiency incentives	✗	✓	?	✗	?	✗
Border adjustment	✓	✓	?	✓	✓?	✓

5. Exploring a border adjustment for Australia

5.1 Choosing the type of border adjustment

A key choice in the design of a border adjustment is whether to adopt an origin or destination system. Under the origin principle of taxation, traded goods are subject to the taxes of the exporting (origin) country. Under the destination principle, they are subject to the taxes of the importing (destination) country and exempted from the taxes of the exporting (origin) country, as is the case for Australia's GST and European VATs.

A destination type border adjustment would most effectively address Australia's competitiveness problem and this is the type we described in section 4 above. A destination type border adjustment for embodied carbon imposes a carbon charge on energy-intensive imported goods, calculated at the same rate as the domestic carbon tax. For energy-intensive exports, it provides a rebate at the border equal to the domestic carbon tax costs incurred in their manufacture.

An origin type border adjustment for embodied carbon only imposes the charge on imports, but with a countervailing credit for any carbon tax already paid in the exporting country. Under an origin system, there is no rebate of domestic carbon tax for energy-intensive exports.

Either origin or destination type border adjustments could be considered for a broad multi-lateral system to counter carbon leakage that included major trading countries, both developed and developing. In the absence of such a multi-lateral solution, however, our goal is to devise an effective system that can be adopted unilaterally by Australia.

An origin type border adjustment might be attractive for the United States or European Union where the major competitiveness concerns relate to energy-intensive industries that primarily produce for local consumption. The U.S. Congress, for example, added a tax on energy intensive imports to President Clinton's 1993 energy tax proposal that ultimately failed to win legislative approval (Hoerner and Muller 1993). More recently, an origin type border adjustment has been suggested for the European Union to address the competitive disadvantage resulting from the refusal of the United States to join the Kyoto Protocol (Biermann and Brohm 2003).

An origin type border adjustment would remove the incentive provided by a domestic carbon price for American industries like coal-dependant aluminium producers and energy-intensive petrochemical plants to relocate to developing countries. The unilateral adoption of an origin type border adjustment by such large economies also would have the advantage of providing a strong incentive for trading partners to adopt equivalent carbon pricing policies. If the European Union, for example, adopted an origin type border adjustment for its emissions trading scheme, countries exporting energy-intensive goods to Europe would face a choice of either adopting their own carbon pricing policy or 'surrendering' to Europe the revenue collected by its border adjustment. In either case, a carbon price would be imposed on their energy-intensive exports.

The unilateral adoption by Australia of an origin type border adjustment, however, would not solve the competitiveness problem facing export industries like aluminium, alumina, steel and LNG. Only a destination system would preserve the competitiveness of energy-intensive exporters. Even the multi-lateral adoption of an origin system by a coalition of developed country Kyoto Protocol participants (should Australia ratify) would not solve Australia's problem, because many of our energy-intensive exports go to developing countries without emissions caps and carbon pricing policies. By contrast, a destination type border adjustment, whether adopted unilaterally or by a 'Kyoto coalition' of developed countries, solves the import competition problem of the United States and Europe as well as Australia's export problem.

5.2 Designing a feasible system

There are two key issues that need to be addressed in designing a destination type border adjustment that is both effective and administratively feasible:

- How does the government determine which products should be eligible for adjustment?
- How does it set the rates of the adjustments for exports and imports of eligible products?

Border adjustments are a common taxation device and, to date, consideration of their use as a climate policy tool has primarily focused on carbon taxes. We therefore first discuss these questions in relation to a border adjustment for a carbon tax. We then consider whether any additional design issues arise in applying a border adjustment to emissions trading.

Determining eligibility

Fossil fuels are used directly or indirectly in the manufacture of almost every product exported from and imported to Australia. Clearly, applying a border adjustment to all exports and imports would be unworkable. However, as demonstrated in section 3, this is not necessary because a carbon tax at likely rates will only raise costs by a very small amount in most sectors of the economy.[36] A border adjustment is only needed for a limited number of emissions-intensive commodity products that are both trade exposed and face significant cost increases.

Nevertheless, a long list of industries can be expected to queue up for inclusion in the event that a border adjustment is adopted. To keep the adjustment scheme administratively manageable and maintain the environmental integrity of the carbon tax, it is important that these pressures be resisted and that inclusion is limited to genuine cases of competitive disadvantage.

[36] Costs may even decrease in many of these sectors if carbon tax revenues are 'recycled' through a reduction in existing business taxes.

Accordingly, objective and transparent eligibility criteria should be established from the outset. This might include specific quantitative criteria, such as a requirement that the carbon tax burden (direct plus indirect) exceed some threshold level – say two percent of the value of the product (Hoerner 1998). Based on our analysis in section 3, if the CO_2 price were A$35 per tonne, such a threshold would limit eligibility to exports of aluminium, alumina, steel, nickel, copper, zinc, lead, gold and LNG, and possibly one or two other primary metals that are produced in minor quantities.[37] Our analysis suggests that this list is relatively robust. All these commodities would still meet the two per cent threshold test if the emissions price were only A$20 per tonne CO_2-e, and even if commodity prices were at January 2006 levels, which in most cases are considerably higher than the average 2002-03 prices shown in Table 7. A quantitative threshold for the level of trade exposure might also be adopted. The same criteria should be applied to export and import-competing industries. Our analysis, admittedly on poorer quality data than was available for the export analysis, suggests that at present only the steel industry is exposed to the level of competition from non-Annex B countries that would qualify it for eligibility on import grounds.

An alternative approach would be to consider the eligibility of industries and products on a case-by-case basis (Sinner 2002). Producers would have to demonstrate to a responsible authority that they would not be competitive without a border adjustment. On the surface, this might seem attractive given the limited information on industry competitiveness held by government agencies. However, such an approach would risk undermining public support for the carbon tax and creating legal problems under WTO rules (see section 5.4) if it degenerated into a series of arbitrary, inconsistent and non-transparent one-off deals.

It would be preferable to maximise industry participation up-front in the development of objective eligibility criteria that are consistently applied, rather than to leave it to a case-by-case assessment process. Some additional flexibility in the implementation of the tax and border adjustment might still be provided by incorporating elements of the negotiated agreement approach into the border adjustment system.

Once a producer or industry had demonstrated that it met the eligibility criteria, it could negotiate an agreement with government addressing industry specific implementation issues. To improve environmental effectiveness, such an approach might also include making eligibility for the border adjustment conditional on a commitment to achieving specified energy efficiency or emissions benchmarks. To ensure transparency these agreements could be made public, as is the case with the UK Climate Change Agreements (Pearce 2005).

Setting the rate of adjustment

The major design challenge is determining how to set the adjustment rates to be applied by Customs to eligible products. We start by considering the rebate for exports which our analysis in section 3 indicates would be the main focus of an Australian border adjustment scheme. We then consider the import charge.

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[37] With the exception of alumina, all the metallic mineral commodities in this list would have to be in the metallic form. Exports of concentrates would not qualify.

The basic principle is that the amount of rebate should equal the per unit increase in production costs that results from the imposition of the carbon tax. Producers will experience cost increases both directly, through their own carbon tax obligations, and indirectly, through increased prices for electricity, fuels and possibly other inputs. The balance between the direct and indirect impost will vary between industries and also depend on where in the fuel chain the carbon tax is levied. Even under a 'downstream' carbon tax, the main impost will be indirect for some industries, such as major electricity users (e.g. aluminium smelters) and possibly major consumers of natural gas or fuel oil (e.g. alumina refiners).[38] It is therefore essential that both the direct and indirect burdens be counted.

Accounting for the direct burden is straightforward as this information would be held both by the producer and the authority that levies the carbon tax. Accounting for the indirect burden is a more difficult task. This requires not only an accounting for the amount of tax paid upstream in the energy supply chain, but also an assessment of how much of these costs have been passed on to consumers and how much absorbed by suppliers. Nevertheless, this should be a manageable task as the problem is confined to a small number of products from industries whose energy and emissions characteristics are well understood. Moreover, as Sinner (2002) notes, a perfect accounting system is not required. The objective is not to set the economically optimal adjustment rate, but rather to provide a rebate that is sufficient to prevent a serious competitiveness problem, while avoiding overcompensation that might raise concerns under international trade rules.

A standard methodology for setting the rebate level could be developed for each eligible product by a body such as the Australian Greenhouse Office, in collaboration with industry and the taxing authority. The methodology could build on the extensive work on company-level greenhouse accounting already undertaken by industry and government under the international Greenhouse Gas Protocol.[39] It would need to incorporate a regular assessment of the cost flow-on issue in relevant energy markets and should be reviewed periodically to account for improvements in energy efficiency and emissions performance.

In the case of a charge on imports, the purpose is to level the playing field between domestic production and imported products. Accordingly, the rate of the adjustment on the 'embodied carbon' of eligible imports should equal the domestic carbon tax rate. Calculating the amount of adjustment for any particular shipment, therefore, in principle requires information on the energy use and fuel mix of production in the exporting country, which would not be readily available to Australian Customs.

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[38] Because of the large number of individual users, it is typically proposed that a tax on emissions associated with these fuels be levied at an upstream point, such as at the pipeline for natural gas and the refinery terminal for petroleum products.

[39] The Greenhouse Gas Protocol is a standard set of rules for estimating and reporting greenhouse gas emissions from individual entities, e.g. firms, that has been developed under the joint auspices of the World Business Council for Sustainable Development and the World Resources Institute. It is widely used by businesses around the world which choose to publicly report their emissions for the benefit of investors and other stakeholders.

An equivalent problem was faced by the United States in the 1980s in devising the border adjustment for the Superfund Chemical Excises as it applied to imported products manufactured using taxable chemicals. Following conciliation with several trading partners under the provisions of the GATT, a two tier system was implemented (Hoerner 1998):

- The importer could provide detailed information on the amounts of taxable chemicals actually used in production and the import charge was then calculated at the prevailing domestic excise rates.

- If the importer failed to provide this information, the charge would be assessed based on the amounts of chemicals that would have been used had the product been manufactured in the United States under the 'predominant method of production'. Regulations were issued by the U.S. Treasury stipulating these amounts for various imported products.

This system was approved by a Conciliation Panel under the GATT. The United States subsequently put in place a similar system for the Ozone Depleting Chemicals Tax.

A two tier system along these lines could be devised for a carbon tax and should be manageable given the very limited number of imported products that would need to be embraced by such a system. As with the export rebate, this system would need to account for upstream emissions.

Concerns could arise of importers under-reporting emissions or taking advantage of the default predominant method approach, in cases where Australian production was less carbon intensive than in the exporting country. With appropriate expert review, it should be possible to detect any such cheating given the availability of exporting country emissions inventories through the UNFCCC, the growing global trend to company-level reporting and the well understood nature of production systems for most energy-intensive goods.

Applying a border adjustment to emissions trading

From the perspective of border adjustment design, possibly the most important difference is that a tax establishes a fixed carbon price (which might be increased over time) whereas the permit price under emissions trading will fluctuate. Recent experience with the EU emissions trading scheme suggests that price fluctuations could be substantial even over short periods of time.[40]

In determining eligibility, price fluctuation would not be a problem. The government could stipulate a carbon value, based on market experience, for the purpose of assessing whether products met the cost burden threshold test. This value could be reset and eligibility reviewed if there was a significant and long lasting shift in the permit price. Determining eligibility, therefore, should be relatively straightforward if permits are auctioned. If permits are partly or fully grandfathered, however, calculation of the cost threshold test would need to be adjusted to take into account this benefit.

[40] See for example PointCarbon; http://www.pointcarbon.com/.

Setting the level of compensation for exports involves a similar principle as for a tax, i.e. its monetary value should equal the per unit increase in production costs that results from imposition of the permit scheme. Direct cost impacts could be avoided by exempting producers on a pro-rata basis from the requirement to acquit permits for the share of their production that is exported.

Indirect cost impacts, however, would need to be estimated as permit acquittal will probably be upstream of eligible producers in important cases (i.e. at the power plant, gas pipeline or refinery). As with a tax, if permits are auctioned, the degree to which suppliers absorb some of this cost will need to be assessed. If permits are grandfathered, as discussed earlier, producers will still face higher energy costs and the extent of these cost increases will need to be assessed. The combination of these cost flow-on considerations with a fluctuating permit price will make estimation of the indirect cost burden more difficult than in the case of a tax. The rebate could be granted in the form of emissions permits that equate in value to the indirect cost burden.

A similar two tier system as suggested for a carbon tax could be established for the import charge. The rate of the charge could be based on the prevailing domestic permit price. Alternatively, importers could be required to purchase and acquit emissions permits, if this approach was considered more consistent with international trade rules.

5.3 Maintaining a national emissions cap

The purpose of a border adjustment would be to overcome barriers to adoption of a carbon price signal. For the reasons explained in section 2, a carbon price signal is a necessary, but not sufficient, element in a package of policy new measures that will be needed if Australia is to limit its rapid growth in emissions from energy combustion. While Australia may (just) meet its Kyoto commitment to restrict its greenhouse emissions to 108 percent of 1990 levels over the 2008-2012 period, on present trends emissions will grow steadily thereafter (Australian Greenhouse Office 2005b). In contrast, at their meeting in Montreal in December 2005, the Protocol's member countries agreed to begin negotiating further (and lower) binding emissions limits for periods beyond 2012

A border adjustment would effectively exempt from a carbon price signal the emissions arising from the production of eligible exports. Under the accounting rules of the UNFCCC, these emissions would still be counted in the calculation of Australia's cap. This would not undermine the emissions trading or carbon tax scheme, because achieving the national cap would be unnecessarily costly if it depended solely on the operation of such a market mechanism on those economic sectors and emission sources to which the mechanism could be applied. As noted earlier, some key emissions sources (e.g. agriculture) cannot be included and the effective and efficient operation of the carbon price scheme would also require complementary policies in the covered sectors (e.g. technology promotion and institutional reform). Accordingly, it has always been envisaged that government would have a broader role in the management of Australia's cap.

Clearly, if the border adjustment spurred rapid growth in emissions-intensive export sectors, this would make it harder for Australia to meet its overall cap and impose costs on other sectors of the economy that would be required to achieve additional compensating emission reductions. The Australian Government, therefore, should carefully review major investment proposals that would increase production eligible for the export rebate. This could be achieved through a greenhouse trigger under the *Environment Protection and Biodiversity Conservation Act (1999)*, along the lines of the 1999 proposal of the former environment minister, Senator Robert Hill (DEH 1999).

New investments should only be approved if they pass a national interest test that includes an assessment of whether the economic and employment benefits outweigh the additional costs imposed on Australia in meeting its greenhouse obligations. Project approvals should be accompanied by a government statement outlining the additional measures to be implemented in order to achieve compensating emissions reductions elsewhere in the economy. The reviews should also assess options for minimising the project's own emissions without undermining its competitiveness. Relevant conditions could be incorporated into a Negotiated Agreement, as discussed earlier.

5.4 Assessing consistency with international trade rules

It is sometimes claimed that border adjustments for a carbon tax or emissions trading would not be permitted by international trade rules under the World Trade Organisation. This is a complex legal issue and its full treatment is beyond the scope of this paper. We simply identify some of the main arguments and suggest a way forward for Australia.

A key principle of the WTO is that countries must treat imported products no less favourably than 'like' domestic products. A central claim of critics of border adjustments is that the definition of 'like' under this principle relates only to the physical characteristics and performance of a product. Differences among countries in how goods are produced (known as Processes and Production Methods (PPMs)) cannot be considered, it is claimed, even though such differences may be of considerable environmental significance. It has become an article of faith for some in the trade community that PPMs are the sole concern of the exporting country and no-one else's business. According to this view, a charge cannot be imposed on imported aluminium or cement, for example, on the basis of the amount of energy used or emissions released in the exporting country, even if the purpose is simply to level the playing field with domestic production.

Whether this objection to border adjustments ever held water is contested (Hoerner & Muller 1996). Recent WTO rulings, however, in a dispute between the United States and several Asian countries over US regulations concerning shrimp imports, make it even more problematic (Frankel 2005; Deal 2002). These WTO rulings allowed the United States to pursue protection of endangered sea turtles through measures relating to the fishing practices of foreign fisherman, so long as these measures are not arbitrary or unnecessarily discriminatory. The global climate, even more starkly than sea turtles, represents a global commons that is the concern of all countries. Like the U.S. shrimp-turtle measures, border adjustments would form part of a scheme intended to protect that global commons.

Another common objection to border adjustments holds that trade rules preclude a rebate being paid on export for taxes on inputs that are not physically incorporated into the exported good. Such a ban would clearly apply to carbon or energy taxes. This argument seems to have been based on a misunderstanding of the original tax provisions of the General Agreement on Tariffs and Trade (GATT) (Hoerner and Muller 1996). It is made even more doubtful by the subsequent Uruguay Round agreement provisions relating to subsidies which explicitly allow the rebate of taxes on ‘energy, fuels and oil used in the production process’. It has been claimed that developed country negotiators reached a private ‘gentleman’s agreement’ not to pursue such rebates, but such an agreement, if it exists, would appear to have no legal status (Hoerner and Muller 1996, Deal 2000).

It seems likely that with careful design a scheme can be crafted that both satisfies WTO principles and serves competitiveness and climate protection goals. The overcompensation of exporters should be avoided, for example, and an opportunity provided for importers to demonstrate that their products are less carbon intensive than local production. A thorough analysis of relevant WTO rules and proceedings should be undertaken to inform the design of a scheme. Further work especially is needed on how to design a border adjustment for a permit trading scheme that is consistent with trade rules.[41]

If Australia were to adopt a border adjustment with either a carbon tax or an emissions cap with permit trading, it would naturally be open to other member countries to challenge it through the WTO. Such a challenge might be lodged, for example, by a country with export industries that stood to benefit from their Australian competitors being subject to higher energy prices. Ultimately, the legality of Australia’s scheme would be determined through the WTO disputes process, which can be unpredictable. The risk of an adverse ruling should not preclude Australia proceeding, even if further analysis suggests the legal outcome would be uncertain. The adoption of a border adjustment by Australia would build momentum for an international solution to carbon leakage, whether or not it prevailed at the WTO.

[41] The discussion above, for example, on whether export rebates are permitted relates specifically to tax provisions of the WTO/GATT that probably do not apply to a rebate for the cost of emissions permits.

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