National Transport Commission

FREIGHT TRANSPORT IN A CARBON CONSTRAINED ECONOMY

DISCUSSION PAPER

JULY 2008

Prepared by

National Transport Commission and Rare Consulting

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Comments by: 29 August 2008

Comments to be addressed to:

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FOREWORD

Transport is the 'engine room' of the nation's economy. It gives Australians better access to jobs, leisure, healthcare and education. It ensures products are delivered to supermarket shelves when we need them at the lowest cost.

Reforms to date have served transport users well, but the system is at risk of choking under a massive forecast increase in passenger and freight movement. These forecasts also include growing greenhouse gas emissions from passenger and freight transport, when the climate change science is telling us we need large cuts in emissions to avoid the worst impacts of climate change. The next phase of reform will require genuine leadership and a significant shift in our thinking.

The federal Minister for Infrastructure, Transport, Regional Development and Local Government, recognised these challenges and asked the National Transport Commission (NTC) for urgent advice on a national transport policy and plan. After some intense consultation, the NTC developed a 'New beginning for transport'; a plan for significant and decisive action to keep this nation moving. The plan includes ten reform hotspots including climate change, environment and energy. This plan was accepted by the Australian Transport Council in February 2008.

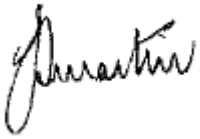
Currently, no country has a detailed strategy or plan for cutting freight transport emissions over the longer term. The aim of this discussion paper is to start to plan ways in which emissions from freight transport can be cut over the longer term. Indeed, there are many measures that can be taken now to start reducing emissions. Many of these measures are productivity reforms which have the double benefit of reducing greenhouse gas emissions and reducing the cost of transport. This report contains a set of proposals for comment that will start focusing actions on ways to reduce freight transport emissions over the longer term.

Some may say we need to wait for a national emissions trading scheme to be introduced before considering additional measures to reduce emissions from freight transport. I disagree. An emissions trading scheme will put pricing signals in place for carbon emissions and set reductions targets for emissions across the economy. However, an emissions trading scheme is not going to create the plan for an integrated transport network for Australia. Having an emissions trading scheme in place is not going to produce the regulatory reforms necessary for higher productivity transport that will reduce emissions and lower the cost of transport.

In May 2008, a forum was convened with then NTC Chairman Michael Deegan and our CEO Nick Dimopoulos with leaders from industry and environment groups to discuss climate change and freight transport. These leaders confirmed that climate change is a major challenge, but also a business opportunity. Indeed, leading companies are already taking steps to actively manage carbon and reduce emissions in their supply chains. These leaders also confirmed that further actions by government and industry are needed to cut emissions from freight transport. I would like to thank those participating in the forum: Professor Ian Lowe, President, Australian Conservation Foundation; David McInnes, Group Manager, Environment and Climate Change, Linfox; Tony McMullen, Chief Executive, Transport Industry Council; Helen Newell, Group General Manager, Asciano; Rupert Posner, Director, Climate Change Group; David Simon, Managing Director, Simon National Carriers; Stuart St Clair, Chief Executive, Australian Trucking Association; Karli Tucker, Garnaut Review Team; Paul Wild, Fleet and Equipment Manager, TNT Express Australia; Eric Willemse, Secondary Freight Manager, Woolworths; and Craig Wilson, Environment Sustainability Manager, Asciano.

This discussion paper is open for public comment until Friday 29 August 2008. NTC will then consider these submissions in the development of a proposal for ATC approval by July 2009.

I look forward to the debate simulated by this discussion paper. I encourage you to put forward your ideas about the ways to cut emissions from freight transport. I would also like to acknowledge the work of Neil Wong, Matthew Loader, Mark Crosher and Rare Consulting as the major contributors to this report.



Greg Martin

Acting Chairman

SUMMARY

Climate change is a major global challenge. The Garnaut Climate Change Review's draft report warns that the costs of inaction on climate change are higher than the costs of taking action.

Australia is currently putting a framework in place to reduce greenhouse gas emissions over the longer term. Transport will need to play a role in an economy-wide response to climate change. While there is focus on carbon solutions for passenger transport in Australia, there is a current gap in the analysis of potential solutions for freight transport and supply chain emissions. Therefore, this report focuses on potential actions and solutions for freight transport. NTC argues that a nationally coordinated response is needed for emissions from freight transport.

There is a number of challenges for reducing emissions from freight transport. These challenges include:

- greenhouse gas emissions from freight transport are forecast to grow strongly out to 2020;
- freight transport is highly connected with the economy. Therefore growth in the Australian economy will lead to higher greenhouse gas emissions;
- greenhouse gas emissions from freight transport is currently a policy 'blind spot';
- the uncertainty of the effectiveness of response measures, and the lag time between introducing transport measures and the subsequent reductions in emissions;
- non-alignment of current policies and regulations leading to higher greenhouse gas emissions; and
- inefficiencies with current transport markets resulting in non-optimal transport choices and higher greenhouse gas emissions.

Both governments and business will have key roles to overcome these challenges. Governments need to introduce policies so the transport sector meets its full environmental costs. The national emissions trading scheme is the key economy-wide reform to achieve this for carbon emissions. The conclusion from the Stern Review on the Economics of Climate Change report is that transport will be the last sector to reduce emissions under an emission trading scheme because of the higher abatement costs. However, there are still measures that can be taken in the short to medium term to reduce emissions from this sector. Government reforms can increase the efficiency of transportation markets, and assist business in moving to a lower carbon economy. In addition, business will need leadership and innovation in developing future supply chain models with low carbon emissions.

A broader strategy for reducing Australia's greenhouse gas emissions is needed. This broader framework involves:

- introducing an emissions trading scheme including coverage of the transport sector;
- removing subsidies and distortions that are not complementary to the emissions trading scheme;
- coordination of abatement measures across governments across all sectors;

- funding for abatement measures and research and development; and
- preparing adaptation strategies that include transport.

These actions are currently under development led by the Commonwealth government. State and territory governments also have a key role in the development of these actions.

In addition to the broader strategy, there is a need to focus on the ways to reduce emissions from specific sectors. Therefore, NTC proposes the following actions for developing a national strategy to reduce greenhouse gas emissions from the freight transport sector.

Recommended Actions	**Comments**
1. The Australian Transport Council (ATC) to provide the lead role in coordinating measures to reduce greenhouse gas emissions from freight transport.	The National Transport Policy Framework being developed by ATC provides the means to not only address greenhouse gas emissions from freight transport and supply chains but also other key transport objectives such as economic, safety, and social outcomes.
2. Implement measures now that are known to reduce greenhouse gas emissions, and further research into ways to reduce freight transport's emissions over the longer term.	With governments playing a large role in transport markets, for example, with the supply of road infrastructure and access conditions, there are government related actions that can complement an emissions trading scheme. NTC proposes that these measures be predominantly focused on infrastructure and productivity measures that can reduce the cost of transport and lower the cost of greenhouse gas abatement over time. These reforms include productivity reforms agreed by COAG such as with wider use of more productivity vehicles and incremental pricing, and reforms under the National Transport Policy Framework such as the supply chain audits. In addition to measures that can be introduced now, it is important to develop further research into ways to reduce freight emissions over the longer term. NTC proposes that work be undertaken to explore possible pathways for large cuts in emissions by the freight transport sector by 2050.
3. Institutional reform to create more efficient markets across all transport modes.	Australia needs a more holistic approach to creating more efficient markets across all transport modes. With more efficient transport markets in place, the freight transport sector will have better price signals that will help them choose the mode of transport needed for the task. In addition, this will produce reduced greenhouse gas emissions. There are currently many constraints to creating efficient markets for transport, and institutional reform is needed to overcome these barriers.

4. Business leadership in moving to low carbon supply chains.	Some Australian companies are already exploring ways to reduce carbon emissions in their supply chains, and further business leadership is needed to redesign current supply chains to lower carbon supply chains.
5. Develop better metrics for freight transport for managing emissions.	The freight transport emissions are reported as part of the transport sector at the national and international level. However, more specific freight transport metrics are needed at the national and international level to better monitor whether freight transport modes have emissions that are increasing or decreasing on an efficiency level as well as an absolute level. In addition, increasing management of carbon emissions from companies is needed.
6. Research and development support by governments to overcome barriers for introduction of low greenhouse gas emission technology and practices.	These research and development programs are needed to make the transition to lower carbon freight transport. The funding mechanism and process for funding decisions that are based on clear objectives needs to be developed.

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1. INTRODUCTION

Global concerns about the potential impact of climate change on human civilisation have given rise to an international policy debate about ways to deliver significant and sustained reductions in global greenhouse gas emissions.

This debate has gained prominence in Australia over the past 18 months, with the Australian Government and state and territory governments foreshadowing the introduction of new legislation designed to achieve greenhouse gas reduction.

In May 2007, the Australian Government released a discussion paper on the development of a national emissions trading scheme for introduction in 2011 (DPMC 2007). The scheme would potentially create a national carbon emissions market valued at $13.6 billion[1].

Since November 2007, there have been substantial developments in Australia's climate change policy. These include ratifying the Kyoto Protocol and accelerating the introduction of a national emissions trading scheme to 2010. In addition to the national policy discussion, a number of Australian states have announced greenhouse gas reduction targets (see Appendix A). Some states have legislated emission reduction targets.

The effect of this legislative and policy development is to reshape the macro-economic environment in which all Australian organisations operate – a new economy where carbon activity will be constrained either directly or indirectly. Such an economy is often referred to as a 'carbon constrained economy'.

The emergence of a carbon constrained economy is likely to produce market changes that extend well beyond mere increases in compliance and reporting costs. Potential effects on Australian enterprise and industry may include, but are not limited to:

- increased costs from pricing greenhouse gas emissions;
- changes to consumer purchase decisions, reducing market shares of products and services that consumers perceive to be carbon intensive;
- changes to the nature of the competitive environment in which many commercial organisations operate;
- increased risk of reputational loss for public-sector organisations and a possible loss of brand capital for commercial organisations;
- increases in the cost of capital for organisations seeking to invest in carbon-intense industries; and
- reductions in the serviceable life (and associated increase in annual maintenance costs) of physical assets such as electricity distribution and road network infrastructure.

[1] Based on a carbon emissions price of A$35 per tonne.

1.1 Scope of this paper

This discussion paper identifies the potential impacts of a carbon constrained economy on the Australian freight transport sector, together with a discussion of some of the potential solutions that might be pursued to minimise these impacts on this sector, and on the wider economy, while maximising greenhouse emission reductions.

The paper has been developed to promote and inform the debate about the future operation of the Australian freight transport sector within a carbon constrained economy by providing:

- a discussion of the relative contribution of freight transport sector emissions to national greenhouse emissions in Australia;
- key issues for future strategies for reducing freight transport;
- the role of governments in climate change policy;
- the impact of the national emissions trading scheme on the freight transport sector;
- identification of some of the current and future measures that could be pursued to reduce emissions from freight transport; and
- a proposed set of actions to develop a national strategy to reduce emissions from the freight sector over the longer term. Feedback from the consultation phase of this discussion paper will be used to help develop this national strategy.

The rest of this section discusses key contextual work for this discussion paper.

1.2 National transport policy framework

The Australian Transport Council (ATC) consists of transport ministers from Commonwealth, State and Territory governments, and chaired by the Commonwealth minister. It is the ministerial forum for the coordination and integration of transport policy issues at a national level.

At ATC's meeting in February 2008, ministers agreed that there is a need for a national approach to transport policy and endorsed the National Transport Policy Framework (ATC 2008). Implementing the National Transport Policy Framework will involve:

- agreeing the details of a national policy framework;
- a new inter-governmental agreement to implement the national policy framework which will establish the governance structure; and
- settling the key work priorities and timetable.

The vision, policy objective and policy principles were agreed at ATC's meeting in May 2008. These are reproduced in Appendix B.

There is an environmental policy objective under the National Transport Policy Framework. This objective is *"to protect our environment and improve health by building and investing in transport systems that minimise emissions and consumption of resources and energy"*.

The Western Australian minister is responsible for developing the work plan for climate change, environment and energy under the National Transport Policy Framework.

1.3 Development and reviews of national climate change policy

A number of policy work and reviews are currently underway relating to national climate change. This section briefly describes some key work.

An Australian emissions trading scheme and targets for reducing greenhouse gas emissions

The Australian Government is developing the national emissions trading scheme. The timetable for this work is release of draft legislation for public comment in late 2008, the formal introduction of this legislation in late 2009 and commencement of an emissions trading scheme in 2010. The Australian Government is aiming to have 70 per cent of Australia's greenhouse gas emissions included in the emissions trading scheme (Wong 2008).

The Australian Government's long term target is a 60 per cent reduction in Australia's greenhouse gas emissions in 2050 (relative to 2000) (Wong 2008). The Australian Government will also set interim targets for emissions of greenhouse gas in finalising the emissions trading scheme.

In addition, the Australian Government is involved in negotiations for the next international policy agreement post the Kyoto Protocol period of 2008 to 2012. Australia's international obligation under the Kyoto Protocol is an eight per cent increase in greenhouse gas emissions from 1990 to 2012.

Garnaut climate change review

The Garnaut climate change review is an independent study by Professor Ross Garnaut, commissioned by Australia's state and territory governments in April 2007. In late 2007, the Australian Government confirmed its participation in the review. The review will examine the impacts of climate change on the Australian economy, and recommend medium to long-term policies and policy frameworks to improve the prospects for sustainable prosperity. The review's final report is due on 30 September 2008 (Garnaut 2008).

Strategic review of Australian Government's climate change programs

The Australian Government is reviewing all its existing climate change programs to:

- ensure they are complementary to the emissions trading scheme;
- phase out less efficient abatement programs and initiatives that will interfere with the carbon price signal arising from emissions trading; and
- rationalise duplicative and overlapping programs (DFD 2008).

The review will develop principles of complementarity and assess whether programs are efficient, effective, appropriate and complementary to an emissions trading scheme. Roger

Wilkins is chairing the review and will report to the Commonwealth in July 2008 (DFD 2008).

COAG climate change group

The Council of Australian Governments (COAG) meeting in February 2006 agreed to adopt a new national climate change plan of action and to establish a high-level interjurisdictional climate change group to oversee implementation of the plan's recommendations. Three working groups were established to examine renewables and low emissions technology, adaptation, and technology (COAG 2006).

COAG working group on motor vehicle efficiency

The COAG meeting in February 2006 requested that the ATC and the Environment Protection and Heritage Council:

- report on programs and incentives to encourage the uptake of more fuel efficient and low emission passenger and freight vehicles; and
- provide advice on opportunities for reforms to regulations, standards, codes and labelling requirements to improve vehicle fuel efficiency.

As a result, the COAG working group on motor vehicle efficiency was created that reports to ATC and Environment Protection and Heritage Council. This working group is currently exploring a number of options for more efficient and low emissions vehicles and to improve vehicle fuel efficiency (COAG 2006).

2. GREENHOUSE, TRANSPORT AND FREIGHT

2.1 Greenhouse gas emissions from transport

Analysis of the various greenhouse gas policy responses that have been advanced by most of the developed economies since 1990 reveals most efforts targeting stationary energy. This is not surprising given that greenhouse gas emissions from this sector is typically the largest sector with alternative lower emissions technologies available, albeit at a higher cost without a carbon price. Compared with the stationary energy sector, the analysis showed fewer initiatives targeting reductions in the greenhouse gas emissions from the transport sector.

The significance of greenhouse gas emissions from the transport sector is perhaps best evidenced by an examination of the contribution to, and growth of, transport sector emissions in Europe, North America and Australia.

Key points about European emissions from transport are:

- transport was the second largest contributor (21 per cent) of greenhouse gas emissions in the European Union-15 in 2005;
- passenger transport's emissions increased by 28 per cent between 1990 and 2005;
- freight transport's emissions grew by 62 per cent between 1990 and 2005; and
- measures introduced in Germany are leading to large reductions in greenhouse gas emissions in transport and will result emissions stabilising in the European Union-15 by 2010.

Key points about transport emissions from the US and Canada are:

- transport was the second largest contributor of greenhouse gas emissions in the US (28 per cent) and Canada (26 per cent) in 2005;
- between 1990 and 2005, freight transport emissions grew by 69 per cent in the US and 65 per cent in Canada; and
- in 2020, transport emissions will be 28 per cent higher in the US (from the year 2004) and 36 per cent higher in Canada (from the year 2000).

A more detailed discussion of emissions from the European Union, US and Canada is presented in Appendix C.

The Australian greenhouse experience for transport is very similar to that of the European Union, although the overall contribution has not grown as fast.

Figure 1 shows that the Australian transport sector accounted for 14.4 per cent of Australia's total greenhouse gas emissions in 2005. This constitutes the third largest sectoral contribution behind stationary energy (50 per cent) and agriculture (15.7 per cent) (AGO 2007a).

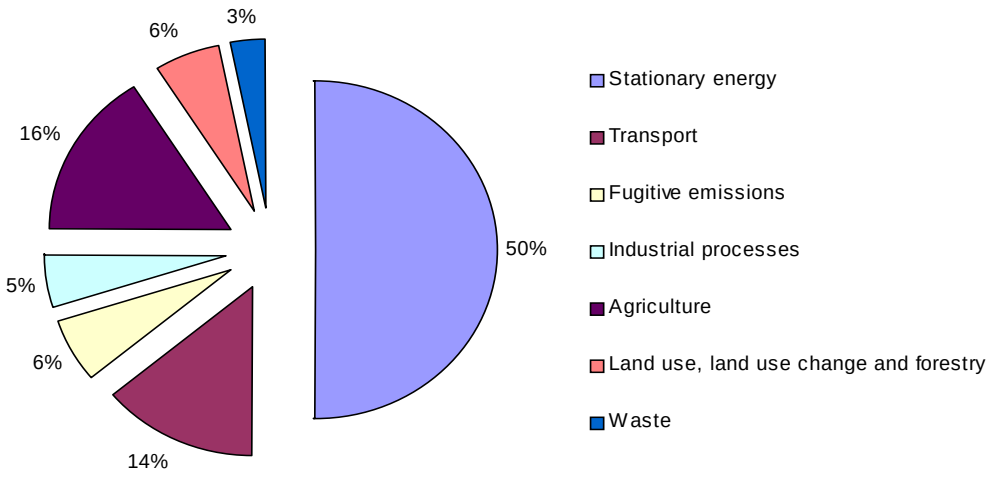

Figure 1. Australian greenhouse gas emissions by sector 2005

Source: AGO 2007a.

Within the transport sector, road transport accounts for just under 90 per cent of all greenhouse gas emissions with passenger cars accounting for around 62 per cent and commercial vehicles accounting for the remaining 38 per cent (AGO 2007a).

Despite an emerging debate about the future impact of greenhouse gas emissions from air travel, growth in non-road transport sector emissions between 1999 and 2010 (3 Mt CO_2-eq) is expected to be less than one-seventh of the growth in greenhouse gas emissions from road transport (22 Mt CO_2-eq).

Between 2010 and 2020, forecasts are for an 8 per cent increase in greenhouse gas emissions from passenger cars and 27 per cent growth in greenhouse gas emissions from commercial vehicles (AGO 2006a).

Key points

Transport emissions have grown in Australia consistent with general growth in transport emissions internationally.

Transport was the third largest contributor (14 per cent) of greenhouse gas emissions in Australia in 2005.

Road transport accounts for about 90 per cent of total transport emissions in 2005.

Freight transport emissions grew by 30 per cent between 1990 and 2005.

Freight transport emissions are expected to grow 27 per cent between 2010 and 2020.

2.2 Transport sector emissions in Australia

2.2.1 Breakdown of transport emissions

Figure 2 shows that road transportation is by far the largest contributor to greenhouse gas emissions within the transport sector, contributing 88 per cent of total transport sector emissions (AGO 2007a). Table 1 shows the emissions within the transport sector for 1990 and 2005, and the forecast emissions for 2020.

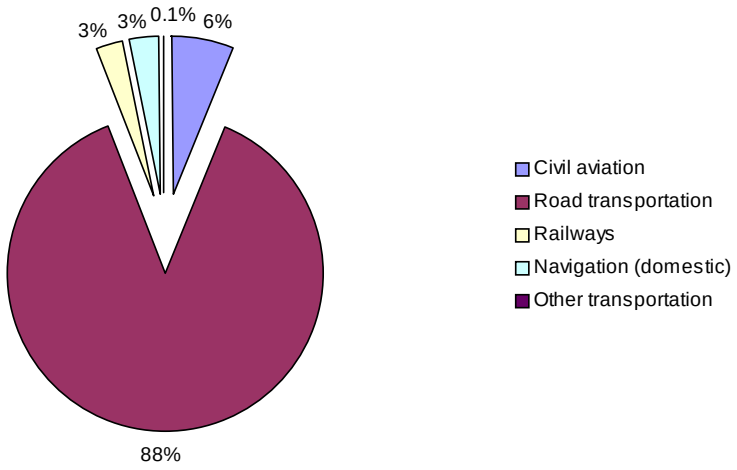

Figure 2. Source of greenhouse gas emissions within the Australian transport sector 2005

Source: AGO 2007a.

Table 1. Transport greenhouse gas emissions for 1990 and 2005, and a forecast for 2020

Transport mode	Mt in 1990 (CO_2-e) †	Contribution to total greenhouse emissions in 1990	Mt in 2005 (CO_2-e) †	Contribution to total greenhouse emissions in 2005	Projected Mt in 2020 (CO_2 - e) †	Projected contribution to total greenhouse emissions in 2020
Road Passenger vehicles	35.2	**6.4%**	44.0	**7.9%**	49.3	**7.5%**
Road Light commercial vehicles	7.5	**1.4%**	11.1	**2.0%**	17.9	**2.7%**
Road Heavy vehicles	10.2	**1.9%**	14.4	**2.6%**	19.7	**3.0%**
Road Buses and motorcycles	1.4	**0.3%**	1.5	**0.3%**	1.9	**0.3%**
Rail	1.7	**0.3%**	2.1	**0.4%**	3.3	**0.5%**
Domestic shipping	3.0	**0.5%**	2.4	**0.4%**	2.8	**0.4%**
Domestic aviation	2.9	**0.5%**	5.1	**0.9%**	8.7	**1.3%**
Total transport	62.1	**11.4%**	80.6	**14.4%**	103.7	**15.8%**
Total Greenhouse gas emissions	547.1‡		559.1‡			656.5*

Note: Values provided refer to greenhouse gas emissions from the transport sector 'with measures' (applicable to 2005 and 2020 values only). Measures refer to past, current or committed Australian, state/territory or local government policy actions that have an impact on greenhouse gas emissions, causing them to deviate from the 'business as usual' path since the base year of 1990.

The total greenhouse gas emission figure for 2020 is based upon a 'with measures' projected increase of 120 per cent of 1990 levels, as outlined in the reference report. For example, this figure reflects an increase in electricity generation from renewable sources in line with the *20 per cent Renewable Energy Target*, however does not account for the introduction of an emissions trading scheme.

Sources: † AGO (2007a), ‡ AGO (2007b), * DCC (2008).

Note that greenhouse gas emissions from international shipping and aviation are not assigned to countries consistent with the International Panel for Climate Change's framework for national reporting.

Analysis of greenhouse gas emissions from road transport reveals that the contribution of commercial vehicles to greenhouse gas emissions is disproportionate when considered in the context of national fleet composition. Table 2 shows that commercial vehicles comprise approximately 18 per cent of the fleet (ABS 2006a), yet they currently contribute approximately 38 per cent of road transport greenhouse gas emissions (AGO 2006a).

Table 2. Contribution of commercial vehicles to greenhouse gas emissions

Vehicle class	% of Australian fleet *	Greenhouse gas contribution of road transport †
Passenger vehicles	78%	60%
Commercial vehicles (light commercial vehicles and trucks)	18%	38%
Other	4%	2%

Source: * ABS 2006a, † AGO 2006a.

2.2.2 Projected future growth in greenhouse gas emissions

The greatest growth in transport emissions within the transport sub sectors between 1990 and 2005 was in domestic air travel, reaching a growth of 76 per cent between the same period with an average annual growth rate in emissions of 5.1 per cent (AGO 2007a).

Between 1990 and 2005, greenhouse gas emissions from light commercial vehicles and trucks/buses grew by 48 and 40 per cent respectively. This growth equates to average annual growth rates of 3.2 and 2.7 per cent respectively (Figure 3) (AGO 2007a).

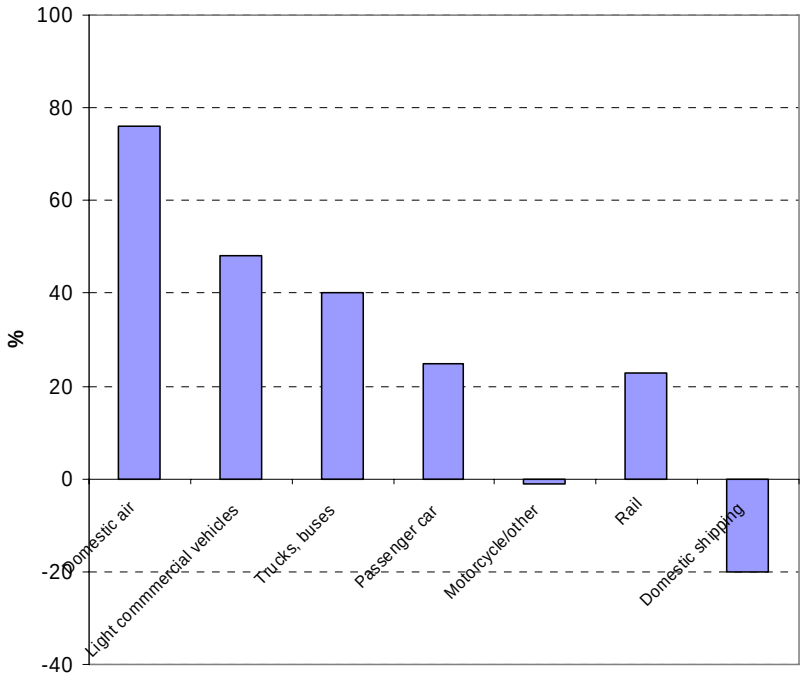

Figure 3. Growth in transport emissions by mode 1990–2005

Source: AGO 2007a.

The Australian road freight task is forecast to more than double between 2000 and 2020 (BTRE 2002). The predicted increase of 118 per cent represents an annual increase in billion tonne kilometres (btkm) of around 4 per cent. The forecast growth (2000–2020) is consistent with the average annual growth of 5 per cent per annum experienced between 1980 and 2000 (TIC/CVIAQ 2004).

This is a cause for major concern as (unlike the period between 1980 and 2000 when B-doubles were introduced) the future increase in the road freight task is not expected to be accommodated by a further doubling in vehicle payloads. Rather the increased demand is expected to result in the addition of approximately 50,000 trucks to the national fleet between 2005 and 2020, approximately 28,000 of which are predicted to be large articulated trucks (TIC/CVIAQ 2004). In Sydney alone, road freight vehicle kilometres travelled is estimated to increase by 50 per cent in the next 20 years, largely due to the forecast that Port Botany container throughput will double by 2021 (BTRE 2006a).

Forecast growth in commercial vehicle kilometres travelled is projected to grow at a much faster rate than the fleet average. Commercial vehicle travel is projected to grow by 3 per cent per annum between 2005 and 2010, and by 2.9 per cent between 2010 and 2020 (compared to the fleet average of 1.9 per cent per annum between 2005 and 2010 and by 1.7 per cent per annum between 2010 and 2020) (AGO 2006a).

Due to the growth in freight vehicle numbers and tonne kilometres traveled, the projected growth in greenhouse gas emissions from commercial vehicles between 2010 and 2020 is forecast to grow by 27 per cent, three times faster than that from passenger cars (AGO 2006a). Further analysis of Australia's emissions from freight transport is presented in appendix D.

3. KEY ISSUES FOR FREIGHT TRANSPORT'S EMISSIONS

This section discusses key issues for greenhouse gas emissions from freight transport.

3.1 Greenhouse gas emissions from freight transport is a policy 'blind spot' in Australia and internationally

In the European Union, transport has not been included in the emissions trading scheme. Therefore, a pathway for reducing freight emissions in the longer term by the European Union is needed. However, during the development of this discussion paper NTC could not find any reports detailing the pathway to reducing freight transport's emissions over time in Europe.

NTC found no comprehensive analysis of the policy response required to growing emissions in freight transport for Australia. It can be argued that, given freight transport emissions are six per cent of Australia's greenhouse gas emissions, resources are better spent in initially tackling the largest sector, stationary energy, that is ten times this size. However, given that freight transport's emissions are growing and forecast to grow in Australia and overseas, the sector will grow to be a larger proportion of overall greenhouse gas emissions over time.

Therefore, NTC concludes that greenhouse gas emissions from freight transport is a current policy 'blind spot' in Australia and internationally.

3.2 Uncertainty of greenhouse gas effectiveness of responses

In developing this discussion paper, NTC also found that there was a lack of information about the effectiveness of abatement measures in the freight sector. Where information did exist, the effectiveness of measures was usually estimated by surveys rather than being based on evaluations of the introduced abatement measures. This lack of uncertainty in the effectiveness of abatement measures for freight transport underpins the absence of any long term strategies for reducing emissions from this sector.

3.3 Freight transport is highly connected with the economy

Transport activity has grown faster than overall economic growth. Improved transport capability and efficiency levels have been a driver of economic growth, but also a facilitator of that growth. Freight forecasts have often adopted forecasts of economic growth as their base as freight growth was said to be "coupled" to economic growth (NTC 2006).

In the last decade, the economies of western industrialised countries have become increasingly dominated by service industries. This contrasts with earlier periods where agricultural, and later, industrial manufacturing dominated. Service industries are much less freight intensive than other areas of economic activity, and also generate freight which is less dense. These changes in economic activity and the resultant changes in the freight task are considered by some commentators to show "de-coupling" of freight growth from economic growth. However, data in Australia does not show this decoupling occurring (NTC 2006). The trend for 1980 to 1990 was freight demand (million tones per annum) growing 1.3 times faster than the economy. Post-1990, freight demand has grown about 1.5 times faster than the Australian economy.

The key challenge for freight transport, and indeed all sectors, is to decouple economic growth from increases in greenhouse gas emissions.

In addition, freight transport costs are also relatively low. The value of the freight goods determines mode choice. For example, in the Netherlands the average road cargo is valued at 1674 €/ton, whereas it is 924 €/tonne for rail and 86 €/tonne for inland shipping (Annema and Francke 2008). For lower values goods, the mode of choice is the lowest cost transport mode. For high value consumer goods, the freight costs as a percentage of the value of the goods means higher cost transport is a viable option, for example, plasma televisions are air freighted into Australia.

Fuel for transport is estimate to be one per cent averaged across total production and supply chain costs in Australia (NTC 2006). It was estimated that fuel prices would need to increase at least tenfold to have any real impact on manufacturing and distribution patterns, and that this is unlikely within the period to 2020. However, this was an estimate only and NTC seeks stakeholder comment on the absolute level of fuel prices that would impact on manufacturing and distribution patterns.

These low transport costs compared to production and supply chain costs also contribute to inefficient use of transport fuels resulting in more greenhouse gas emissions. For example, produce may be transported interstate to consolidate distribution, then transported back to the original state and then delivered to the store.

3.4 Lag times between introducing fleet and infrastructure improvements and reducing greenhouse gas emissions

Australia has relatively old fleets of heavy vehicles and locomotives. Therefore, it takes time for the fleet to turn over after the introduction of new vehicle or locomotive technology before the reductions in greenhouse gas emissions are reaped. For road transport, this is estimated to be at least ten years.

There are also lags between the planning of new infrastructure and the opening of that infrastructure for use. This will contribute to lags with measures designed to reduce greenhouse gas emissions.

3.5 Non-alignment of policies and regulations

Policy objectives for freight transport are often focused on managing the negative impacts. With the development of greenhouse policy, the non-alignment between existing policies or regulations with greenhouse objectives becomes apparent. These existing policies can lead to higher greenhouse gas emissions.

Examples of this non-alignment of policy objectives for freight transport includes:

- noise amenity regulations that restrict access of freight vehicles rather than restricting noise; and
- air pollution standards on vehicles that are paramount around populations to reduce health impacts, but could be relaxed to allow better fuel efficiency and lower greenhouse gas emissions in rural or remote areas away from populations.

As previously discussed, the national transport policy framework aims to move from this situation to one where we plan and operate transport networks in an integrated way.

3.6 Inefficiencies with current transport markets

The current market for transportation is inadequate to provide meaningful price signals on the cost of supply or the level of demand. As a result, transport operators are unable to make informed choices about the appropriate mode of transport or type of vehicle that they should use to minimise the cost of operations.

The road market provides the most distorted pricing signals. Although both heavy and light vehicles are required to pay registration and fuel charges, the regimes are different. The registration charges for light vehicles are determined by the state the vehicle is garaged in. The charges bear no relationship with the cost of access. In contrast, heavy vehicle charges fully reflect the cost of infrastructure provision and are uniform across all governments. Further, heavy vehicle owners receive a rebate on the amount of the fuel excise which is above the infrastructure cost.

Neither heavy nor light vehicles are subject to externality costs, such as those associated with emissions.

In addition, the current market framework for roads fails to identify or link demand signals to road investment. As a result it is difficult to identify investments in the network which maximise productivity.

The rail sector has a stronger market framework as a result of market reforms which occurred in the 1990's. However, rail operations are effectively subsidised (by not recovering adequate rates of return) and charges do not recover externality costs associated with rail operations. Like the roads sector, rail operations are split between commercial and non-commercial (public transport) operations and are subject to different regimes. As with road, these different regimes can mean that inefficient outcomes result and that rail freight may be disadvantaged.

The end result of these incomplete and partial markets is that the most efficient means of freight transportation and infrastructure investment do not occur. Operators may be effectively be "encouraged" or limited to using less productive vehicles or use longer routes than desired. The clear consequence of this market framework is the production of a greater level of emissions than is necessary to carry out the current freight demand.

COAG has outlined a reform agenda which seeks to address the market inadequacies in the road sector. Of most significance is the movement to a form of direct pricing for heavy vehicles. Matched with institutional reform and the inclusion of externalities in calculating charges, the reforms are expected to improve efficiency in the use and provision of the transport network. However, similar reforms are yet to be considered for the rail sector.

4. THE ROLE OF GOVERNMENT IN CLIMATE CHANGE POLICY

4.1 The basis for government intervention

Sir Nicholas Stern said that climate change represents the single greatest market failure in human history (Stern 2006). This presents a case for government intervention that is compelling.

The term 'market failure' comes from the theoretical economic literature. It is a short-hand way of indicating that, in some circumstances, market forces are not able to work perfectly to deliver socially optimal results, resulting in an inefficient allocation of resources, compared with the theoretical ideal. As a conceptual approach, market failure analysis provides a useful rationale for government intervention and regulation – and assists in determining the scope and form of that intervention.

Underpinning the market failure analysis is the understanding that, generally, competitive markets:

- provide the most efficient means of allocating resources to maximise the benefits to the community;
- ensure the goods and services that consumers demand are produced efficiently; and
- encourage innovation and broader consumer choice.

Thus, where market failures exist, there is a potential role for government to improve outcomes for the community, the environment, businesses and the economy. In addition, government intervention should not stifle private innovation. Ideally, therefore, interventions should be based, to the degree practicable, on pricing signals and market-based regulatory models. This may include co-regulation or self-regulation depending on the nature of the market failure concerned.

Much of Australian government policy, particularly regulatory policy, is now seen through a prism of market failure. This is a position endorsed by COAG and given effect through the process of regulatory impact statements.

4.2 Types of market failures

The main sources of market failure are:

- public goods – where it is not possible to charge for a service or good on a market basis (e.g. public parks, law enforcement);
- externalities – where a cost or benefit in an economic transaction is received by a third party (e.g. car crashes, air pollution producing health problems). The key transport externalities are discussed in detail in Appendix F;
- information asymmetry – where one party to a transaction has more or better information than another (e.g. when receiving professional advice); and
- imperfect competition – where one or more participants have more market power (e.g. monopolies or oligopolies) (Better Regulation Office 2008).

Most relevant to climate change is the failure of prices to address externalities.

It is only a relatively recent development that regulatory controls have been developed over the atmosphere, which traditionally was viewed as a public good, that is it is available and accessible to all for use on a non-excludable and non-rival basis. In part the task of framing an emissions trading scheme is an exercise in finding an acceptable formula for attributing a cost using greenhouse gas emissions as the metric.

The technological knowledge required to address climate change, too, may be viewed as a public good insofar as it is impossible to prevent others from using that knowledge without some form of government intervention. Without such intervention, many innovative ideas would not be pursued because of disincentives that, in an unregulated environment, exist. Intellectual property regulation is the principal method governments have used to respond to this market failure (e.g. copyright, patents, etc). In addition, governments have invested in research and development where the public interest to do so. Because of the pressing need to address climate change as a priority, there will be a role for government in investing in technology development at an applied level to enable accelerated development and to speed up industry take-up of new technology.

Clearly use of the atmosphere has involved externality costs impacting upon society in general, specific industries and individuals as a result of climate change – the same costs that an emissions trading scheme is designed to amortise and eliminate. Many of the costs are well known, but include oceanographic, meteorological and seasonal climatic changes causing impacts upon land use, human settlement patterns, access to resources and infrastructure demands – all of which will have substantial economic consequences. By assigning a price on carbon emissions in a "cap and trade" scheme, businesses will be compelled to internalise these external costs and, through a process of structural adjustment, reduce the emissions associated with them.

4.3 Climate change policy-making in a freight transport context

Applied to the challenge presented by climate change, it is apparent that there are multiple levels of intervention available to governments not only to reduce greenhouse gas emissions generally but also, at a more 'fine grained' level, within the freight transport sector specifically.

For example, within the framework of a national emissions trading scheme, transport agencies will have a role to target carbon emissions via 'complementary measures'. A complementary measure will address market failures – often sector specific – that exacerbate or contribute to the overall market failure. By focussing on sector specific complementary measures, transport policy makers can make a significant contribution to the national response to the greenhouse gas externality and assist in accelerating the transition to lower carbon emissions in the freight transport industry. As discussed below, this is particularly important due to the lack of significant price sensitivity in the freight transport market.

Key areas for work therefore include:

- research, development, and innovation support for low emissions technologies and emissions abatement;
- measures to help the use of low emissions technology, including infrastructure provision or access arrangements;
- measures to address information failures and encourage behaviour change; and

- measures to reduce demand for energy, such as further energy efficiency measures and motor vehicle fuel economy improvements (VDPC 2008).

While the climate change problem invites policy makers to implement new measures, much of what can be achieved in the transport arena lies in recognising how other policy initiatives can be utilised to optimise emissions reductions in freight transport. Measures to combat urban congestion, for example, can obviously be leveraged for an emissions benefit. Similarly, productivity-enhancing reforms (such as opening a national B-triple network) may also significantly contribute to reductions in carbon emissions.

Finally, it is also important to take advantage of the overlap between transport policy and other areas of government activity. Infrastructure planning and land use management are two obvious correlatives of transport that will have a significant role to play in combating climate change, and must be integrated with actions in transport to maximise their effectiveness. These important overlaps are evident in the discussion of potential complementary measures below.

Key points

Generally, government interventions should be focussed on addressing market failures.

All types of market failure are evident in the climate change problem, suggesting the need for a national emissions trading scheme to be complemented by sector specific interventions at all levels of government.

Any complementary measures implemented in the freight transport sector should leverage off existing reform priorities and take account of overlapping portfolio areas to maximise their effectiveness. Complementary measures should access the full range of intervention tools available to government.

5. THE IMPACT OF AN EMISSIONS TRADING SCHEME ON FREIGHT TRANSPORT

Emissions trading schemes are a form of economic regulation designed to address the greenhouse gas externality. These schemes place a cost on producing greenhouse gas emissions as there is currently no cost placed on the damage produced by these emissions. With the additional cost for the environmental damage caused, emitters can chose the most cost effective way to reduce their emissions by either directly reducing emissions or by purchasing emissions permits.

Although the discussion to date in Australia has been about the emissions trading scheme and maximum coverage across the Australian economy, there are a number of possible scenarios for the transport sector and pricing greenhouse gas emission. Three of these scenarios are:

- the transport sector is included in the emissions trading scheme. This is similar to the approach New Zealand is implementing.
- the transport sector is not included in an emissions trading scheme in Australia and carbon emissions from this sector are not priced. This is similar to the current European situation.
- the transport sector is not included in an emissions trading scheme but a fixed price carbon tax is applied.

The role for government is different in each of these three scenarios. With the emissions trading scheme, the role of government is to create an efficient marketplace for reducing greenhouse gas emissions at least cost for sectors included in the scheme (although other market failures will still exist and a role for government intervention will still exist). Where there is no carbon price for transport emissions, the role of government is to intervene with direct measures to reduce greenhouse gas emissions from transport starting with the measures with the lower abatement costs. The role for governments where there is a fixed carbon price for transport emissions is somewhere in-between the two scenarios discussed above.

A carbon price in the stationary energy sector is expected to make major changes about supply decisions for energy infrastructure. For example, alternative energy sources with lower greenhouse gas emissions will become more commercially viable in a carbon constrained economy. In additional, energy efficient measures on the demand side from a carbon price will also provide abatement opportunities to move to a low carbon environment. However, analysis shows that a carbon price will not make significant short or medium term reductions in greenhouse gas emissions from transport, especially for freight transport. The impact of a carbon price in the transport sector is analysed using elasticity of transport demand data. For passenger travel, historically there has been a high inelasticity of demand (BTRE 2002), that is, passenger transport demand is not very sensitive to price changes. Recent reports about behaviour changes from the sharp increase in global oil prices reflect that if prices increase enough over a short period of time, then people become responsive to those dramatic price increases. These examples include motorists changing their driving behaviours to reduce fuel consumption (AAP 2008), motorists not driving as much or finding alternatives ways to travel (The Age 2008), and higher public transport patronage in Australian cities. However, it is still inelastic if people are not reducing their consumption by a proportionate amount of the price increase (i.e. if prices go up a third, but consumption reduces by less than a third, then it is still inelastic).

There is even less available data about price sensitive for freight transport compared to passenger transport. However, analysis by the Australian Productivity Commission (APC 2006) reveals that freight movement does not appear to be sensitive to price. While there are transport substitutes for individual car travel (e.g. public transport, carpooling, bicycle, walking), for passenger transport, these transport mode substitutes are not readily available for freight transport. Fuel constitutes around 22 to 30 per cent of operating costs for heavy vehicle operators. However, whilst it is a significant cost factor for operators, it is generally only a small percentage of the final cost of the product. Therefore, increases in road transport costs may not necessarily lead to a reduction in demand by customers. Furthermore, alternative modes of transport (such as rail) which may produce less emissions on a tonne kilometre basis may not be considered due to limited routes and service quality.

Specific modeling undertaken to assess the transport's likely response to the Australian emissions trading scheme (Graham, McKenzie, Brewster et al 2008) concluded that: *"due to the low impact of CO_2-e permit pricing on fuel costs and the moderate share of fuel costs in total transport costs, the Australian transport sector is not likely to be very sensitive to CO_2-e permit prices."*

Therefore, the carbon price in the short to medium term is not expected to reduce greenhouse gas emissions in the transport sector.

Industry submissions (AIGN 2008, ATA 2008 and ARA 2008) to the Garnaut review have argued that the design of the emissions trading scheme should include the large commercial users of transport fuel to opt into the scheme, that is, have direct liability for permits. Such an approach would allow transport and logistics companies to invest in greenhouse gas positive measures as a means of reducing their greenhouse gas footprint and either banking their allocated permits for future use or trading these permits. As the price of the emission permits increased, so too would the economic incentive for investment in greenhouse positive innovations within the freight transport sector.

Whatever the final design of the Australian emissions trading scheme, overall Australia's greenhouse gas emissions will still reduced under a scheme because fewer permits are allocate over time. Even if greenhouse gas emissions from the stationary energy (50 per cent of Australia's emissions) could be hypothetically reduced to zero by 2050, further cuts in emissions from other sectors are required to meet the national reduction target of 60 per cent.

The emissions trading scheme will raise funds via permit sales. Funding of measures and research and development to help transition transport to a lower carbon future is also an issue. A possible model is to use some of the funds raised via the emissions trading scheme to fund the transition of transport, including freight transport, to a lower carbon future.

Key points

The Australian emissions trading scheme is the main economic policy instrument to reduce emissions across the Australian economy.

The emissions trading scheme is unlikely to be effective on its own for reducing transport emissions.

6. COMPLEMENTARY MEASURES

As discussed in the previous section, the inclusion of transport in a national emissions trading scheme seeks to reduce greenhouse emissions by putting a price on greenhouse emissions. This action is primarily designed to reduce emissions from the Australian transport sector by:

- removing the artificial price advantage currently enjoyed by carbon intensive transport modes owing to the failure to price the greenhouse externality, thereby increasing the price attractiveness of transport modes with lower carbon intensity characteristics; and

- creating an economic incentive for investment in lower carbon innovations in the transport sector by lowering the gap between the prevailing market price of carbon intensive transport technologies (passenger and freight) and the point at which new low carbon transport technologies can be substituted on economic grounds.

For reasons discussed earlier in this paper, the key challenge associated with the application of an economic approach to the reduction of greenhouse emissions from the Australian transport sector lies in the price inelasticity in transport demand.

The high level of observed price inelasticity appears to be driven by two factors. First, the price of transport is a subservient consideration in the selection of a particular transport mode by transport consumers (i.e. passenger and freight). Factors such as journey time, safety and security, flexibility and convenience all appear to more significant considerations than transport price (Rare Consulting 2007).

Second, there are a number of barriers preventing the development and introduction of low carbon innovations in the Australian transport sector. These barriers (or market failures) can be categorised as follows:

- **HIGH START-UP COSTS:** Despite offering significant potential for the delivery of significant reductions in transport sector emissions, some technological innovations involve a significant investment at start-up before they become economic. These investments cannot be justified on commercial grounds and effectively constitute a barrier to market entry. The high capital cost associated with the development of greenhouse positive natural gas engine technologies for heavy vehicles (and establishment of associated refuelling infrastructure) provides an example of this barrier in action.

- **INVESTMENT UNCERTAINTY:** Some technological innovations require substantial investment over a long period of time (e.g. 15 to 20 years), in the face of considerable uncertainty about both the future characteristics of the Australian transport market and the likely legislative and regulatory actions of government. Proponents of gas-to-liquid and coal-to-liquid technologies cite this barrier, together with technological constraints, as a major reason for the delayed entry of this technology for transport in Australia. Similarly, large transport companies suggest that they are delaying investment in supply chain and vehicle improvements owing to uncertainty about future government directions on greenhouse gas legislation and regulation.

- **INFRASTRUCTURE LIMITATIONS:** A major barrier to switching the transport task (passenger and freight) from carbon intensive modes to transport modes with lower carbon intensity – or realisation of reductions via greater use of multi mode movement of freight – is the lack of spare capacity in existing transport infrastructure in Australia.

Examples of these infrastructure limitations include the increasing level of urban congestion being experienced in Australia's capital cities, the bottlenecks experienced at our major sea ports, and congestion on urban rail networks from passenger transport impacting on freight movements.

- **PERFORMANCE UNCERTAINTY (ECONOMIC AND ENVIRONMENTAL):** Uncertainty about the environmental and economic performance of alternative vehicle technologies creates a major challenge for policy makers in promoting "cleaner" vehicle and fuel technologies. Global debate about the total environmental value of biofuels (OECD 2007) and the variable performance of natural gas in heavy vehicles observed under the Australian Government's alternative fuels conversion programme provide practical examples of this barrier and the need for a better mechanism for the rigorous evaluation of new engine and fuel technologies for the transport sector.

- **INFORMATION FAILURES:** Low market awareness about the genuine opportunities for reducing greenhouse gas emissions constitutes a significant barrier to the take-up of cleaner engine and fuel technologies. An example of this failure is the absence of reliable information about the comparative greenhouse performance of engine technologies in new heavy vehicles.

- **NON-ALIGNMENT OF POLICIES AND REGULATIONS:** As discussed in section 3.5, non-alignment of policies and regulations can lead to higher greenhouse gas emissions.

Given the above, there appears to be a role for government to advance a suite of measures that complement the operation of an emissions trading scheme for transport. However, what should these measures be? The next section explores a number of current and potential complementary measures.

Key point

There appears to be a role for government in advancing specific actions that support the introduction of measures that will complement the operation of the emissions trading scheme for transport.

Question
Are there additional market failures constraining the introduction of low carbon technologies and practices in the Australian transport sector? If so, what are they?

6.1. Potential complementary measures

An analysis of the potential complementary measures that could be deployed is presented in Table 3 but the list is not exhaustive. The analysis in Table 3 includes an examination of the key barriers to implementation and the potential role of government in assisting the freight transport sector in overcoming these barriers to realise greenhouse gas emissions reductions.

These abatement measures can be classified into three general groupings:

- measures that have been undertaken in Australia or overseas and there is information available. Some of these measures are currently being developed or are known to produce productivity benefits;
- measures where there has been some initial work, such as a report or desktop evaluation; and
- new measures with little or no information.

There are also limitations to this analysis. In the column "relative greenhouse gas reduction potential", the available data from the literature on the amount of greenhouse gases reduced is limited. In addition, the greenhouse potential of the measure is dependent on the uptake of the measure (e.g. the penetration of low carbon vehicle technology) and the timeframe for the realisation of the measure. Available data on the cost-effectiveness of the measures is also limited (International Transport Forum 2008). Therefore, Table 3 should be interpreted with some caution for the columns "relative greenhouse gas reduction potential" and "likely cost-effectiveness".

The literature provides a relative abundance of abatement measures of passenger transport and other sectors, but there are fewer abatement measures for freight transport that have been well documented. For example, a McKinsey report (2007) includes only four freight-specific measures out of thirty-six abatement measures listed.

Table 3. Analysis of potential complementary measures for the freight transport sector

Potential Countermeasure	Mechanism for greenhouse gas reduction	Relative greenhouse gas reduction potential	Likely cost-effectiveness	Implementation barriers (or market failures)	Timeframe to realise greenhouse gas benefit	Potential role for government
1. Improve urban road infrastructure	An articulated heavy vehicle will typically generate 45 times more greenhouse emissions per year than a six cylinder family sedan. It therefore follows that congestion delays suffered by an articulated heavy vehicle will produce more greenhouse emissions than a family sedan. Significant reductions in urban traffic congestion are therefore likely to reduce greenhouse emissions from road freight.	High	Medium	High start-up costs Infrastructure limitations Investment uncertainty (private sector investment) Institutional barriers	Long term	It is generally recognised that, in the face of continued growth in annual vehicle travel, the Australian economy cannot afford to build the additional road capacity necessary to significantly reduce urban traffic congestion. There are, however, strategic opportunities to deliver urban road infrastructure improvements that allow more effective movement of road freight. Governments can play an active role in accelerating the delivery of these road improvements by either direct funding or increasing the attractiveness of private sector investment in urban road infrastructure. There are three types of measures: 1. discrete infrastructure that is constraining productivity (e.g. single bridge); 2. corridor strategies; and 3. major infrastructure.
2. Improve urban rail infrastructure	Improvements in urban rail freight infrastructure would increase productivity. If rail can provide the service quality of road transport, this will reduce greenhouse gas emissions from urban freight in Australia.	Medium	Medium	Infrastructure limitations High start-up costs Investment uncertainty (private sector investment) Institutional barriers	Long term	NTC is currently undertaking a review of rail productivity. This work will inform the role of governments for productivity measures for freight transport by rail.
3. Encourage increases in multi-modal freight movement in Australia's capital cities	The characteristics of non-bulk freight suggest that there is limited opportunity for transfer of this freight from road to other modes such as rail. However, improvements in the interfaces of the road-rail modes would provide the opportunity for the lower carbon intensity of freight movement by rail.	High	Medium	Infrastructure limitations High start-up costs Investment uncertainty (private sector investment) Institutional barriers	Medium term	Multi-modal freight movement is currently constrained by the lack of supporting infrastructure such as urban multi-modal freight hubs. Governments could accelerate the delivery of these facilities in Australia's major cities.

Potential Countermeasure	Mechanism for greenhouse gas reduction	Relative greenhouse gas reduction potential	Likely cost-effectiveness	Implementation barriers (or market failures)	Timeframe to realise greenhouse gas benefit	Potential role for government
4. Encourage the purchase of low emission vehicles in the road freight sector	The purchase of vehicles that encourage the adoption of cleaner commercial vehicles.	Low to medium	High	Performance uncertainty Information failures	Medium term	The development of a rigorous methodology and rating system for the greenhouse performance of commercial road vehicles sold in Australia could be undertaken by governments. Such a guide could be developed along the same lines as the Australian Government's Green Vehicles Guide for passenger cars sold in Australia. This work is being developed by the COAG working group on motor vehicle fuel efficiency.
5. Introduce cleaner vehicle fuels and vehicle technologies for road freight	Adoption of road transport fuels (e.g. natural gas and, some biofuels and GTL) and vehicle technologies (Hybrid engine technologies for some applications) could be used to lower the emissions produced per tonne kilometre travelled – relative to the diesel fuel baseline.	Medium to High	Medium	Performance uncertainty Investment uncertainty High start-up costs Information failures	Medium term	There is an opportunity for government to work in partnership with industry to develop, evaluate and trial potential cleaner technologies in partnership with industry. The model could be managed along similar lines to that adopted for the demonstration projects conducted under the Federal Alternative Fuels Conversion Programme.
6. Eco-driving to save fuel	Industry adoption of eco-driving a standard practice will reduce fuel consumption.	Low to medium	High	Information failures	Short term	Government could assist industry in developing information and promoting eco-driving.
7. Accelerate the replacement of older heavy duty road vehicles	Older trucks (more than 15 years old) are significantly less fuel efficient than late model trucks when considered on the basis of tonnes consigned. Given the significant number of these vehicles in the Australian vehicle fleet, the replacement of these vehicles is likely to result in a reduction in the average fuel consumption of heavy duty trucks (and GHG emissions)	Medium	High	High start-up costs Institutional barriers	Short term	This measure has been undertaken overseas to reduce air quality. The scrapping of older vehicles inevitably gives rise to equity concerns. Governments could potentially trial measures that progressively seek to encourage the replacement of older vehicles, supported by incentives for the replacement of older heavy duty vehicles.

Potential Countermeasure	Mechanism for greenhouse gas reduction	Relative greenhouse gas reduction potential	Likely cost-effectiveness	Implementation barriers (or market failures)	Timeframe to realise greenhouse gas benefit	Potential role for government
8. Urban congestion pricing for road transport in Australia's capital cities	The imposition of a high price for road travel during peak periods has the potential to reduce congestion by relocating road travel demand to non-peak periods. The magnitude of the emissions benefit is subject to a degree of uncertainty according to the quantum of spare road capacity available during non peak periods (or the spill over effect created around road pricing cordons).	Medium	Low (direct) to medium (indirect)	High start-up costs Performance uncertainty Institutional barriers	Medium term	Governments could trial congestion pricing on a cordon basis and consider a progressive introduction of area-wide pricing schemes. Funds derived from these schemes could be used to create a new revenue stream for road infrastructure and/or public transport infrastructure improvements. The congestion working group under the National Transport Policy Framework is undertaking work in this area.
9. Improved maintenance practices for commercial road vehicles	Programmes (Government and Corporate) promoting improved vehicle maintenance programmes are typically targeted at the reduction of vehicle-related air pollution. These programmes also offer some potential to deliver reduced average fuel consumption rates by ensuring that vehicles are tuned for optimal operating performance.	Low	Medium	Performance uncertainty Information failures	Short term	While the vast majority of these schemes have been solely targeted at regulated emissions, the older age characteristics of the Australian fleet suggest that these programmes may deliver some greenhouse benefits when used in conjunction with alternative fuels (refer to the Port of Los Angeles Port truck replacement programme).
10. Performance based standards for innovation in road vehicle designs	The performance-based standards approach will allow industry additional opportunities to innovate, resulting in improved productivity for a given freight task, safer performance and the least possible effects on roads and bridges. It focuses on how well the vehicle behaves on the road, rather than how big and heavy (length and mass) it is, through a set of safety and infrastructure protection standards.	Medium	Medium	Performance uncertainty Information failures Institutional barriers	Short term	Road freight has been traditionally regulated by tightly defined vehicle mass and dimension rules (i.e. 19 metre overall length for general access). But prescriptive vehicle regulations are widely recognised as being close to their limits because of infrastructure protection and road safety concerns. Performance-based standards offers an alternative approach to government regulation. While prescriptive regulations govern what a vehicle should look like, performance-based standards will determine what the vehicle can do, subject to meeting predetermined safety and environmental conditions. It ensures regulation keeps pace with emerging technologies by delivering flexibility in how outcomes are achieved.

Potential Countermeasure	Mechanism for greenhouse gas reduction	Relative greenhouse gas reduction potential	Likely cost-effectiveness	Implementation barriers (or market failures)	Timeframe to realise greenhouse gas benefit	Potential role for government
11. Incremental pricing	There appears to be an opportunity to improve road freight efficiency by allowing increases in axle loadings for existing truck-trailer combinations.	Medium	High	Infrastructure limitations Institutional barriers	Short term	The Northern Territory government and NTC are currently undertaking incremental pricing trials. If these trials are successful, operators can increase loads and pay for the extra road consumption.
12. Introduce a lower speed limit for road vehicles	The optimum fuel consumption for most vehicles is in the range between 35kph and 80kph. Below 35kph and above 80kph, vehicles consume more fuel per kilometre travelled – at an exponential rate. Reductions in traffic congestion can lift average speeds to the optimum range, but reduced speed limits could also be applied to reduce average fuel consumption of vehicles on the open highway.	Low	Low	Performance uncertainty Institutional barriers	Short term	This measure also has safety benefits. Governments could investigate the opportunity to realise reductions in greenhouse gas emissions from road vehicles. An example of this measure is that the American Trucking Association wants lower highway speed limits to reduce emissions and to increase road safety.
13. Introduce higher productivity vehicles	Increasing the load carried or volume capacity per prime mover provides an opportunity to increase the efficiency of road freight in Australia.	Medium	Medium	Infrastructure limitations Institutional barriers	Short to medium term	As governments control access, this work requires national agreement on these higher productivity vehicles. Current examples of this work include the use of B-triples, super B-doubles and double road trains.
14. Encourage increased night time movement of road freight in urban areas.	By encouraging movement of road freight outside of congested periods, road freight experiences less delays resulting in improvements in average fuel consumption (and reduced greenhouse gas emissions). Care needs to be taken to mitigate against the impacts of increased night-time noise and this might be achieved by restricting these operations only to vehicles that comply with the latest drive-by noise standards.	Medium	High	Performance uncertainty Institutional barriers	Short term	Government could conduct pilots of increased night time operation of urban freight with a view to assessing the impact on night-time amenity, productivity and greenhouse effectiveness of this measure.

Potential Countermeasure	Mechanism for greenhouse gas reduction	Relative greenhouse gas reduction potential	Likely cost-effectiveness	Implementation barriers (or market failures)	Timeframe to realise greenhouse gas benefit	Potential role for government
15. Encourage improved supply chain practices for freight	The historical marginal cost of fuel in the supply chain has resulted in the centralisation of distribution centres in many parts of Australia which has served to increase total freight kilometres (and associated greenhouse gas emissions).	Medium	Medium	Performance uncertainty Investment certainty Information failures Institutional barriers	Short term	NTC is currently undertaking four pilot studies of national supply chain as part of the National Transport Policy Framework. These supply chains are livestock, oil and gas, grain, coal and intermodal supply chains. In addition, companies can also improve the operations of their existing freight transport business. These include such measures as integrating greenhouse gas and other environmental measures into their business systems, for example, eco-driving, reduced empty loads, reduced speeds and reduced idling.
16. National ports and terminals strategy	Setting out a long term plan for the location and growth of ports and transport terminals, and their links to major arterial roads and the standard gauge rail network is needed. This will improve supply chain efficiencies and reduce bottlenecks leading to reduced greenhouse gas emissions.	Medium	Medium	Institutional barriers Infrastructure limitations	Long term	A transparent commitment to long-term forward planning by governments should be supported by regulation to prevent the attrition of transport corridors due to urban encroachment or alternative land use. Protected corridors are essential to ensure the urban amenity problem is not relocated elsewhere. This proposal was included in the National Transport Policy Framework.

Question

Do you have feedback about the measures listed in Table 3?

Are there any other complementary measures for freight transport not listed in Table 3?

6.5 Uncomplementary measures

For the purposes of this paper, uncomplementary measures are measures that effectively lower the cost of carbon intensive travel (freight and passenger) relative to lower carbon intensive travel, or measures that reduce the economic incentive for investment in cleaner vehicle and fuel technologies.

While introduced for sound economic or social reasons, these measures serve to encourage additional travel and therefore generate increased greenhouse emissions from the Australian transport sector. There may be other policy objectives the measure may seek to address.

Examples of uncomplementary measures include the current structure of vehicle-related fringe benefit tax concession which effectively increases the tax benefit for motor vehicle owners, and industry and trade policy.

An example of a recently removed uncomplementary measure is the Australian Transport Council's decision in February 2008 to remove the cross subsidy for B-doubles and road trains and make vehicle classes pay for their full road infrastructure costs.

Therefore, in addition to developing and implementing measures that complement the operation of an emissions trading scheme for transport, the Australian and state and territory governments should remove those measures that are not complementary to the operation of the emissions trading scheme.

7. PROPOSED ACTIONS

This section outlines the proposed actions needed to address greenhouse gas emissions from freight transport. Section 7.1 outlines the actions underway to develop Australia's framework for reducing greenhouse gas emissions. This work is currently being pursued by the Australian Government and the states and territories.

NTC proposed actions for freight transport to reduce emissions in Section 7.2. Although this is a discussion paper, NTC puts these proposed actions forward to stimulate debate and comment. Section 7.3 discusses some issues for reducing emissions from freight transport that NTC is seeking stakeholder comment on.

7.1 Setting up Australia's framework for reducing greenhouse gas emissions

Establishing a broader strategy for reducing Australia's greenhouse gas emissions is the first step in developing a framework for longer term emissions reductions. This involves the following five areas:

Introducing the emissions trading scheme including coverage of the transport sector

NTC argues that transport should be included in an emissions trading scheme to provide the broadest coverage of Australian emissions. It is a necessary step to place a price on carbon emissions for the damage it causes the environment.

Removing uncomplementary measures

The current uncomplementary measures - subsidies and distortions - that are inconsistent with the objectives of the emissions trading scheme need to be removed as a priority. This will enable the emissions trading scheme to deliver the lowest cost abatement of greenhouse gas emissions over time.

Coordination of complementary measures across governments across sectors

The coordination of complementary measures across the sectors within the Australian economy is important. Governments will have a key role in coordinating measures, but there will be overlapping areas across and within the three tiers of government that need to be resolved.

Funding for complementary measures, and research and development

The funding mechanism to reduce greenhouse gas emissions needs to be determined. NTC argues that the design and implementation of the emissions trading scheme needs to take into account the need for funding research and development and complementary measures in the transport sector, including measures for freight transport.

Prepare adaptation strategies for transport

There is the need to prepare for the impacts of climate change. These impacts will affect transport infrastructure in a number of ways. These include the impacts of transport infrastructure from storm surges, and greater wear and tear of road and rail infrastructure due to climatic changes. Therefore an active strategy of preparing adaptation strategies for transport infrastructure is needed.

These five areas of work are currently being developed by the Australian Government and the states and territories.

7.2 Prepare specific response for greenhouse gas emissions from freight transport

While a broader strategy for greenhouse gas emissions is being developed, it is timely to start preparing the response required by the freight transport sector. Therefore, NTC proposes the following actions for comment:

- the Australian Transport Council be responsible for coordinating reductions in greenhouse gas emissions within the freight transport sector;
- implement complementary measures now that are known to work, and further research into ways to reduce freight transport's emissions over the longer term;
- implement institutional reform to create more efficient markets across all transport modes;
- business leadership in moving to low carbon supply chains;
- develop metrics for freight transport to better manage emissions; and
- governments provide research and development support to overcome barriers for introduction of low greenhouse gas emission technology.

These actions are discussed in more detail below.

7.2.1 Responsibility for coordination of freight transport specific measures

The Australian Transport Council consists of all transport ministers covering all transport modes: road, rail, shipping and aviation. As a vital part of the Australian economy, the Australian Transport Council manages freight transport issues of national importance. Therefore, responsibility for coordination of complementary measures for freight transport will be a key function of the ATC.

The National Transport Policy Framework being developed by ATC provides the means to not only address greenhouse gas emissions from freight transport and supply chains but also other key transport objectives such as economic, safety, and social outcomes.

As part of the national transport policy framework (see section 1.2), the ATC is developing a climate change, environment and energy work plan. The development and coordination of freight specific measures can be included as part of this work plan. In addition, there are many current actions under the national transport policy framework that can contribute to reducing greenhouse gas emissions, for example, productivity measures.

Another action for ATC is to monitor the impact of the proposed emissions trading scheme on freight transport emissions.

7.2.2 Implementing complementary measures now, and further research into ways to reduce freight transport's emissions over the longer term

There are a range of complementary measures that can now be undertaken to reduce greenhouse gas emissions from freight transport. These include available measures by business to reduce fuel consumption and greenhouse gas emissions.

With governments playing a large role in transport markets, for example, with the supply of road infrastructure and access conditions, there are government related actions that can complement an emissions trading scheme. NTC proposes that these measures be predominantly focused on infrastructure and productivity measures that can reduce the cost of transport and lower the cost of greenhouse gas abatement over time.

With measures that reduce the cost of transport, there is the "rebound effect" that lowering the cost of transport will result in increased travel and therefore increased greenhouse gas emissions. Estimates of this "rebound effect" vary widely from a 10 to 50 per cent offset in fuel savings, with the mid-range being around 20 per cent (BTRE 2002). However, these measures with the "rebound effect" included will still produce lower greenhouse gas emissions.

The productivity reforms already underway include:

- mass reforms including the incremental mass reform and B-triples;
- performance-based standards;
- rail productivity review;
- supply chain audits to facilitate improved supply chain and logistic practices; and
- congestion work under the national transport policy framework.

The infrastructure reforms already underway include:

- the Australian Government has established Infrastructure Australia to work on developing long term solutions for infrastructure bottlenecks and investment in the nation's transport, water, energy and communication assets. In its first 12 months, Infrastructure Australia will conduct audits of nationally significant infrastructure and develop an Infrastructure Priority List to guide public and private investment.
- the Australian Government has established the Building Australia Fund. The Building Australia Fund will fund investment in economic infrastructure in transport and communications (e.g. road, rail, port facilities and broadband).
- capital works programs by state and territory governments on transport infrastructure.

In addition to measures that can be introduced now, it is important to develop further research into ways to reduce freight emissions over the longer term. NTC proposes that work be undertaken to explore possible pathways for large cuts in emissions by the freight transport sector by 2050. This work will be developed with governments, industry and other interested stakeholders. This work will inform additional actions that can be undertaken to reduce emissions from freight transport.

7.2.3 Institutional reform to create more efficient markets across all transport modes

Australia needs a more holistic approach to creating more efficient markets across all transport modes. With more efficient transport markets in place, the freight transport sector will have better price signals that will help them choose the mode of transport needed for the task. In addition, this will produce reduced greenhouse gas emissions. There are currently many constraints to creating efficient markets for transport, and institutional reform is needed to overcome these barriers.

7.2.4 Business leadership in moving to low carbon supply chains

Future supply chains will have low carbon emissions. Business leadership is needed to redesign current supply chains to lower carbon supply chains, and some Australian companies are already exploring ways to reduce carbon emissions in their supply chains.

An example of this business leadership from overseas is Global Commerce Initiative's 2016 Future Supply Chain (GCI 2008). This initiative involved business leaders from Europe and the US developing a vision of supply chains in 2016. This future supply chain was underpinned by a new model for enhanced supply chain collaboration with steps for businesses to move to implementing these new supply chains. Indicative savings from these new supply chains are a 40 per cent reduction in transport costs per pallet, and a 25 per cent reduction in greenhouse gas emissions per pallet, as well as savings in handling costs, lead time and freight transport movement.

Australian business needs to show leadership in moving to lower carbon supply chains.

7.2.5 Develop metrics for greenhouse gas emissions from the freight transport sector

Metrics are important to monitor progress. The freight transport emissions are reported as part of the transport sector at the national and international level. However, more specific freight transport metrics are needed at the national and international level to better monitor whether freight transport modes have emissions that are increasing or decreasing on an efficiency level as well as an absolute level.

There is also a need for company level metrics to help monitor company performance. The Australian Government's national greenhouse and energy reporting system is mandatory for large users of energy, including companies that have transport logistics. Companies not captured under this program could also benefit by measuring their emissions and taking steps to reduce them.

7.2.6 Research and development support by governments for the introduction of low greenhouse gas emission technology

Uncertainty about the real-world environmental and economic performance of fuels and technologies appears to be creating a substantial barrier to investment in the development and take-up of alternative fuels within all freight modes. Although Australia is generally a technology taker for freight vehicles across all modes, there is still a role for Australian governments. There have been government programs for research and development for moving to lower carbon technologies, for example, the alternative fuels conversion program resulting in the more widespread uptake of heavy vehicles fuelled by natural gas.

These research and development programs are needed to make the transition to lower carbon freight transport. The funding mechanism and process for funding decisions that are based on clear objectives needs to be developed.

Questions

NTC seeks comments on these proposed actions and measures. What are your comments on the proposed actions outlined above?

Are there any other actions that should be included?

7.3 Discussion on some of the issues around the proposed actions for freight transport

As discussed above, the actions listed in section 7.2 have been included to stimulate debate and feedback about the response needed for freight transport. In this section, NTC discusses some of the issues that are likely to be raised during the consultation period, and puts forward its views. Again, NTC wants to have a robust debate about these issues during the consultation period.

Will an emissions trading scheme address Australia's greenhouse gas emissions over the longer term without any additional government intervention for freight transport?

An emissions trading scheme will put a cost on greenhouse gas emissions, and reducing the available emissions permits over time will reduce Australia's carbon emissions. However, even with a well designed emissions trading scheme, there will still be other market failures. Additional government intervention may be needed to correct these market failures. These complementary measures support the emissions trading scheme by reducing the cost of abatement over time.

Many of the proposed actions in section 7.2 focus on productivity measures. These measures lower the cost of freight transport as well as reducing greenhouse gas emissions.

Why are the proposed actions mainly focused on road freight transport?

The proposed actions in section 7.2 are mainly focused on transport from road freight because greenhouse gas emissions from this mode make up 89% of freight transport emissions (see section 2.3.3). Therefore, a five per cent cut in emissions from road freight transport will have more of an impact on overall freight transport emissions than a similar five per cent cut in emissions from rail or shipping.

Are modal shift policies needed to move freight transport from road with higher emissions to rail or shipping with lower emissions?

NTC has previously argued that modal shift policies distort transport markets (NTC 2006b). NTC contends the focus should be creating efficient transport modes. By doing this, and working to create efficient interfaces between the modes, the rail and shipping sectors will be able to better compete with road transport.

A report (Annema and Francke 2008) with analysis on modal shift policies from the Netherlands supports NTC arguments. The following is an extract from the report:

> *"In the Netherlands 'modal shift' was seen in the 1990s as a promising way to make freight transport more environmentally friendly. This picture has now*

> *changed, the main reason being the increasing awareness of the fact that the markets for the different freight modes overlap less than most people seem to think. For example, different modes carry different kinds of goods. An average road cargo is valued at 1674 €/ton, whereas this is 924 €/tonne for rail and 86 €/tonne for inland shipping. The prices reflect the difference in bulk ('cheap') versus more processed and manufactured materials and goods ('more expensive'). The distance of the goods transported also determines modal choice. An average ton of goods carried by road travels about 110 km, a distance over which rail or inland waterways prove less efficient, because road transport is needed to and from the loading point. So modal shift may be an option, but only for specific market segments."*

In Australia, rail is the dominant freight mode for the eastern states-Perth corridors as it is an efficient mode over long distances. No modal shift policies were required along this corridor as the relative advantage of rail to move goods over longer distances at a lower cost comes into play. However, over shorter intercapital freight movements, rail has a low market share compared to road transport. In these cases, although rail may have a slight cost advantage to road, it is unable to match service quality. As a result, road is able to effectively compete along these shorter routes. Through the creation of more efficient transport markets and the introduction of an emissions trading scheme, the threshold for the distance where rail is more competitive in price than road is likely to increase and help rail increase market share of freight.

What about the impact on industry from these proposed actions?

There will be an impact on industry in moving to a carbon constrained economy. This impact will result in operational changes, and the use of different equipment and technologies. In developing specific measures, governments undertake a cost-benefit analysis that includes stakeholder consultation. This analysis includes the impact on industry.

This discussion paper also points out that governments have a role in assisting structural adjustments for industries. NTC seeks stakeholder views on the ways governments can provide assistance to industry in transitioning to a low carbon economy.

Questions

NTC is seeking stakeholder comment on section 7.3. What are your comments on the issues raised in this section? If you have a different view, can you describe your arguments with any relevant supporting data?

8. CONSULTATION

This discussion paper is open for public comment until Friday 29 August 2008. NTC will consider these submissions in developing the proposal for the Australian Transport Council's approval by July 2009.

In May 2008, NTC invited leaders from industry and the environment sectors together to discuss freight transport and climate change. These participants are listed in the foreword. Some key messages from this forum were:

- all stakeholders agreed that a plan for reducing freight transport emissions is needed;
- because about 90 per cent of freight transport emissions comes from road transport, large cuts from road transport are needed to reduce overall freight transport emissions;
- rail and shipping are lower emissions modes for freight transport compared to road and can provide reduced emissions if these modes are able to compete more effectively with road transport;
- there are ways available now to reduce greenhouse gas emissions from freight transport and these are often at a low cost;
- Further research about measures and pathways to cut freight transport emissions over the longer term is needed;
- Government, industry and the environment sector must work together to find solutions for large cuts in emissions from freight transport; and
- companies are already introducing ways to reduce greenhouse gas emissions from freight transport, but governments can provide support to accelerate the uptake of these new technologies and practices.

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APPENDIX A: GREENHOUSE GAS REDUCTION TARGETS BY STATE

State	Short-term target	Long-term target	Reference
New South Wales	Return to year 2000 greenhouse gas levels by 2025	Reduce greenhouse gas emissions by 60 per cent by 2050, relative to year 2000 emissions	DECC 2008
Victoria	Not defined	Reduce greenhouse gas emissions by 60 per cent by 2050, relative to year 2000 emissions	DPC 2008
Tasmania	Reduce emissions to 7.4 Mt CO_2-eq by 2020 which is a 25 per cent reduction from greenhouse gas levels in 2000	Not defined	TTPB 2007
South Australia	Not defined	Reduce greenhouse gas emissions by 60 per cent by 2050, relative to year 1990 emissions	SA Gov. 2008
Western Australia	Not defined	Reduce greenhouse gas emissions by 60 per cent by 2050, relative to year 2000 emissions	WA DEC 2007
Queensland	Not defined	Reduce greenhouse gas emissions by 60 per cent by 2050, relative to year 2000 emissions	Qld Gov. 2008
Australian Capital Territory	Return to year 2000 greenhouse gas levels by 2025	Reduce greenhouse gas emissions by 60 per cent by 2050, relative to year 2000 emissions	Department of Territory and Municipal Services 2007
Northern Territory	Although the Northern Territory does not have specific targets, it is committed to a prompt national approach to climate change		DPC 2007

APPENDIX B: NATIONAL TRANSPORT POLICY FRAMEWORK'S VISION, POLICY OBJECTIVES AND POLICY PRINCIPLES

Source: ATC 2008.

Vision for Australia's Transport Future

Australia requires a safe, secure, efficient, reliable and integrated national transport system that supports and enhances our nation's economic development and social and environmental well-being.

Transport Policy Objectives

To achieve this vision, Australia's Transport Ministers commit to the following policy objectives:

- **Economic**: To promote the efficient movement of people and goods in order to support sustainable economic development and prosperity.
- **Safety:** To provide a safe transport system that meets Australia's mobility, social and economic objectives with maximum safety for its user.
- **Social:** To promote social inclusion by connecting remote and disadvantaged communities and increasing accessibility to the transport network for all Australians.
- **Environmental:** Protect our environment and improve health by building and investing transport systems that minimise emissions and consumption of resources and energy.
- **Integration:** Promote effective and efficient integration and linkage of Australia's transport system with urban and regional planning at every level of government and with international transport systems.
- **Transparency:** Transparency in funding and charging to provide equitable access to the transport system, through clearly identified means where full cost recovery is not applied.

Transport Policy Principles

Australia's transport policy framework is underpinned by the following guiding principles:

- **Infrastructure pricing:** sending the appropriate signals to influence supply and demand for infrastructure;
- **Competitive markets:** establishing competitive markets wherever possible to minimise the need for regulation;
- **Private sector:** involve the private sector, where it is efficient to do so, in delivering outcomes;
- **National regulation:** a national perspective should be adopted where regulation is required;
- **National markets:** encourage national markets where possible; and
- **Customer:** Customer – focussed. Equitable access for all users.

APPENDIX C: TRANSPORT'S GREENHOUSE GAS EMISSIONS FROM EUROPE, US AND CANADA

Europe

Figure 4 shows that the European Union-15 (EU-15) combined transport sector is the second largest proportional contributor (21 per cent) to total EU-15 greenhouse gas emissions. Road transport makes up 93 per cent of total transport emissions, providing 19 per cent of total EU-15 greenhouse gas emissions. Moreover, road transport's share in total EU-15 emissions has increased over the last 15 year period from 15 per cent in 1990 to 19 per cent in 2005 (EEA 2007).

Between 1990 and 2005, greenhouse gas emissions from the EU-15 combined transport sector grew by 26 per cent, passenger transport increased by 28 per cent, and freight transport by 62 per cent (EEA 2007). All EU-15 sectors, except for transport, exhibited reductions in greenhouse gas emissions over the same period.

Although all EU-15 nations (except Germany and Luxembourg) project increasing transport emissions into the future, the latest European Environment Agency projections reveal that emissions from transport are expected to stabilise by 2010 mainly due to the effect of the following initiatives, all located in Germany:

- existing policy such as the mandatory biofuel quotas introduced in 2002; and
- additional measures such as the introduction of a taxation scheme based on carbon dioxide emissions and the mandatory use of low-friction oils and tyres (EEA 2007).

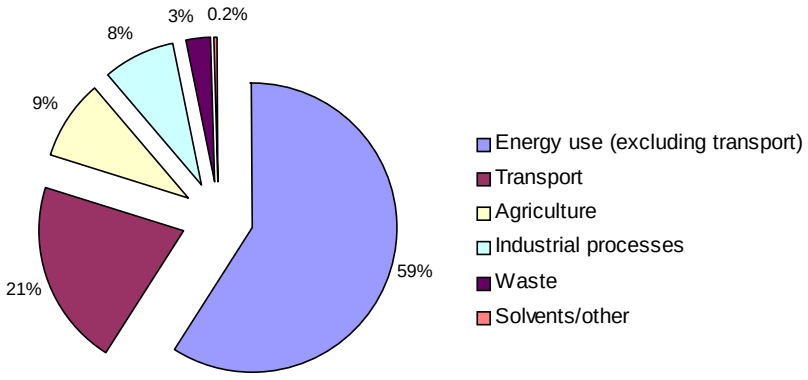

Figure 4. EU-15 greenhouse gas emissions by sector 2005

Source: EEA 2007.

Since Germany is responsible for almost one-fifth of EU-15 transport emissions, the policies described above are expected to make a significant reduction on total EU-15 emissions.

Within the road transport sector, freight transport is expected to grow more rapidly than passenger transport. This will provide a significant challenge for the European Union as currently freight transport is not directly included in any European Union greenhouse gas reduction strategy (EEA 2007).

North America

The latest figures from the United States reveal that the transport sector represents 28 per cent of total greenhouse gas emissions[2] (Figure 5). The transport sector's contribution is second to electricity generation which contributes 34 per cent to total emissions (USEPA 2007).

Greenhouse gas emissions from the transport sector experienced a considerable growth of 29 per cent between 1990 and 2005[3]. Notably there was a growth in emissions from freight vehicles of 69 per cent between 1990 and 2005, which represents the largest emissions rate increase of all the modes of transport over that period (USEPA 2007).

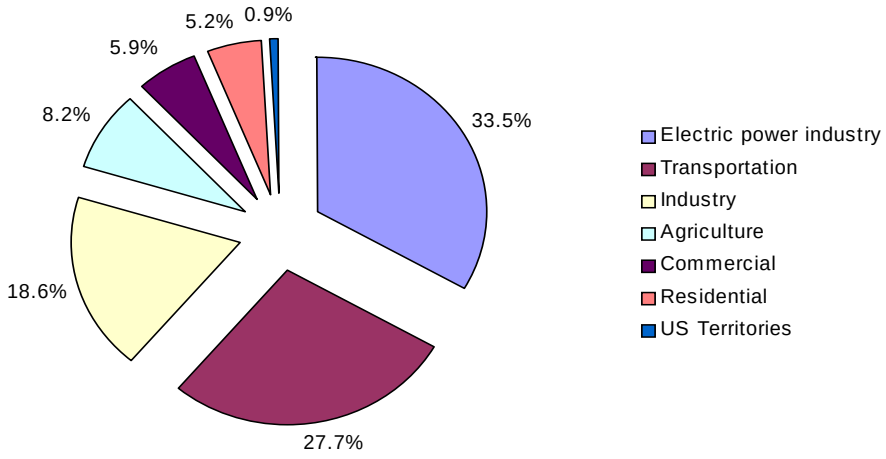

Figure 5. US greenhouse gas emissions by sector 2005

Source: USEPA 2007.

The latest greenhouse gas inventory report from Canada reveals a similar situation to that of the United States: emissions from the transport sector account for 26 per cent of Canada's total emissions (second largest sectoral contributor) (Figure 6) and grew by 33 per cent between 1990 and 2005. Moreover, this sector was responsible for 32 per cent of the growth in overall emissions between 1990 and 2005 (EC 2007).

Of particular interest was the high growth in emissions from light-duty petrol trucks (109 per cent), and heavy-duty diesel vehicles (84 per cent) between 1990 and 2005. Environment Canada states that the high growth in emissions from light-duty petrol trucks is due to the increasing use of sport utility vehicles and small to medium trucks and vans for personal use and that the increase in emissions from heavy vehicles is due to the increase in road freight transport (EC 2007).

[2] This transport sector figure was devised from the US emissions 'economic sector method' (USEPA 2007). It is not expected that it would vary significantly if the 'allocation method' transport figures were used.

[3] These transport sector figures were devised using the US emissions 'allocation method' (USEPA 2007). It is not expected that it would vary significantly if the 'economic sector' transport figures were used.

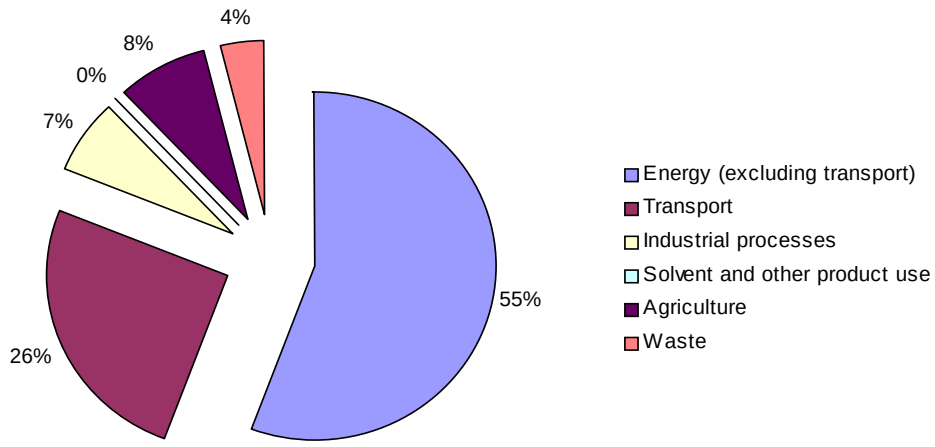

Figure 6. Canada greenhouse gas emissions by sector 2005

Source: EEA 2007.

It is expected that greenhouse gas emissions will continue to grow in North America, especially in the road transport sector. In the United States it is estimated that by 2020 total emissions will grow by 28 per cent from 2004 levels for the 'business as usual' scenario (US 2007).

In Canada, it is estimated that by 2020 total greenhouse gas emissions will be 36 per cent higher than they were in the year 2000; the transport sector is expected be the largest contributor, in both absolute and growth terms, to total greenhouse gas emissions up to 2020. Passenger vehicles and freight are predicted to equally share the majority of this large greenhouse gas contribution (EC 2005).

APPENDIX D: GREENHOUSE GAS EMISSIONS FROM THE AUSTRALIAN FREIGHT TRANSPORT SECTOR

When considered from a greenhouse perspective of the freight modes, road freight is the most significant consideration in terms of both total emissions produced and carbon intensity per tonne of freight moved.

Modal diversity within the freight sector

The freight transport sector is highly diverse in activity and consists of four different mode types: road, rail, sea and air. Currently sea and rail freight carry the majority of the bulk load in almost equal proportions (Figure 7). Road has the majority share in non-bulk freight transport. Air freight's carrying share is less than 1 per cent of interstate non-bulk freight (for both 'tonnes consigned' and 'tonne kilometres' sectoral analysis) (BTRE 2006b).

In the year that ended June 2000, the Australian freight task completed an estimated 382.5 billion tonne km (btkm) (BTRE 2006b). The mode share of this achievement is illustrated in Figure 8. As can be seen, road tonne kilometres make up just over one-third of the total freight (i.e. bulk and non-bulk) tonne kilometres performed; the road freight task accounted for approximately 143 btkm that year (BTRE 2006b). Rail and shipping account for almost another third each of total tonne kilometres.

The main freight route of competition between the modes occurs over the interstate carriage of non-bulk goods. The road freight task has been securing increased market share, over rail, in this area (BTRE 2006b). It is estimated that the contestable freight movement between capital cities between road and rail transport is 15 per cent of the total road task (BTRE 2006b).

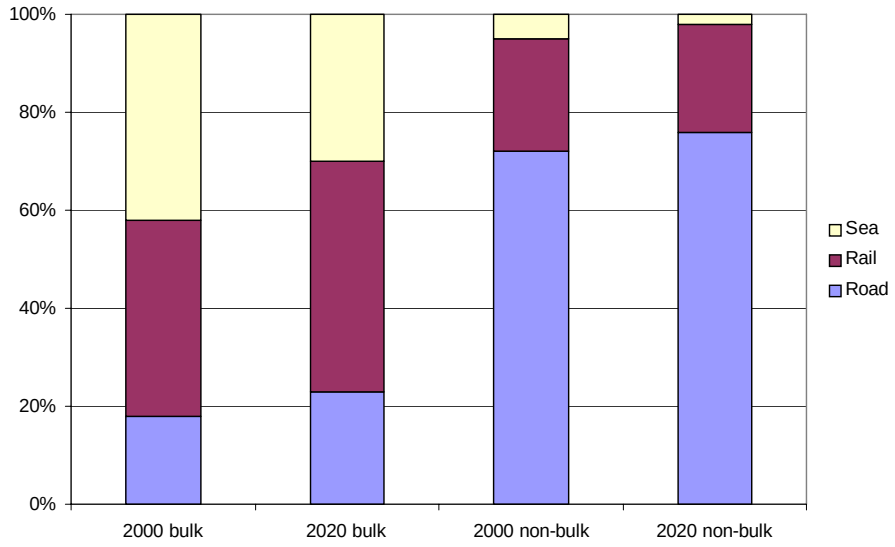

Figure 7. Proportions of the freight task by mode (current and projected)

Source: BTRE 2004.

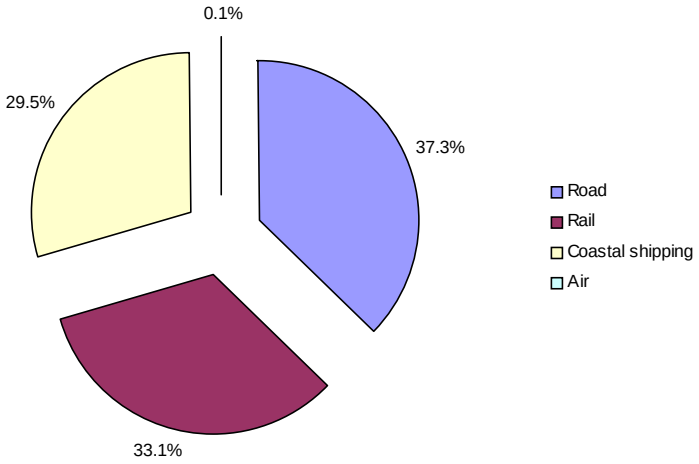

Figure 8. Mode split of the total Australian freight tonne kilometres performed (June 1999 – June 2000)

Source: BTRE 2006b.

If the total freight task is broken down into 'tonnes consigned' for the same year, road freight's share in the total dramatically increases to 72 per cent (Figure 9).

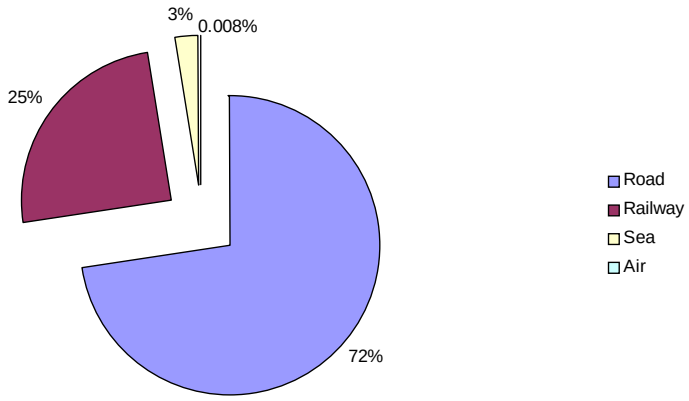

Figure 9. Mode split of Australian domestic freight by estimates of tonnes consigned (June 1999 – June 2000)

Source: BTRE 2006b.

The non-urban road freight task has grown more rapidly than sea, air and rail freight tonne kilometres travelled over the period 1985 to 2003 (Appendix E and Table 4) (BTRE 2006b). Growth in urban road freight has also been strong, although not as strong as growth in non-urban freight.

BTRE's analysis of the forecast future growth in the Australian freight sector forecasts that rail and shipping are likely to lose mode share to freight between now and 2020 in terms of total tonne kilometres travelled (BTRE 2006b). Non-urban road freight tonne kilometres are predicted to grow at an average annual rate of 4 per cent between 2003 and 2020, compared with 2.1 per cent for rail and 1.9 per cent for shipping; air freight is projected to grow by 3 per cent per annum, but from an almost negligible base (BTRE 2006b).

As a consequence, road freight is expected to account for an even more significant share of all freight moved in Australia by 2020 than is currently the case, with double the annual growth rates of sea and rail freight.

Table 4. Average annual growth rates of transport modes (tonne kilometres) 1985–2003

Mode	Average annual growth rates
Urban road	3.9%
Non-urban road	5.2%
Government rail	4.5%
Private rail	4.5%
Air	2.5%
Sea freight	0.5%

Source: BTRE 2006b.

Nature of road freight in Australia

In the year ending June 2000, the road freight task accounted for an estimated 143 btkm of all freight moved in Australia. Approximately 68 per cent of this movement occurred outside urban areas with the remaining 32 per cent driven within urban areas (Figure 10) (BTRE 2006b).

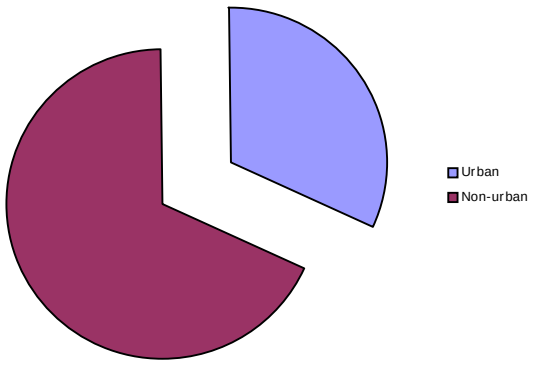

Figure 10. Urban/non-urban split of Australian road freight task total tonne kilometres (June 1999 – June 2000)

Source: BTRE 2006b.

Figure 11 shows the breakdown of the road freight task into bulk and non-bulk commodities carried. As can be observed, the majority of the road freight task will be the transport of non-bulk goods (currently and into the future). This figure also foreshadows the significant growth in tonne kilometres that is forecast to occur through to the year 2020.

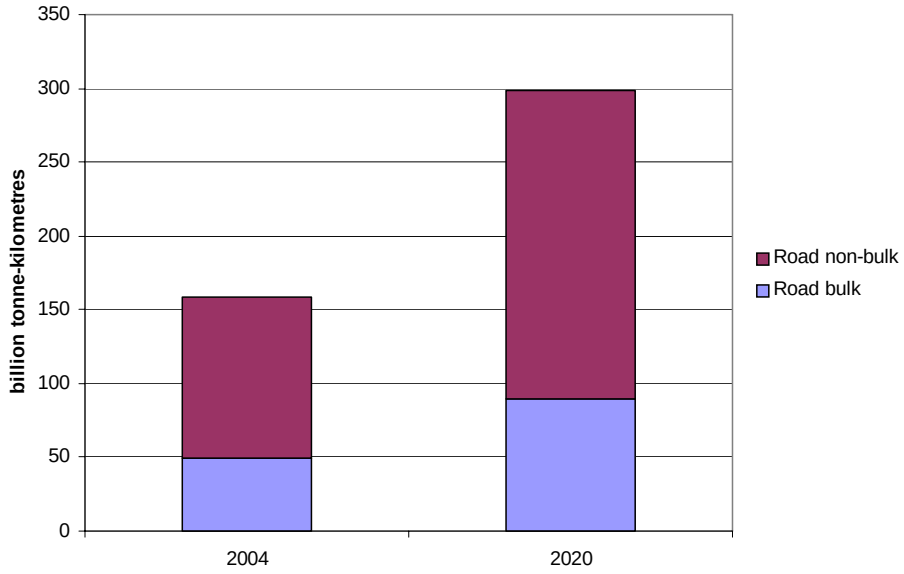

Figure 11. Current and projected road freight task

Source: BTRE 2004.

Figure 12 shows the share each freight vehicle is responsible for out of total tonne kilometres of the entire road freight task. Articulated trucks, by far, have the greatest share of tonne kilometres.

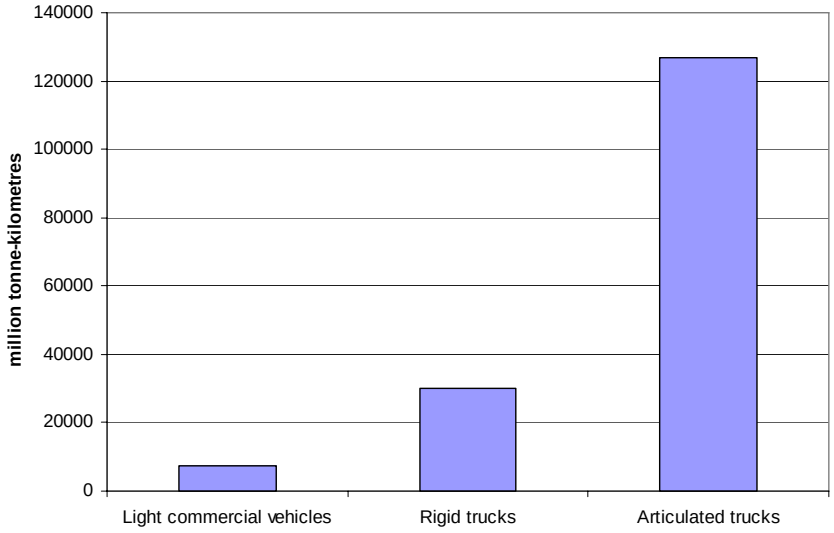

Figure 12. Tonne kilometres travelled by vehicle type in 2005

Source: ABS 2006b.

The road freight task exhibited strong growth between 1985 and 2000 (Table 5). In 1985, 68 btkm were driven and by 2000, 143 btkm had been driven (i.e. in the last fifteen years, road freight tonne kilometres have more than doubled) (BTRE 2006b). Over most of the last thirty years, the annual rate of growth of total road tonne kilometres exceeded the rate of GDP growth (around 3.5 per cent) (BTRE 2006b).

Very strong growth can be observed in urban light commercial vehicles tonne kilometres and non-urban articulated tonne kilometres (Table 5). Light commercial vehicles can also boast having the largest number of vehicles in their category which seems logical as they have smaller carrying capacity. The increase in personal income and e-commerce (e.g. increase in demand for home deliveries) has been stated as a cause behind this observable phenomena (BTRE 2006b).

Table 5. Average annual growth rates in tonne kilometres of the Australian road freight task (1985–2000)

Location	Vehicle type	Average annual growth 1985–2000 (%)
Urban	Light commercial vehicles	12
	Rigid	6
	Articulated	6
Non-urban	Light commercial vehicles	-1
	Rigid	0.4
	Articulated	10

Source: BTRE 2006a.

Analysis of the road freight fleet over the thirty-year period between 1 January 1971 and 31 December 2000 (BTRE 2006b) reveals that:

- the number of trucks increased by 3.9 per cent per year;
- the number of heavy trucks (i.e. vehicles with gross vehicle mass above 16 tonnes) increased by 1.2 per cent per year;
- tonne kilometres increased by 6 per cent per year (BTRE 2006b).

A key factor in the slower rate of growth in heavy truck numbers can probably be attributed to changes to national regulations governing maximum length and mass dimensions for interstate trucks from the mid 1980s (i.e. single trailer rigs being replaced with B-doubles).

Greenhouse gas emissions by freight mode

The following greenhouse gas contributions by freight mode have been made by discounting the relatively insignificant volume of air freight and considering both consigned and unconsigned non-urban freight (tonne kilometre basis):

- road freight accounts for 89 per cent of greenhouse gas emissions from the Australian freight transport sector; and
- rail freight accounts for approximately 6 per cent, and sea freight accounts for the remaining 5 per cent.

Road freight is likely to account for an even greater proportion of greenhouse gas emissions by 2020 than is currently the case (DCC 2008).

Carbon intensity by freight mode

Sea freight is generally considered the least emissions-intensive freight mode followed by rail, then road and air (AGO 2002). Research conducted by the international maritime industry indicates that the carbon intensity of moving freight by sea is between 0.12 to 0.3 megajoule (MJ) per tonne kilometre compared with 0.7 to 1.2 MJ per tonne kilometre for road transport (ICS 2004).

It can be argued that the relative differences in carbon intensities for each mode are a factor of the volume of freight moved by each mode with smaller volumes (typically high value, non-bulk freight) associated with the higher carbon intensities. This argument is supported by the fact that road currently accommodates more than 70 per cent of all non-bulk freight moved in Australia (Figure 7).

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APPENDIX E: AUSTRALIAN FREIGHT TASK GROWTH TRENDS

Table 6. Road freight average annual growth rate (%) of billion tonne kilometres

Source: BTRE 2006b.

	By area		By load		By vehicle type (all areas)				Interstate		
	Urban	Non-urban	Bulk	Non-bulk	LCV	Rigid	Articulated	Total	Bulk	Non-bulk	Total
1985–2003	3.9	5.2	4.8	4.8	5.2	3.4	5.2	4.8	6.4	6.4	6.4
2003–2020	3.5	3.9	3.8	3.8	3	1.3	4.3	3.8	4	4	4

Table 7. Rail freight average annual growth rate (%) of billion tonne kilometres

Source: BTRE 2006b.

	Rail/public access			Rail/private	All operators			Interstate		
	Non-urban			Non-urban	Non-urban					
	Bulk	Non-bulk	Total	Bulk	Bulk	Non-bulk	Total	Bulk	Non-bulk	Total
1985–2003	4.5	4.6	4.5	4.5	4.5	4.6	4.5	3.8	3.1	3.2
2003–2020	2	2.4	2.1	2.4	2.2	2.5	2.2	2.1	2.8	2.6

Table 8. Sea freight average annual growth rate (%) of billion tonne kilometres

Source: BTRE 2006b.

	Non-urban			Interstate		
	Bulk	**Non-bulk**	**Total**	**Bulk**	**Non-bulk**	**Total**
1985–2003	0.8	5.2	1	0.2	5.3	0.5
2003–2020	1.6	5.2	1.9	1.7	5.2	2.1

Table 9. Air freight task average annual growth rate (%) of billion tonne kilometres

Source: BTRE 2006b.

	Non-urban	Interstate
	Non-bulk	**Non-bulk**
1985–2003	2.5	2.4
2003–2020	3	3

APPENDIX F: KEY TRANSPORT EXTERNALITIES

Greenhouse

The escalation of greenhouse gas emissions has been a global phenomenon linked closely to industrialisation and development, rising dramatically in the 20th century.

The link between atmospheric build up of greenhouse gases as a potential cause of global climate change has been debated across numerous forums. Some effects of global climate change include more volatile and less predictable weather patterns, shifts in mean weather temperatures, and melting of polar ice caps and rising sea levels. The effects have wide ranging implications for sections of society and the planet as a whole.

The insurance industry would likely incur increased insurance claims as the occurrence of natural disasters rises. Current agricultural production would decline as a result of agricultural areas experiencing abnormal rainfall. Loss of biodiversity would occur as mean temperature changes alter ecosystems. Then there is the probability of the need for mass relocation of human populations as low lying land areas are swallowed by rising sea levels.

The general consensus across a majority of governments throughout the world is that because the potential costs of global climate change are so great, inaction in trying to curb greenhouse gas emissions simply is not a viable option.

The Garnaut Review sharpens the focus of strategic policy making on the issue of managing the greenhouse externality in Australia. In comparison to other countries, the Garnaut Review is expecting Australia to be a big loser, and possibly the biggest loser among developed countries, from unmitigated global climate change (Garnaut Climate Change Review 2008). As a result, governments, industry and the general public will be required to be responsive and work together in order to make headway towards the challenge of reducing greenhouse emissions.

Air pollution (air quality)

Air pollution generated by transport has the potential to create significant adverse impacts on wider society. Direct impacts include damage to ecosystems and loss of agricultural production; indirect impacts include damage caused by acid rain, and health impacts caused by breathing in the pollutants.

In urban centres within Australia, a majority of the air pollution externality is attributed largely to passenger vehicle emissions (Amoako *et al.* 2003). The major pollutants that have been found to impact on health include particulates, nitrogen dioxide, benzene, ozone and, to a lesser degree, carbon monoxide. Anecdotal evidence suggests that as capital city populations continue to increase, and major cities become increasingly dense, the severity of health impacts caused by air pollution has significant potential to increase if existing proportions of motor vehicle use continue.

At a local level, the health impacts caused to the individual from air pollution depends on various factors such as weather patterns which influence the flow of pollutants relative to population centres, and then largely on the susceptibility of individuals in the population. For example younger children, the elderly, or those suffering medical conditions such as asthma are more likely to incur direct health problems on high pollution days.

Some of the potential health effects of the pollutants can include breathing difficulties and exacerbated respiratory problems, tiredness and headaches caused by diminished blood oxygen levels, effects on throat and lungs, skin and eye irritations, other headaches or nausea (Amoako *et al.* 2003).

The costs being placed on society are difficult to quantify, but are generally classified to be either through premature mortality in its most severe case, or impaired quality of life (morbidity). Amoako *et al*. (2003) attempted to estimate actual costs of air pollution in Australian major capital cities for the year 2000. Their analysis estimated that, attributed to motor vehicle pollution:

- about 1200 persons died (range of 758 to 1700 deaths with a 95 per cent confidence);
- there were 2,400 hospital cases and 21,000 days of asthma attacks; and
- a total economic burden of $3.3 billion was placed on society in Australia.

Noise

The noise externality from transport and freight can have localised impacts on wider society. Impacts vary depending on the proximity of residential populations to transport infrastructures that support road, rail and air transport modes. Noise is emitted from a vehicle's engine, brakes or contact with the road or rail they are passing over.

In 1994 a study on noise externalities was conducted as part of a wider Environment Protection Authority Victoria report into transport externalities (Leonie Segal Economic Consultants 1994). Noise impacts were generally classified as the valuation of the loss in quality of life from traffic noise and related interruptions. Their study used hedonic pricing to estimate the diminished value of residential property attributed to proximity to traffic noise based on 1991 metropolitan Melbourne house price data. General impacts from noise on the communities were considered to occur at 55 dB, with the 'excessive' threshold being exceeded beyond 62 dB.

The results of their study found that houses exposed to traffic noise in the 63 dB to 68 dB range incurred a decrease in house prices between 5 to 10.5 per cent. For properties experiencing noise levels in excess of 68 dB, house prices were found to be diminished by between 7.5 to 15 per cent.

Road trauma

Annual road crashes in Australia typically result in around 1,600 deaths and 30,000 serious injuries requiring some degree of hospitalisation or medical treatment (ATSB 2004, 2007).

The annual monetary cost of all road crashes in 2005, including injury and property damage crashes but excluding the social costs of pain and suffering, was estimated to be in the vicinity of $18 billion per annum. This cost can be attributed to the cost of delivering emergency response services, medical costs, the cost of rehabilitative services, the associated loss of population productivity, traffic delays and vehicle repairs.

Heavy vehicles, particularly articulated vehicles, tend to be over-represented in fatal and serious injury crashes owing to their larger mass. In recent years, crashes involving heavy vehicles account for approximately 270 deaths each year (ATSB 2007).

Congestion

The congestion externality is the external cost placed on society as a result of an additional unit of use of transport infrastructure beyond saturation or natural capacity in the short run. It is typically localised and seasonal in its nature, occurring most at peak travel times in cities as people commute to and from work.

Congestion results directly in increased travel times above optimal times for users of transport infrastructure. Owing to diminished productivity, it can also result in exacerbation of other transport externalities such as air pollution and greenhouse gas emissions.

The Bureau of Transport and Regional Economics found that the compounded 'avoidable' business as usual costs of congestion across Australian capital cities in 2005 was estimated at $9.4 billion per annum, and is expected to grow to $20.4 billion per annum in 2020 (Competition and Regulation Working Group, 2006). The allocated costs of congestion included extra noxious pollutants, extra vehicle operating costs, trip variability, business delay and private delay.