



AUSTRALASIAN RAILWAY ASSOCIATION INC

Association Number A03958 ABN 64 217 302 489

8 April 2009

The Secretary
Senate Select Committee on Climate Policy
PO Box 6100
Parliament House
CANBERRA ACT 2600
Email: climate.sen@aph.gov.au

Submission Senate Select Committee on Climate Policy

I refer to the request for submissions to the Senate Select Committee on Climate Policy. This submission is made by the Australasian Railway Association (ARA) on behalf of its membership.

There is a paucity of information about the ultimate consequences of climate change to transport directly. Climate change is impacting physically on operations in the transport industry.

The rail industry supports the introduction of an emissions trading scheme and its broad design. However, the policy in the Carbon Pollution Reduction Scheme (CPRS) to favour road transport over more carbon efficient rail transport introduces an additional market failure which will increase cost of abatement for Australian business and the community generally, and must therefore be overturned or neutralised.

The most effective way to reduce emissions in the transport sector is through modal shift from road to rail and sea, for both passenger and freight. Policies supporting modal shift will reduce greenhouse gases and significantly reduce the immense social costs from transport.

Implementation of the CPRS and the introduction of complementary policies and investment in rail would reduce emissions and slow their growth so they would be just less than 5% above their 2010 level in 2030.

The rail industry looks forward to continuing to work co-operatively with the Australian Government on issues relevant to the rail industry. It would be greatly appreciated if in future you could liaise with the ARA's Director Policy, Brett Hughes on (02) 6270 4508 or bhughes@ara.net.au and our other rail industry members throughout Australia.

Yours sincerely

Bryan Nye
Chief Executive Officer



AUSTRALASIAN RAILWAY ASSOCIATION INC

Submission to the Senate Select Committee on Climate Policy

April 2009

Summary of the Rail Industry Submission to the Senate Select Committee on Climate Policy

Climate change is amongst the highest of government priorities. There are four issues for government and industry to consider:

1. the weather effects of climate change
2. the effects of climate change on human activity;
3. appropriate responses to climate change; and
4. the consequences of responses.

There is a paucity of information about the ultimate consequences of climate change to transport directly. Consequently, there is insufficient information for government and industry to make decisions on appropriate responses with any degree of certainty. Optimal responses to climate change require collaborative activities between governments and industry, including railways.

Climate change is impacting physically on operations in the transport industry. In the current financial year one major railway incurred \$11.4m of damage from incidents related to extreme climate events, including flash floods, cyclones and extreme heat. Costs of damage to the rail network, roads and lost operating revenue are additional to this \$11.4m. Action to reduce greenhouse gas emissions, improve infrastructure and support the use of lower emissions transport solutions is required.

The rail industry supports the introduction of the Carbon Pollution Reduction Scheme (CPRS) and its broad design, however the CPRS will not be sufficient in itself. The policy to favour road transport over more carbon efficient rail transport, introducing another market failure which increases abatement costs to Australian business and the community generally, must be overturned or neutralised.

The most effective way to reduce emissions in the transport sector is through modal shift from road to rail and sea, for both passenger and freight. Policies supporting modal shift will reduce greenhouse gases and significantly reduce the social costs from transport. Social costs to Australia of current transport patterns are immense and estimated at \$52 billion or 5.6% of GDP in Australia in 2005, before including congestion costs. These social costs are mainly due to road transport since rail contributes only 9% of these costs. Investment and policies that support rail and a cost for carbon from the CPRS will provide high social returns and lower emissions. If implemented, the potential social benefits accruing over 2010 – 2020 are worth \$27.4 billion.

On a business as usual case, transport emissions will be approximately 30% above their 2010 levels in 2030. Implementation of the Carbon Pollution Reduction Scheme and the introduction of complementary policies and investment in rail would reduce emissions and slow their growth so they would be just less than 5% above their 2010 level in 2030.

Australia needs price signals from a Carbon Pollution Reduction Scheme to commence now, so that long term price effects drive the necessary changes in the transport sector. Price impacts will have only a limited effect in changing transport to low emissions modes and solutions, and it will be the complementary policies for transport that will be successful in driving the most significant change in the shorter term. Nevertheless, the long term advantages of a carbon price can only be achieved through early implementation of the CPRS together with complementary policies.

The rail industry urges the Senate to include complementary policies to the Carbon Pollution Reduction Scheme to address climate change.

Such policies should include:

- **A Long Term Plan for Rail** – is needed to ensure that a long term sustainable vision is achieved by State and Federal governments in the development of the rail network in order to achieve improvement in rail productivity which will decrease the greenhouse gas emissions intensity of rail and transport in Australia.
- **Access to World Class Technology** – to allow the rail operators to quickly purchase the latest international technology that will provide energy and efficiency improvements at significantly reduced cost.
- **Infrastructure Standards Must Improve** – allowing longer trains and double stacking of containers to significantly improve the productivity of freight train services, the amount of energy per net tonne transported and as a result the amount of greenhouse gases produced to move a tonne of freight. This initiative has been highly successful on the rail network between Adelaide to Perth. Providing similar rail network standards to allow longer double stacked trains across all key freight corridors would provide significant greenhouse gas benefits.
- **Transport Corridors and Land Availability** – the release and zoning of land for transport use is needed to provide terminals and corridors in metropolitan areas to grow capacity and provide service quality and a low emissions rail solution.
- **Remove Conflicts between Passenger and Freight Rail Networks** – as this creates a less productive outcome for freight transport and reduces its ability to provide a low emissions solution.
- **Infrastructure Investment** – to improve rail service quality and competitiveness with road that meets market requirements and rail market growth. This must be part of an integrated national transport plan.
- **Security of Land Tenure** – by increasing lease periods of terminals and infrastructure and provide security from third parties seeking access. These will increase investment certainty and encourage increased investment in transport infrastructure.
- **Asset Depreciation** – to encourage early investment in newer low emissions locomotives and the retirement of less emissions efficient equipment.
- **R&D Incentives** – to provide 100% rebate on R&D activities in emissions reduction initiatives in cash form to assist the cash flow of parties involved in research.
- **Congestion Charges** – on key corridors or metropolitan areas to assist modal shift to rail.
- **Appropriate Truck Sizes** – to ensure the benefits of large trucks in the most appropriate situations and not at the expense of the mode best suited for the task.
- **Mandatory Rail Use Target (MRUT)** – to set targets for mandatory rail use as already done by the Victorian and NSW state governments to move toward more sustainable transport choices, and provide supporting policies to ensure success.

The Australian rail industry submits to the Senate Select Committee on Climate Policy that:

- 1. There is a need for urgent early action in reducing greenhouse gas emissions.**
- 2. The rail industry supports an emission trading scheme and carbon price, which includes all transport, to reduce greenhouse gas emissions.**
- 3. The CPRS is not sufficient in itself to meet the government climate change objectives.**
- 4. The policy in the CPRS which favours road transport over rail transport introduces an additional market failure which needs to be overturned or neutralised.**
- 5. An integrated national transport plan and policies that support productivity improvements in the rail industry are essential for halting the increase in transport emissions.**
- 6. The policy instruments submitted are needed to support modal shift to lower emissions rail.**
- 7. Investment in rail infrastructure must be increased to allow it to provide a viable low emissions solution for Australia and meet market service quality and capacity requirements.**

Further support from complementary policies are necessary to assist in minimising climate impacts on Australian businesses and support the use of lower emissions transport.

1. Background

Climate change is amongst the highest of government priorities. There are four issues to be considered by government and industry:

1. the weather effects of climate change
(e.g. changes rainfall and temperature patterns, increased frequency of extreme events);
2. the effects of climate change on human activity
(e.g. increased infrastructure damage);
3. appropriate responses to climate change
(e.g. government and industry interventions such as carbon trading schemes, tighter environmental regulation, more fuel efficient locomotives); and
4. the consequences of responses
(e.g. lower emissions, increased freight on rail, different transport costs).

An enormous amount has been written on the first of these, particularly by scientists, and has been the subject of considerable professional, political and public debate. The conclusion is that the climate is changing in ways which are detrimental to human activity in places where large populations current exist. Part of this change is the increase in the frequency of extreme events.

There appears to be very little information available on the last three issues, except in certain sectors such as agriculture. The Commonwealth Government has embarked on several initiatives concerning climate change and the parallel issue of energy use including the National Infrastructure Climate Change Adaptation and Risk Assessment (NICCARA) project by the Department of Climate Change and the Energy White Paper by the Department of Resources, Energy and Tourism.

There is a paucity of information about the ultimate consequences of climate change in transport directly. Consequently there is insufficient information for government and industry to make decisions on appropriate responses with any degree of certainty. Optimal responses to climate change are likely to require collaborative activities between governments and industry, including railways.

In March 2009 the Federal Government Department of Climate Change released its exposure draft for the CPRS legislation. The rail industry has been an active participant in the inputs for the design of the CPRS. Submissions and involvement have been provided through participation in the Industry Roundtable Consultation forums; submissions to the Garnaut Climate Change Review, the CPRS Green Paper, the Wilkins Review, the Federal Treasury, and submissions to the National Transport Commission reviews on Rail Productivity and Freight Transport in a Carbon Constrained Economy.

Transport in Australia is the third highest contributor to national greenhouse gases, with stationary energy (electricity) and agriculture holding first and second place respectively. If the electricity used in the provision for electric rail transport is taken into account, transport is the second highest cause of emissions.

Rail transport is inherently a much less carbon intensive form of transport than other land transport modes. The short and long term benefits of switching people and freight to rail

transport are immediate and significant. The availability of options to increase rail productivity through investment in the rail network will also result in reduced transport emissions. Unlike the road sector, current technology is available that allows rail to use electricity and therefore become even lower emissions as a result of reform in the electricity generation sector.

Transport can represent 1% to 10% of the final cost of a product, and greenhouse gas emissions from transport can represent more than 10% of the carbon footprint of a product. In a world of increasing energy costs and costs for carbon emissions, increases in rail productivity have the potential to assist in dampening inflationary impact on the costs of goods in Australia and lower transport emissions.

2. The Need for a Carbon Pollution Reduction Scheme

The rail industry supports the government timeframe for the introduction of a CPRS to commence in July 2010. Ongoing debate could continue ad infinitum, on the merits of a cap and trade scheme versus a carbon tax, or other further design options of the proposed cap and trade scheme. However, the rail industry believes that the broad mechanism for the design of the proposed Scheme is sound and is not a cause for further delay.

There have been significant opportunities for industries to engage with the government on the design of the CPRS. While the diabolical nature of climate change policy means that there will be winners and losers as a result of introducing such policy, the threat of climate change and the need to implement a framework for the future should not be drowned out by the complaints of the political stakeholders and those who will have to change their businesses in response to climate change.

The delay in bringing some sectors into the CPRS through protection to road vehicles (on-road business users, passenger vehicles, and heavy vehicles) and delays in including the agriculture sector and deforestation, is in itself recognition that a staged implementation will soften the implementation of the Scheme on the economy.

While the rail industry does not support the exclusion of road vehicles from the CPRS in its early years, these points of disagreement are no reason to delay the Scheme's commencement. The exclusion of further sectors or a delay in the introduction of the start of the Scheme will not serve to provide further significant improvement in the Scheme, but instead place a greater burden on the remainder in achieving the National emissions reduction targets.

3. Transport and Greenhouse Gases

Transport Emissions

Australian transport emissions are increasing at a dramatic rate and at a rate greater in scale to national emissions. With national emissions increasing by Kyoto obligations of 8% between 1990 and 2012, transport emissions increases are significantly out of proportion and have instead increased at a rate of 29% between 1990 and 2005. In a world where there is an urgent requirement to reduce emissions by large amounts, the transport sector with its emissions growth rate will require significant focus and support to move to a negative emissions trajectory and assist Australia in achieving emissions reductions.

Transport emissions from cars, trucks, trains and aircraft are all increasing and the two key markets for these emissions are the transportation of passengers or freight. Growth in emissions from road transport is projected to be seven times higher than all other forms of transport, between 2010 and 2020, and it is this road transport emissions growth that can be reduced through appropriate modal shift to rail.

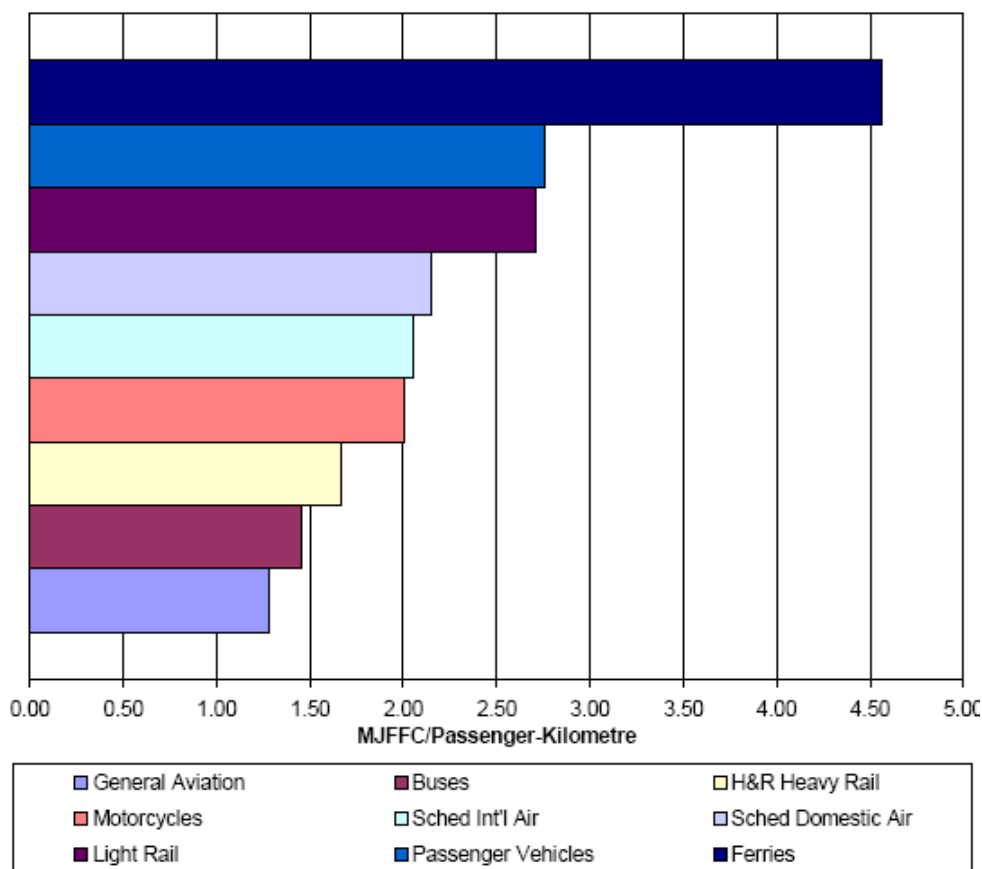
The benefits of rail in providing a low emissions rail solution are globally recognised. The United Nations Intergovernmental Panel on Climate Change in their AR4 report released in late 2007, support the use of rail as a transport policy for emissions reduction.

Modal Shift Benefits

Passenger Rail

The lower emissions of rail transport compared with trucks and cars are significant, with rail emissions one third to a half of the emissions from road. The comparison between road and rail passenger transport shown in the diagram below illustrate the superiority of rail transport and demonstrates the immediate emissions reduction benefits available from modal shift for passenger travel. These differences are more pronounced during peak periods where trains are more heavily utilised and cars are less efficient in congested traffic.

Energy Intensity in Undertaking Passenger Task 2004/05



Source: Australian Rail Transport Facts 2007, Apelbaum Consulting Group

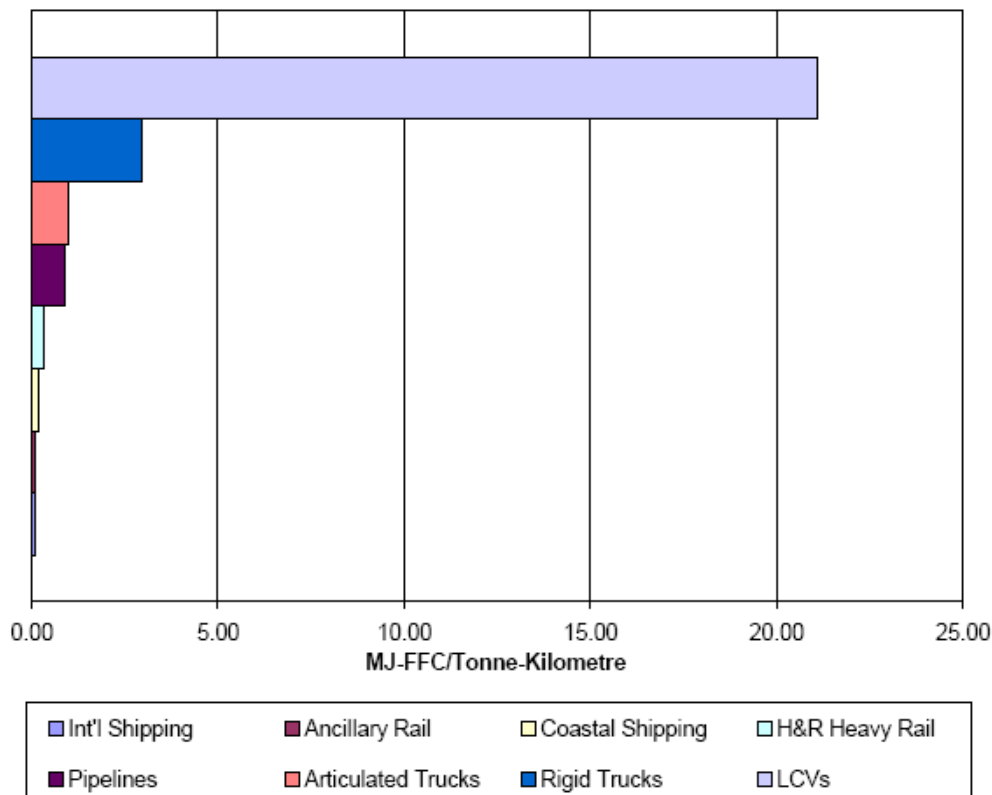
Barriers for the adoption of low emissions rail transport unless addressed, will prevent the use of low emissions rail solutions. The key barriers for increased passenger rail use are the lack of infrastructure and availability of services to widen the catchment area of public transport. If sufficient infrastructure were in place, rail would have the ability to command a greater percentage of the national transport market, and therefore lessen the demand for Australia’s energy resources and reduce transport’s greenhouse, environmental and social impacts.

Land use planning and the built environment can be managed more effectively through Transport Orientated Development (TOD) with appropriate design of modal points to allow transport interchange with higher reliance on public transport. Built environments where people can both live and work in close proximity to public transport would see patterns of transport behaviour change over time.

Freight Rail

In comparing rail freight emissions with road freight, and including additional emissions for rail with road pick up and delivery of goods at the origin and destination, rail provides a marked emissions reduction benefit for the same quantity of goods moved. The chart below illustrates the significant low emissions benefits of rail transport. Rail emissions are one third to a half of the emissions from road, which highlights the immediate emissions reduction benefits available from modal shift in the freight sector.

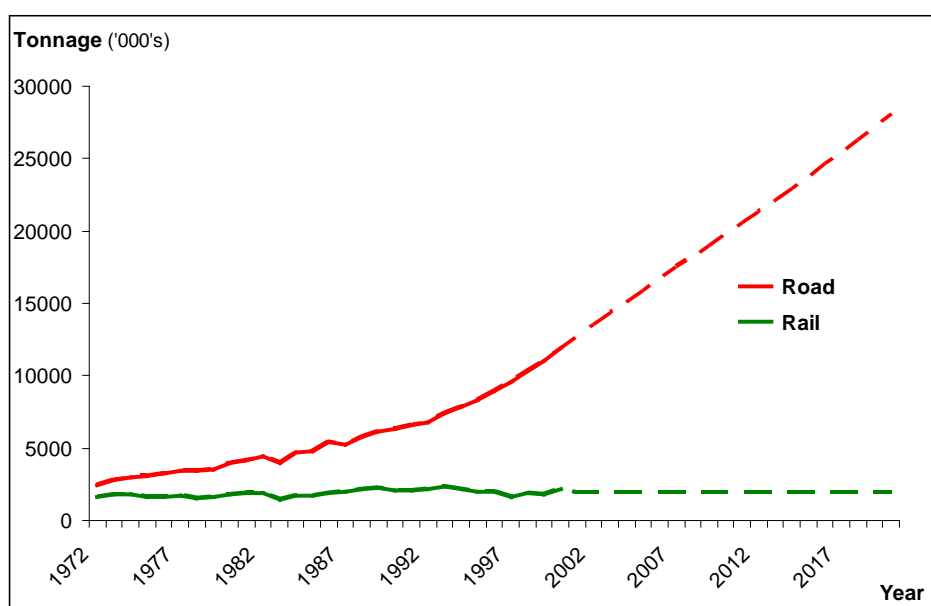
Energy Intensity in Undertaking the Freight Task 2004/05



Source: Australian Rail Transport Facts 2007, Apelbaum Consulting Group

Interstate rail freight for many demands has been declining, especially on the East Coast of Australia and for lower tonnages in regional areas. Even for long distance intermodal transport, rail demand between Melbourne, Sydney and Brisbane has only marginally increased, while road transport has dramatically increased¹. Without significant government intervention, this unsustainable trend is expected to continue, as shown in the following diagram. In 1972 the proportion of land freight carried by rail between Eastern States capital cities was 39%, which is expected to decline to 6.5% by 2020 if current directions and initiatives continue. Over the period 1972 to 2020, rail freight is anticipated to increase by 21%, while road freight is anticipated to increase by 1038%.

Eastern Corridor Land Freight Task



The modal transport shift from road to rail cannot be under valued. With the freight transport task to double between 2000 and 2020, this increases the quantum of emissions cuts required in the freight transport sector to meet national emissions reduction targets. It will not be possible for road transport to provide the reductions required.

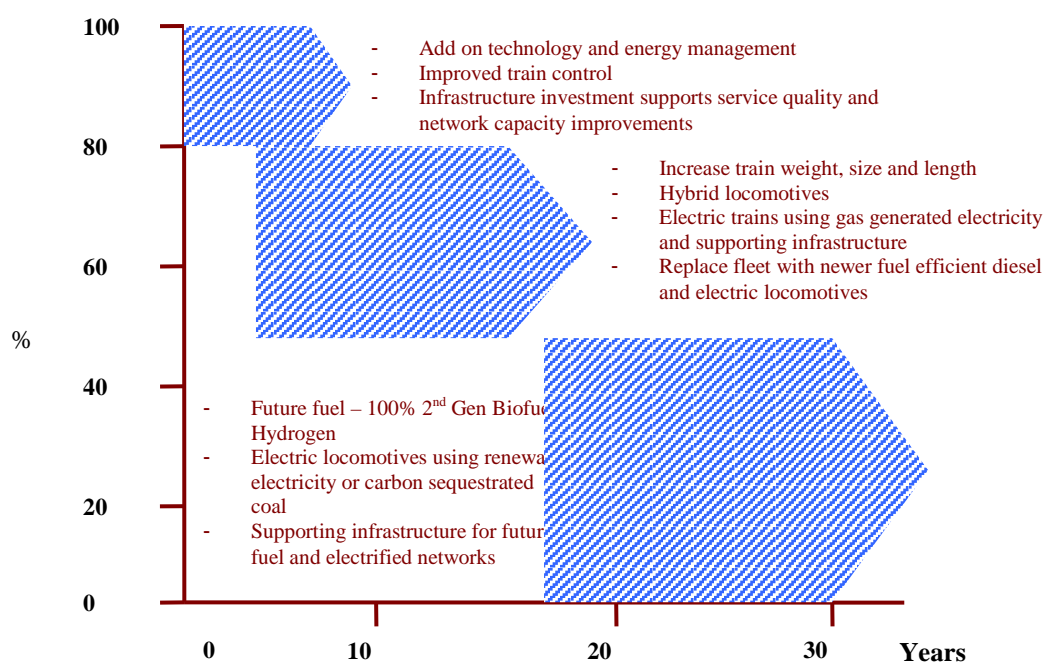
Future Emissions Pathway

To meet the emissions reduction targets intended for 2050, rail is in a position to provide further emissions reductions. A number of these though, are captive to government policy decisions that will improve the productivity of the rail industry and reduce the amount of greenhouse gas emissions per passenger or tonne of goods carried.

There are a number of existing technological options for rail to reduce emissions from their current levels per unit of goods transported. The options involve investment in above rail operations in the operation of trains and below rail investment in the supply of rail network. The following diagram shows options that will reduce rail emissions and allow these to provide a freight transport solution for Australia that meets the national emissions reduction targets for 2050.

¹ Extracted from *Freight Measurement and Modelling in Australia*. Report 112, Bureau of Transport and Regional Economics (BTRE) 2006.

Rail Emissions Reduction Options showing Percentage Emissions Reduction and Implementation Timeframes



4. A Carbon Price and Other Policies

The Garnaut Review states that the transport sector is a market failure when it comes to the desired effect from a CPRS. The price effect of carbon will be too low in the short term, and the alternative transport choices too few due to infrastructure limitations, to drive a change to lower emissions transport solutions. The Garnaut Review recommends that complementary policies are necessary to support structural change in the transport sector to complement the price effects from a carbon price, and drive a change to lower emissions transport modes such as rail and ships. The rail industry supports this conclusion and recommendation.

Therefore, the commencement of a CPRS in Australia should not be delayed and complementary measures to support the use of lower emissions transport should be a key element of government policy to reduce transport emissions.

Improving rail productivity will further improve the greenhouse gas benefits of rail transport. Addressing the following issues through complementary policies to a carbon price will be beneficial in reducing greenhouse gas emissions.

A long term plan to improve rail productivity

Transport is an enabler for economic activity and wealth creation. An efficient transport industry allows other industries to be efficient, and creates wealth in all sectors of the Australian economy.

Productivity increases in freight transport translate to greater national productivity growth. A focus on freight transport productivity and rail productivity will have long term benefits,

particularly in providing a lower emissions transport solution for Australia. For these benefits to be achieved, there is a need for a long term vision that can be articulated and implemented in all transport planning strategy.

By example, in examining productivity reform in the rail industry consideration should be given to what has occurred with the planning of continuous improvement in the trucking industry. In 1971 a national highways strategy evolved and a vision of dual carriage lanes on the Australian Eastern seaboard north-south transport corridor was developed. This vision and resulting plan had the commitment of governments at State and Federal level. This plan has resulted in continual upgrade in the road infrastructure, which has supported the upgrade in heavy road vehicles.

Over the decade to 2003 – 2004, the total expenditure by all levels of government in Australia on roads was \$91 billion (in 2004 – 2005 prices). This has seen a change in truck types for inter-capital haulage, from rigid trucks, to articulated trucks, to B-Doubles, to the introduction of B-Triples using the latest overseas technology. With intercity truck movements expected to increase by 2 – 3 per cent per annum, there may be 5,000 – 6,000 trucks on the Hume Highway each day by 2025², increasing from the current level of 3,000 – 4,000 trucks each day.

To meet the increasing transport task, the rising costs for transport, and with reduced creation of greenhouse gases, similar long term vision for the rail industry, and in particular long distance intermodal freight haulage must be realised. This must be supported, with a plan and commitment from all levels of government.

Access to world class technology

There is significant opportunity for increases in rail productivity by addressing technology and standards to allow rail operators to use the latest world class technology and practice.

Whilst Australia has a common standard gauge rail network to all capital cities, this gauge is inconsistent with that of the key equipment suppliers in the United States. The USA AAR (Association of American Railroads) track standard is able to take heavier equipment up to 32.5 tonne axle load. The current Australian interstate rail network has an axle load limit of 23 tonnes. The AAR standard also has a larger rolling stock window outline in comparison to the smaller outline for the Australian network. Unlike road transport where most vehicles designed overseas can fit on Australian roads, rail rolling stock for use in Australia cannot be purchased ‘off the shelf’ and instead must be made smaller and lighter to fit on the Australian network. This has several negative effects:

- it increases the cost of equipment as it has to be redesigned and built as a limited one off manufacture;
- it decreases the speed of response to rail customers as lead times for rolling stock are extended and can take years to acquire;
- it limits the ability to find room in the rolling stock for the various noise and pollution equipment in an environment where standards for these measures are increasing and applied inconsistently across the country;
- it delays the acquisition of the latest technologies as manufacturers instead focus on key markets that do not required redesign of their equipment; and

² Laird 2007

- it limits access to more fuel efficient technology which in turn limits opportunities to reduce greenhouse gases.

Infrastructure standards must improve

Similar to productivity improvements in road through the use of bigger and longer vehicles, the rail network infrastructure must be improved to enable use of High Productivity Trains.

Specifically the following major improvements are required:

- increase the current maximum 1500m length of trains between Melbourne and Adelaide, Melbourne and Sydney, and Sydney and Brisbane to 1800m or longer;
- implement plans to provide double stacking of containers between Sydney and Perth, and Melbourne, and Perth. It is recognised that the Sydney to Brisbane route has existing overhead electric locomotive wiring, tunnels, structures and grades that makes double stacking on this route difficult and costly to implement at this point in time. Any future inland route between Melbourne and Brisbane must provide for double stacking of containers.

Changes to infrastructure standards should be incorporated into long term planning to enable the delivery of High Productivity Trains throughout the Defined Interstate Rail Network. This would increase rail productivity which would also provide lower greenhouse gas emissions solutions.

Transport corridors are congested and more land for transport must be made available

There is an urgent need to make more land available for intermodal terminal facilities and rail transport corridors. Existing terminals and corridors suffer from urban encroachment which has created pressures to limit rail operations, or require additional noise mitigation that are now costly and complex to fix.

These network bottlenecks and terminals limitations affect the service quality and reliability of rail operations. This in turn decreases the attractiveness in the use of this mode as well as lowering its productivity. Modal shift from road to rail can only be achieved if there are rail corridors to allow rail to provide a comparable service to road.

Commitment by government and track owners is required to:

- identify and reserve suitable sites for transport use to meet future intermodal terminal needs;
- identify locations where the existing rail corridor is insufficient for future needs, and protect required additional land from inappropriate developments which may prevent its later use
- require new residential developments within the normal ‘noise envelope’ from rail operations to fund noise walls or other mitigation to allow satisfactory co-existence between residents and rail operations; and
- gazette new transport corridors where identified in the network vision, such as the Inland rail route through the southern part of Brisbane, to maintain future access to this land.

Passenger and freight rail battle for limited network capacity which results in poor network utilisation

In those situations where passenger and freight trains share the network, priority is given to passenger services. Where capacity limits are being reached, this results in significant loss of productivity for rail freight. The best example is in Sydney which has adopted curfews for the arrival and departure of freight services during the morning and evening passenger peaks, both north and south of Sydney. While the planned construction of the dedicated South Sydney Freight Line will assist on the south side, no such separation is planned for the crucial corridor north of Sydney. Rail productivity will continue to be severely constrained as long as Sydney insists on a curfew.

Freight rail is also considered last in the network planning process. Consequently, the 'passenger' rail network is optimised for passenger movements and sub-optimised for freight haulage.

The ownership of metropolitan below rail networks by State governments highly politicises their operations with any daily issues that negatively affect passenger services, resulting in further restrictions on freight rail operations.

For productivity gains to be realised in the rail industry, reform of its structure is required. There needs to be a single national operator of the Defined Interstate Rail Network (DIRN) and further work on separating passenger and freight operations on networks where there are conflicts in optimising the network for one rail market to the detriment of the other.

Infrastructure Investment

The key attributes of service quality for rail are service transit time and service reliability. Service transit time is the ability of the particular service to meet its planned transit time and for these transit times to meet market capacity requirements. Service reliability of on-time departures and arrivals through the whole supply chain are important in ensuring complex supply chains function well, and that trains are able to meet follow on transit departure windows.

Currently rail has difficulty in providing the service quality it requires to gain market share from modal shift. Transit times for the carriage of freight between capital cities in Australia are not competitive with road. Market requirements for freight delivery at certain times and or on certain days can condense rail traffic into peak periods, placing a strain on infrastructure capacity that can negatively affect transit times and reliability. With limited alternative route options in the event of disruption to the rail network, transit times also suffer.

The reliability in being able to provide on time freight departure and arrival in the supply chain is also critical. Rail's ability to provide reliable services that can deal with track maintenance, incidents affecting track network access, weather effects and changes to the planned operation is critical.

With significant investment earmarked for road construction and improvement versus the investment commitment for rail, the service quality competitiveness of rail is currently at a disadvantage.

The National Transport Commission's (NTC) February 2008 paper, *A New Beginning*, is an admission of the previous failings of an integrated transport planning framework in Australia. This NTC report is welcomed as it recognises the need for integrated planning on a national scale. The lack of integration between transport modes, and ineffective planning for freight corridors and whole of supply chain planning has led to a network of individual transport plans that have led to capacity constraints.

Significant immediate increases in investment in rail infrastructure to improve service quality and to provide capacity for the large modal shift from road to rail is required to achieve national emissions reduction targets.

Security of Land Tenure

The security of land tenure for transport infrastructure and supporting freight terminals must be increased. Longer leases are needed to encourage the significant investment required to develop these terminals to provide capacity and improve efficiency. Security from third parties seeking access also needs to be resolved as such issues create investment uncertainty.

Companies will be reticent to invest in infrastructure if this only then supports competitor claims to its use. Clear policy to provide longer term lease options, security of tenure and access to infrastructure assets, is needed to support a national transport plan.

Asset Depreciation

The rail industry operates under very long investment periods for high cost rolling stock. Encouragement is required for early investment in more efficient and low emissions rolling stock prior to the much delayed effect of any carbon price signal. Changes to reduce current depreciation times of 20 to 30 years to much shorter periods would improve the financial justification for earlier technology change.

To encourage early retirement of a large locomotive fleet and its replacement with newer lower emissions locomotives, financial incentives through taxation policy are required.

R&D Incentives

Amendment of the current research and development incentives would assist the industry develop lower emissions technology. Introducing a mechanism to provide 100% rebate on R&D activities into the greenhouse emissions reduction initiatives would encourage innovation in this area.

Congestion Charges

Key road transport corridors experience congestion and this will increase with time. The London congestion charge has assisted shifts to public transport in that city. Applying a similar congestion charge either for key road transportation routes or for large truck entry within metropolitan limits would encourage modal shift to rail.

Appropriate Truck Sizes

The introduction of B Triple trucks in Australia has benefits in moving large quantities of goods with lower emissions. Nevertheless, the carriage of the type of goods most likely carried by B Triples between capital cities is such that these could equally be transported by rail with lower emissions.

The United States has banned B Triple truck movements on federal interstate highways due to safety concerns and on the grounds that these goods can equally be carried by rail. Indeed the carriage of large quantities of goods long distances is the core strength of rail.

In seeking low emissions modal choices, and addressing other externalities such as road congestion, air quality and safety, the most appropriate modal choice must be used for each market. In some cases larger road vehicles will provide justifiable advantages in relieving congestion in port areas or a low emissions solution in the carriage of goods in areas not supported by rail. Further investigation on a policy regarding road vehicle sizes to encourage larger vehicles in the most appropriate circumstances is required.

Mandatory Rail Use Target (MRUT)

The Federal government has introduced a key instrument to drive behaviour outside of the emissions trading scheme. The RET (Renewable Energy Target) as imposed on the energy generation sector with a 20% MRET by 2020, has given a clear signal to this industry well before any emissions trading price signal is available.

An MRUT is an equally viable instrument to drive road transport to rail. Currently Victoria and New South Wales state governments have MRUTs for rail to and from ports. The NSW government has set a target of 40% of freight on rail to and from Port Botany by 2010. The Victorian government has set a MRUT of 30% freight on rail to and from Victoria's ports by 2010.

These State targets are unlikely to be achieved through lack of appropriate rail infrastructure investment, terminal access and capacity, road charging mechanisms, and other policies to drive freight from road to rail. This reinforces that supporting policies on rail infrastructure transport planning, terminal land availability and security of tenure are needed.

Restrictions in road vehicle movements or costs to access ports would also assist in driving modal shift to meet the MRUT.

Extension of such a scheme to key interstate freight corridors would require similar supporting transport planning policies. Consideration is also needed on whether financial penalties or incentives would be appropriate tools to encourage accurate compliance and reporting and increase the price differential between road and rail to drive this modal shift to achieve the MRUT.

5. Climate Policies and the Benefits from Rail

Recent economic research conducted by the Co-operative Research Centre for Rail Innovation demonstrates that the CPRS is not sufficient in itself to meet the government climate change objectives³.

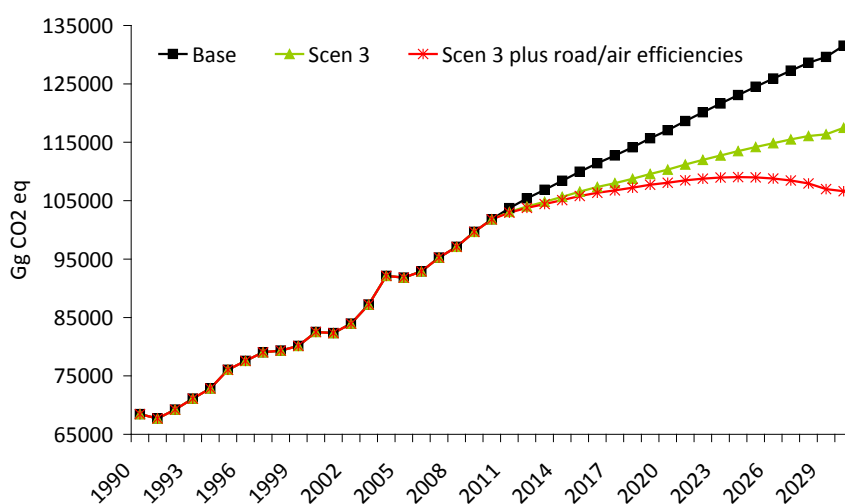
This work identifies that the economic and social costs to Australia of current transport patterns are immense. The social costs arising from transport are estimated at \$52 billion or 5.6% of GDP in Australia in 2005, before including congestion costs. These social costs are mainly due to road transport with rail contributing 9% of these social costs.

³ CRC for Rail Innovation, 2009 – *Transforming Rail: A Key Element in Australia's Low Pollution Future*

Investment and policies that support rail and a cost for carbon from the Carbon Pollution Reduction Scheme if implemented, would provide high social returns and lower emissions. The potential social benefits accruing over 2010 – 2020 are worth \$27.4 billion.

Similar carbon emissions benefits are realised through pricing, complementary policies and investment that drive modal shift from higher emissions transport modes to rail. On a business as usual case, transport emissions will be approximately 30% above their 2010 levels in 2030. Implementation of the CPRS and the introduction of complementary policies and investment in rail would reduce emissions and slow their growth so they would be just less than 5% above their 2010 level in 2030.

Total transport emissions to 2030, base case, scenario 3 (rail policies and investment) and increased fuel efficiency in road and air transport (Gg CO₂-e)



Source: Actual data and projections to 2010, BITRE (2008c); estimates of the authors.³

The benefits of structural adaptation of Australia’s transport use through policy that is cognitive of greenhouse gases supported with a carbon price will provide significant benefits for Australia.

6. Climate Change is Hurting Business

Railways are affected by most extreme weather events across Australia. The CSIRO *Climate Change in Australia 2007 Technical Report*, proposes that significant weather events will become more extreme and/or more regular.

In the current financial year, one major rail operator has experienced a number of significant incidents directly attributable to extreme climate events. Significant incidents include derailments from heat buckling of track, flash flooding destroying track and extreme wind causing double stacked containers to topple. These incidents resulted in derailments that cost the operator Pacific National, in excess \$11.4M in damages. Significant lengthy obstruction of main rail corridors, lost revenue and damage to rail network infrastructure costs are additional.

'Minor' climate impacts from route diversions due to the Victorian bushfires and flooding in north Queensland blocking transport corridors, have also impacted on the costs of operating a road or rail transport company in Australia.

The Victorian Government in its publication, *Climate Change and Infrastructure – Planning Ahead*, acknowledges that infrastructure for a wide range of businesses in Australia is vulnerable to climate change impacts.

7. Conclusion

While the CPRS will have economic costs, Australia should not be ignoring the future increase in economic costs from inaction on climate change. While the CPRS will not address the physical impacts of climate change on transport infrastructure and operations, a start in the reduction of greenhouse gases, with the introduction of the CPRS legislation is necessary for long term sustainability.

Further support from complementary policies are necessary to assist in minimising climate impacts on Australian businesses and support the use of lower emissions transport.

ATTACHMENT A

Summary from the

***ARA Submission to the Senate Economics Committee on
the Exposure draft of the Carbon Pollution Reduction
Scheme legislation***

Summary of the Rail Industry Submission to the Senate Economics Committee Inquiry on the Exposure Drafts of the Legislation to Implement the Carbon Pollution Reduction Scheme

1. Scheme Design

The rail industry supports the introduction of a Carbon Pollution Reduction Scheme (CPRS) and its broad design.

The long term advantages of a carbon price can only be achieved through early implementation of the CPRS.

The rail industry supports an efficient and effective emissions trading scheme which includes all transport, which means there should be no exclusions or offsets.

The CPRS is a valuable mechanism in reducing carbon price but will not be sufficient in itself to meet the greenhouse gas targets.

The most effective way to reduce emissions in the transport sector is through modal shift from road to rail and sea, for both passenger and freight.

Complementary policies for transport are essential to meet the objectives of the CPRS.

2. Transport Issues

Policies that support modal shift from road to rail will not only reduce greenhouse gases in the transport sector but will also significantly reduce the immense social costs from the transport sector.

All rail track owners and rail operators are already experiencing the direct cost impacts of climate change. Australia should not be ignoring the economic costs to businesses of climate change and the adaptation that will be necessary.

3. Scheme Improvements

The rail industry urges the government to further improve the CPRS with the following initiatives:

1. Optimising Rail's Economic and Environmental Credentials

- **Offset intermodal railways fuel to match heavy road transport;**
- **Accelerated taxation depreciation for environmentally friendly rolling stock and infrastructure;**
- **Provide a Climate Change Credit; and**
- **Provide incentives to use public transport.**

2. Climate Change Action Fund (CCAF)

- **Allocate CCAF funds for targeted rail investment; and**
- **Allocate CCAF funds for programs to inform transport choices.**

The rail industry urges the government to implement an improved Carbon Pollution Reduction Scheme in July 2010 to address climate change.

4. Complementary Policies

Substantial and wide ranging complementary policies will be required to eliminate market failures to both reduce the carbon price required and generate a more efficient response, including :

- introduce mass-distance-location charging for large, long distance trucks to ensure all costs are recouped;
- private and public investment in major rail infrastructure;
- develop and implement Standards for rolling stock and infrastructure to reduce costs and improve effectiveness;
- R&D support programs and enhanced depreciation allowances to modernise Australia's rail system and to increase its scale of operations;
- investment in the electrification of large scale rail systems and the linking of those systems to sources of renewable energy.

5. Railways Environmental Contribution

On average, rail transport is around four times as energy efficient as road transport for freight and twice as efficient as for moving people.

Greater use of both passenger and freight rail will benefit business, the environment and the Australian community in general. Rail should be the preferred mode of transport for high volume, long distance freight including:

- all intermodal freight between capital cities;
- bulk freight; and
- mass public transport.

An efficient, effective, safe transport system is required to meet Australia's short and long term needs.

Australia faces significant challenges in meeting transport outcomes including:

- transport capacity;
- greenhouse gases and other pollution;
- operation and infrastructure cost escalation;
- congestion and slowing urban travel speeds;
- vulnerability to liquid fuel availability and price;
- road crashes and health impacts of transport emissions; and
- deterioration of urban amenity increasing funding demands on Treasuries.

Incremental changes alone will not achieve national objectives and fundamental structural changes to Australian transport systems are essential.

Passenger and freight rail must take a much larger proportion of land transport in Australia.

ATTACHMENT B

Information from

***Transforming Rail: A Key Element in Australia's Low
Pollution Future, Final Report***

Co-operative Research Centre for Rail Innovation, 2009

This information is based on “*Transforming Rail: A Key Element in Australia’s Low Pollution Future Final Report*” and supporting papers, by CRC for Rail Innovation, March 2009.

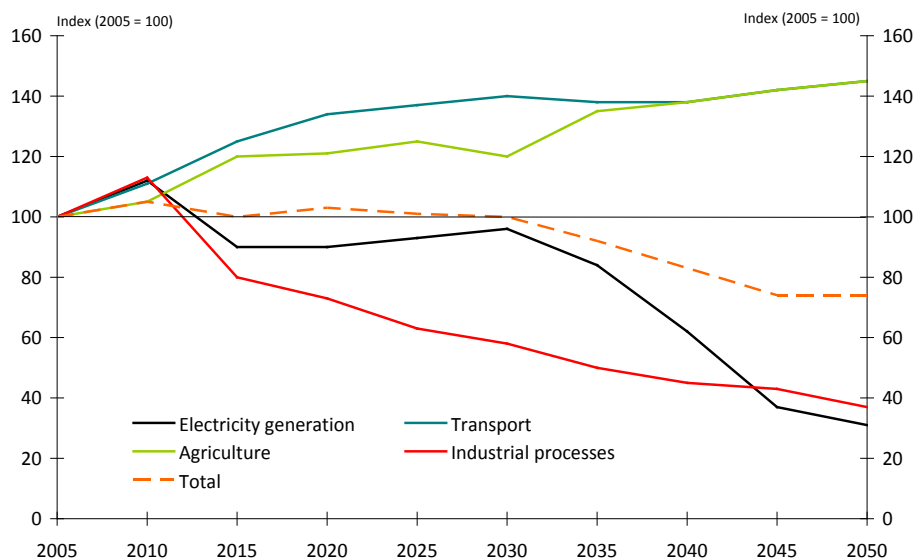
1. Major Arguments

1. Australia cannot achieve its climate change goals to 2030 implied in its recent White Paper without a sharp reduction in transport emissions;
2. These changes will not be achieved by emission trading systems alone; a new generation of transport policies are required to support the massive private and public investment; and
3. Reducing transport emission will require a substantial modal shift from road to rail, as well as lower emissions intensity in all transport modes. A modal shift from road to rail will have large economic, social and environmental benefits.

2. CPRS Emissions Forecasts

Figure 1 summarises the Australian Treasury projections for domestic emissions for the 5% reduction target, with industry emission levels equal to 100 in 2005. This modelling estimates that transport emissions will increase by 40% to 2030 before flattening, if other transport policies stay unchanged.

Figure 1. Industrial sector emissions for Australia, CPRS-5 scenario, 2005-2050



Three factors imply large scale reductions in emissions from domestic industries which are not Emissions Intensive Trade Exposed (EITE⁴) industries will be required:

1. the underestimation of the current level of global emissions;
2. the difficulties in shifting virtually all of the absolute reduction in Australia’s emissions up to 2030 offshore; and
3. the profound implications of the EITE scheme for other industries.

⁴ EITE industries receive favoured treatment in the form of free or cheap permits due to international competition from competitors in countries not subject to carbon costs

If the EITE industries grow at 3% per annum over 2010-20 and Australia’s target is for a 5% reduction in emissions by 2020 relative to 2000, the allocation for all other industries falls by 29.4% between 2010 and 2020. Therefore non EITE industries (including rail) will be required to make the larger share of abatement and at higher cost to business, the community and the general Australian economy.

3. Estimation of Benefits

The CRC research project developed a model to investigate the benefits and costs of three scenarios representing different transport policies over the next 12 years to 2020, compared to the base case as proposed in the Treasury modelling. The three scenarios were:

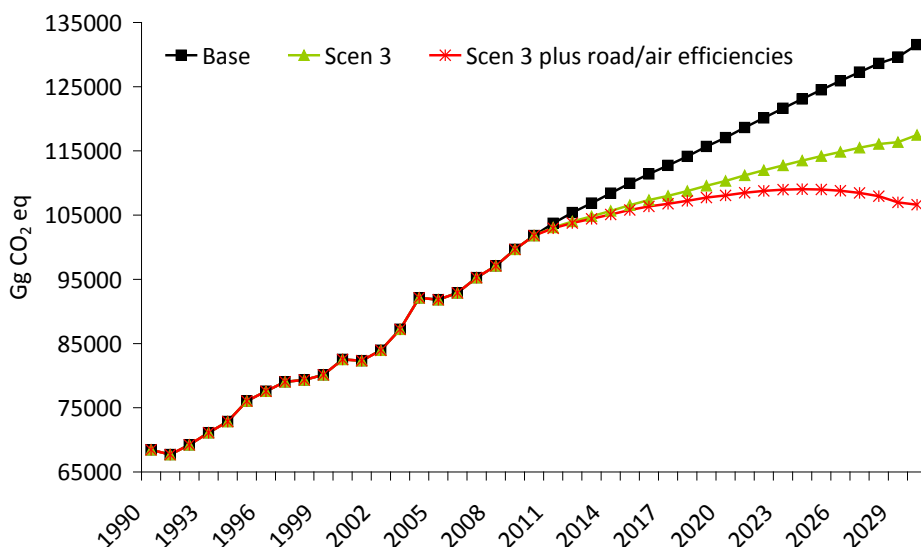
1. No increase in truck tonne-km after 2010; all growth in freight carried by rail;
2. 50% of 2010 - 2020 passenger growth is provided by public transport (70% rail, 30% bus); and
3. Scenarios 1 and 2 plus increased electricity and renewable energy for rail.

The practicability of these scenarios have not been tested, but represent possible strategic changes in transport policy directions.

Transport Greenhouse Gas Emissions Reductions

The estimated effects of Scenario 3 on total transport emissions are summarised in Figure 2. Total transport emissions are about 11% lower than in the base case by 2030. If account is also taken of further action to reduce emissions intensity levels in road and air transport, then total transport emissions are about 19% lower than the base case by 2030.

Figure 2. Total transport emissions to 2030, base case, scenario 3 and increased fuel efficiency in road and air transport (Gg CO₂-e)



When freight tasks are modified as in Scenario 1 the emissions savings are estimated at 3.8 Mt CO₂-e; when an increase in rail passenger traffic alone is achieved (Scenario 2) annual greenhouse gas emissions are reduced by about 2.3 Mt CO₂-e; and when increased electrification and greater use of renewable energy is added to the passenger and freight changes (Scenario 3), then there is about 6.8 Mt CO₂-e less greenhouse gas emitted annually by 2020 (see Table 1).

Table 1. Greenhouse gas emissions (Mt CO₂-e) benefits from investing in rail

Greenhouse gas emissions reductions (Mt CO₂-e per annum)	Scenario 1	Scenario 2	Scenario 3
2020	3.8	2.3	6.8

Time Savings and Reliability Improvements

Other non-financial business benefits of the three scenarios are also shown in Table 2, which indicates substantial savings in both journey time and increases in reliability would occur on both the North-South and East-West corridors.

Table 2. Time and reliability benefits from investing in rail infrastructure

Non-financial Business Benefits	Scenario 1	Scenario 2	Scenario 3
North-South corridor			
Hours saved from upgrades	23	23	23
Reliability increase	35%	35%	35%
East-West corridor			
Hours saved from upgrades	26.1	26.1	26.1
Reliability increase	30%	30%	30%

Social Benefits

Table 3 indicates substantial annual savings in social effects; accidents, noise and air pollution (excluding climate change) of the scenarios in 2020.

Table 3. Reduction in social costs in 2020 (\$ billion)

Social effects	Scenario 1	Scenario 2	Scenario 3
Accidents	0.58	1.04	1.62
Noise	0.12	0.09	0.20
Air pollution	3.37	0.11	3.48
Total	4.06	1.23	5.30

Total Benefits

Table 4 shows a reduction in annual operating costs of at least \$1.8 billion all scenarios by 2020 compared to the base case, with this benefit reaching \$4.3 billion in Scenario 3. Social costs, such as noise and air pollution, are reduced by at least \$1.5 billion compared to the base case, with a total of \$5.3 billion in Scenario 3. Climate change costs when compared to the base case are reduced by \$0.12 billion to \$0.34 billion. The overall benefit for the year 2020 ranges from \$3.8 billion in Scenario 2 to \$10.0 billion in Scenario 3.

Table 4. Summary of benefits: Annual benefits in 2020 (\$ billion)

	Scenario 1	Scenario 2	Scenario 3
Total reduction in operating costs	1.88	2.44	4.32
Total reduction in social costs (ex. climate change costs)	4.06	1.23	5.30
Total reduction in climate change costs	0.19	0.12	0.34
Total benefits	6.14	3.79	9.96

Using a conservative real discount rate of 10% per annum, the net present value in 2010 of the benefits accruing over 2010-20 ranges from \$16.8 billion to \$27.4 billion, as shown in Table 5. Substantially higher returns result for lower discount rates.

Table 5. Net present value in 2010 of total benefits over 2010-20, relative to the base case (\$ billion, constant prices)

Discount Rate	Scenario 1	Scenario 2	Scenario 3
4%	25.6	16.1	41.7
7%	20.6	13.0	33.7
10%	16.8	10.6	27.4

The benefits included in the net present value calculations only extend to 2020, and these benefits will also accrue for many subsequent years. The benefits illustrate the magnitude of the economic and social costs being imposed on Australia by the transport patterns that have built up since the Second World War, and hence the benefits that can be gained by even partially reversing those trends.

4. Investments to Achieve the Benefits

It has not been possible to quantify the costs of the many and varied investments required, although some important components (the rail freight track component for the North-South corridor) have been costed by the ARTC at \$4.9 billion. Overall it is likely that an investment of the order of \$15-20 billion (in constant prices) over 2010-20, or \$1.5-2.0 billion per annum, would be required to achieve the outcomes.

The growth rates for rail freight are assumed to be in accordance with the expected increases reported by the ARTC. These growth rates will be easily contained within the growth projections of which ARTC report, so the extra rail task is practicably achievable.

Table 6. Annual justified investment to achieve total benefits, for different discount rates
(\$ billion per annum over 2010-20)

Discount Rate	Scenario 1	Scenario 2	Scenario 3
4%	2.9	1.8	4.8
7%	2.7	1.8	4.5
10%	2.6	1.8	4.2

Table 6 shows an annual real level of investment outlay of \$4.2 billion, or an undiscounted total of \$42 billion over the period would be justified by these benefits. This is well above the actual level of investment that is likely to be necessary in practice to achieve the benefits.

Alternatively, the implied social rate of return in 2010 of an upper bound estimate of \$2 billion annual investment , or an undiscounted total of \$20 billion over the period 2010-20 to achieve these benefits has an implied social rate of return on this investment is 50%.

ATTACHMENT C

Background on Transport Policy Context

This section provides information about the transport context, particularly for railways.

1. Current Australian Transport

The serious deterioration in the performance of the transport system, which will occur in the foreseeable future, must be recognised. Australia is potentially at a watershed in Australian rail transport with a triad of unprecedented and unrelenting pressure that cannot be ignored:

- traffic congestion in urban areas;
- climate change and the imperative to stop global warming by reducing greenhouse gas emissions; and
- reduced liquid fuel availability resulting in fuel prices increasing at an unprecedented rate.

Any one of these pressures requires substantial changes to occur. All three of them together demand it. These pressures threaten the sustainability of the Australian community, environment and business. At the same time transport demand is increasing due to commodity exports, increasing GDP and increasing population.

The Issues Paper could be read to indicate that, with reasonable modification, the transport system can meet Australia's future needs with acceptable impacts. The reality is that the transport system will not have sufficient capacity in the infrastructure, rolling stock and vehicles, people and systems to meet future demand and adverse consequences will continue to rise. Australia needs a fundamentally different transport planning and decision making paradigm to address these issues.

Analysis of the transport system⁵ shows that:

- transport fuel use and emissions are amongst the highest per capita in the world;
- more than 1600 people die on our roads and another 30,000 are injured annually;
- average fuel consumption is not decreasing;
- the financial cost of road crashes is over \$20 billion annually (the economic cost is much higher when suffering and other effects are accounted for, but these are too difficult to quantify, so they are ignored);
- traffic congestion in cities costs more than \$10 billion annually;
- it is estimated that transport emissions are responsible annually for
 - the deaths of over 1500 people a year, and
 - over 4,500 cases of asthma and other sickness (since these are 'central estimates' the figures could be 40% higher);
- the cost of death and sickness induced by transport emissions exceeds \$2.3 billion annually;
- personal transport times and costs are increasing as a proportion of available time and disposable income to the extent that transport is contributing to family pressure⁶;
- over three decades there has been no move towards more sustainable modes of transport, until the last two to three years; and
- fuel usage of passenger cars have not decreased for many years.

⁵ Most of these indicators are from published Government reports including ATSB, BITRE WP63, and WP71, etc which can be provided as necessary.

⁶ See for example " *Vulnerability Assessment for Mortgage, Petrol & Inflation Risks & Expenditure*, Dodson & Sipe, Griffith Uni, 2008"

2. Future Australian Transport

Australia continues to improve its transport system, but even with these changes we can expect:

- by 2050 transport emission will comprise more than 66% of nation's entire greenhouse gas emissions target;
- transport congestion costs are increasing at a faster rate than traffic is increasing (a cause for concern in itself);
- in the 15 years to 2005 heavy vehicle congestion costs increased about 50%, while in the 15 years to 2020 it is estimated they will increase by an additional 120%, making a total increase of 230% over 1990 levels;
- traffic congestion in cities will cost \$20-30 billion annually by 2020; and
- road safety is not generally improving:
 - the number of road deaths is not decreasing,
 - the number of serious injuries caused by road crashes is rising (which ATSB has ceased reporting),
 - the number of deaths caused by articulated vehicles is increasing, and
 - the number of serious injuries caused by articulated vehicles is not decreasing.

Australia faces significant challenges in meeting transport outcomes including:

- transport capacity;
- greenhouse gases and other pollution;
- operation and infrastructure cost escalation;
- congestion and slowing urban travel speeds;
- vulnerability to liquid fuel availability and price;
- road crashes and health impacts of transport emissions; and
- deterioration of urban amenity increasing funding demands on Treasuries.

An efficient, effective, safe transport system is required to meet Australia's short and long term needs. Clearly, incremental changes alone will not achieve the target required and fundamental structural changes to Australian transport systems are essential. Compared with historical practice, passenger and freight rail must take a much larger proportion of land transport in Australia. To do so requires many and diverse industry and government activities at substantially higher levels than have occurred previously.

It is not evident that concurrent policy developments will be coherent. That is, one policy decision may be offset or undermined by another decision thereby diluting the value of a seemingly valuable intervention. Undeniably, incremental changes alone will not achieve the outcomes required, and fundamental structural changes to Australian transport systems are essential.

3. Transport System Development

The majority of transport has generally changed very slowly and incrementally for a variety of reasons. Once a system exists, it is very difficult to change it. People involved in an unchanging industry tend to repeat the past, and there have been few transport crises to demand change or quantum leaps in technology to drive change.

There are long time lags that occur in changing the transport system, so it is imperative that structural change commences as soon as possible, because significant effects of change will not be evident for several years. This occurs for several reasons:

- the long life of system elements (eg the average age of locomotives is over 30 years);
- the majority of the structure of transport which will exist in 2050 already exists;
- the inability to change fundamental physical arrangements such as track alignments and locations of intermodal terminals);
- the long time to implement new large transport projects (typically in the order of 10 years or longer); and
- the short term decision making of governments, business and the community.

There is a belief that market based systems will provide optimum business, community and environmental outcomes. While market based systems are a valid mechanism of choice, the reality is that market failures occur, or stakeholder preferences demand different outcomes, and various government or community interventions are required.

Australia has a history of transport system development determined by microeconomic evaluation based on free market principles. This basis has led the nation to its current position where adverse transport system effects (such as congestion, and pollution) are increasing faster than the amount by which transport is increasing. Clearly, future transport system developments must be based on future requirements, not on historical analysis or selective information which restricts the choice of solutions.

While AusLink moved towards more holistic and integrated transport development in principle, in practice there was little change in the decision making process. In addition, AusLink failed to address urban and regional transport issues, due to its focus on intercapital and selected nationally significant transport.

The ARA proposes that the following principles should guide the development of transport policies and programs:

- there should be positive economic, social and environmental outcomes at all levels (not just overall);
- consequences should be equitable and fairly distributed;
- the business burden should be as low and possible;
- any perverse regulatory, market, social or environmental outcomes should be minimised; and
- compensatory mechanisms should be implemented where these principles are not achieved.

Information, such as the indicators identified above, shows these principles are not being achieved.

4. The Role of Railways

Passenger and freight rail provides a numerous benefits to the Australian community, business and the environment including:

- supporting regional communities;
- reducing community health effects;
- minimising environmental consequences;
- reducing the road toll by reducing crashes;
- limiting local government road maintenance;
- limiting road investment demands on Treasuries;
- improving international competitiveness for agriculture;

- reducing road infrastructure costs for state government road authorities; and
- maintaining robust transport systems to suit a variety of futures, including reduced oil availability.

Greater use of both passenger and freight rail will benefit business, the environment and the Australian community in general. Rail should be the preferred mode of transport for high volume, long distance freight including:

- all intermodal freight between capital cities;
- bulk freight; and
- mass public transport.

Rail transport is around four times as energy efficient as road transport for freight and twice as efficient as for moving people. These efficiencies are much higher for tasks with higher demand. Rail is cheaper for all intercapital freight transport. Therefore, any government interventions should maximise the inherent advantages of rail transport to be successful. If Australia is to achieve its transport performance targets, a significant increase in rail transport must be part of the solution. Government policy and infrastructure investment must ensure that rail transport contributes as a key solution in improving transport outcomes.

5. Government Policy Context

It is difficult to develop policy without adequate context and direction for integrated land transport. Overcoming the policy vacuum requires government direction on:

- a strategic plan describing the intended future for integrated and multimodal transport intentions and solutions;
- a comprehensive policy agenda describing the directions to meet future requirements; and
- adequate data and information from which to base strategic and specific activities.

Without this clear context there is a significant risk that individual actions, while appearing beneficial at the micro level, are counterproductive to the desired objectives of the land transport system as a whole. Furthermore, there is a risk that key elements which might provide integrated benefits for the various modes may be overlooked.

The choice of solutions to Australia's transport challenges should occur through a robust transport management decision process, in order to produce a balanced transport strategy which optimises solutions. Unfortunately, this generally does not occur in Australia where transport planning and decision making is characterised by narrow analysis and short term horizons. Therefore, NTC should be investigating new governance arrangements and processes to improve Australian transport.

6. Transport Context and Information

There is insufficient strategic context available about future demands and supply, and analysis of the gap which results, such as:

- future city operation
 - congestion, health, crashes, emissions, travel time, fuel pricing, etc;
- transport demands (which is the driver of system need and provision)
 - population, agriculture, consumer, regional, mining, tourism, etc;
 - safety, reliability, comfort, speed, etc;
 - the size of the future transport task;

- the proportion of the transport task available or possible for rail to transport; the amount of freight which is contestable by road and rail.
- the term 'contestability' should also be critically assessed, because it depends on so many factors;
 - infrastructure and rolling stock
 - life, applicability, deterioration, etc; and
 - system capacity and performance
 - travel time, congestion, safety, health, reliability, cost, etc.

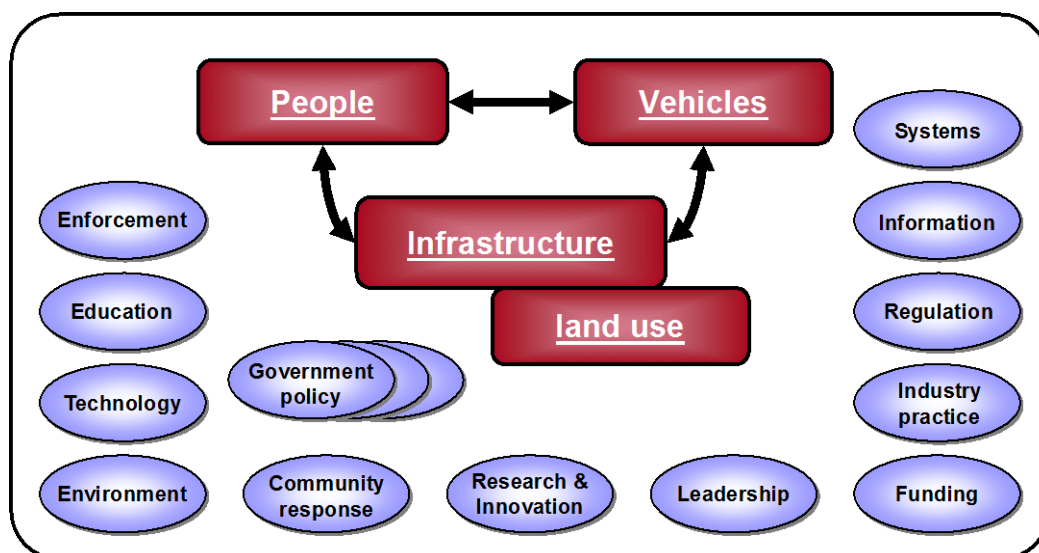
Without this contextual and strategic information the most effective and efficient productivity improvements may not be identified and chosen.

The data and information provided as background to the Paper is too limited to describe the context, industry and issues. Indeed, there is a perception in the rail industry that the Paper conveys the wrong impression about railways and would therefore lead to incorrect and inadequate solutions.

Due to the generalised nature of the context described, specific issues are not evident. For instance, rail carries 53% of the land freight task, a demand which is growing significantly. However, such a statistic hides the shift from rail to road freight for contestable markets such as grain, the difficulty in maintaining market share for intermodal freight transport or the market differences between different corridors.

7. Whole Transport System Perspective

We can consider the railways from a system view, recognising its wider context as a part of transport and wider still to the economy, community and environment, as shown in the following diagram.



The three fundamental elements comprise:

- infrastructure (including land use)
 - track, signalling, stations, terminals ticketing & information systems, stabling, and
 - surrounding urban form, intermodal terminals, passenger interchanges, ports, road and other access, etc;
- rolling stock
 - locomotives, wagons, passenger cars; and

- people
 - users (passengers & freight forwarders) and a wide variety of staff.

These operate in a wider context including;

- community expectations and needs;
- business/commerce and the economy
 - demand and competition, agriculture, mining, services, tourism, etc, sectors;
- the finance sector
 - both private and government including funding and taxation;
- regulation
 - safety, environment, occupational health and safety, access/pricing, business, etc;
- technology
 - mechanical, construction, information communication & control, etc;
- industry practice
 - culture, systems, processes, standards, etc;
- research, innovation, data and information, needs assessment and gap analysis;
- processes for decision making, user choice, planning, by government, private sector and others; and
- leadership
 - risk management, enthusiasm, strategic planning, ensuring capacity and competency, integration, etc.

The benefits (and costs) of overcoming impediments and realising opportunities for each one of these should be considered and analysed for improvements which could potentially benefit rail productivity.

8. Complementary Policies

Due to the diversity and complexity of the transport system there are numerous potential interventions available to governments, such as:

- urban form/land use
 - stations, public transport interchanges, intermodal terminals, access roads etc;
- land use and transport planning improvements and innovations;
- transport system research & data;
- railway research and innovation;
- Government policy, systems, processes and planning for transport land use, the environment, finance, regions, business and other areas;
- procurement strategies;
- staffing and skills;
- demand analysis leading to needs assessment;
- rolling stock age, configuration & suitability;
- required investment levels;
- the role of ownership and control in the logistics chain or value chain analysis;
- proper road pricing
 - especially earlier introduction of mass-distance location charging; and
- financial arrangements (eg accelerated depreciation for rolling stock and infrastructure).

9. Market Based Transport Systems

Market principles and systems often provide a valid basis for the provision and operation of transport in Australia. However, these systems should not be relied on unquestionably as they are evidently imperfect, due to:

- inability to price all benefits and costs accurately;
- inability to include all externalities appropriately;
- difficulty in including social and welfare benefits;
- business influences such a ownership control and contractual arrangements;
- difficulty in balancing 'winners and losers';
- political influence; and
- other specific occurrences of traditionally recognised market failures.

There is no subsidisation given to rail operators to use the rail network. In contrast, road networks are shared with individual private users and their cost input to the use of the road network cross subsidises road investment. Concerns regarding road congestion and commuter transit times encourages or forces road investment, which then benefits road freight transport. From a greenhouse gas emissions perspective, this road freight subsidy has negatively distorted the outcome to favour road transport over more carbon efficient rail transport.

The costs for accessing rail and road infrastructure and the externalities that result from congestion costs, accidents, and environmental impact are certainly not recovered by road user charges when compared to rail. NTC should examine the true costs in providing transport network infrastructure to ensure that the full costs and cross subsidisation is understood so policies can be clearly considered to ensure that inefficient investment and pricing disparities between competing transport modes are removed.

ATTACHMENT D

Adapted from

**ARA Submission to Carbon Pollution Reduction Scheme
Green Paper**

Summary

The Rail Industry's Position on Emissions Trading

The rail industry must play a positive role in responding to climate change issues.

- the rail industry must improve the environmental performance of its activities by using existing technology, which will further reduce its emissions to lower levels (zero if using electricity from zero emissions sources)
- increased rail use, relative to total transport use, will positively improve environmental outcomes including reducing the impact of climate change.

Rail industry supports an emissions trading scheme which includes all transport which means:

- excluding transport from the emissions trading scheme will threaten the integrity and viability of scheme and therefore the ability of Australia to reduce emissions to acceptable levels.
- excluding transport from the emissions trading scheme will transfer the burden of cost to other sectors and increase costs in those sectors to higher and disproportionate levels.
- excluding transport will not reduce the cost of emissions trading to Australia, but will merely increase the costs on a narrower group of industries (including domestic electricity).

The government should include in its legislation the ability for companies to pass on reasonable carbon permit costs if contracts don't have existing means to do so.

Emissions reporting for companies with a permit liability should not be required at facility level and is instead reported at entity level.

The government should use the revenue from the auction of the emissions trading permits to facilitate even greater environmental benefits by supporting energy efficient industry, including rail.

With respect to the CPRS as outlined in the Green Paper, the rail industry proposes the following specific measures to optimise the effectiveness of the CPRS and mitigate transport's impact on climate change.

Improvements to the Carbon Pollution Reduction Scheme

1. Optimising Rail's Economic and Environmental Credentials

- **Offset intermodal railways fuel to match heavy road transport**
Intermodal rail carrying contestable freight, should be granted the same offset of emissions costs which are to be granted to heavy road transport. A subsidy of the carbon price for heavy road transport provides competitive cost advantage to road over rail. This subsidy will drive shippers to use energy intensive trucks increasing greenhouse gases, and result in further market share loss from rail that will take many years to recover.
- The average age of Australian rail rolling stock is more than 30 years resulting in opportunities for significantly improving environmental performance. Sympathetic taxation arrangements will encourage the introduction of new technology to speed faster deployment of environmentally efficient investment.
Accelerated taxation depreciation should be introduced for new, environmentally friendly locomotives and wagons, and for infrastructure within the rail industry.

- **Provide a Climate Change Credit**

Freight forwarders should be encouraged to use rail for contestable freight instead of more emissions intensive transport. This arrangement places the incentive on those who decide the mode of transport, and equalises the offset provided to road transport industry.

Taxation measures should be introduced to provide incentives for freight forwarders to use rail instead of more emissions intensive transport, by offsetting emissions costs.

- **Provide incentives to use public transport**

Employers should be encouraged to maximise the environmental advantages of using public transport.

Taxation measures should be introduced to provide incentives for employers to encourage employees to use rail public transport.

2. Climate Change Action Fund (CCAF)

- **Allocate CCAF funds for targeted rail investment**

Investment in railway facilities and rolling stock would advance the climate change agenda and improve productivity. This would include the use of alternative fuels, hybrids and new technologies.

- **Allocate CCAF funds for programs to inform transport choices**

There are several products which provide information to users about the consequences of their travel choices. Schemes such TravelSmart and internet carbon calculators change user's behaviour resulting in cost effective environmental benefits. Other transport and environmental information would assist freight forwarders and developers to better integrate land use and transport resulting in lower emissions.

1. Background

The rail industry welcomes the introduction of a Carbon Pollution Reduction Scheme into the Australian economy. The need to reduce greenhouse gas emissions is urgent and the introduction of a Scheme that drives Australia to a lower emissions target is needed.

The rail industry provides the following comments in relation to the design of the Scheme which in its early design phase could benefit from the consideration of a number of factors and amendments, to ensure its long term success.

The Role of Rail

Greater use of both passenger and freight rail will benefit business, the environment and the Australian community in general. Rail should be the preferred mode of transport for high volume, long distance freight including

- all intermodal freight between capital cities;
- bulk freight; and
- mass public transport.

Rail transport is around four times as energy efficient as road transport for freight and twice as efficient as for moving people. These efficiencies are much higher for tasks with higher demand. Therefore any climate change legislations should maximise the inherent advantages of rail transport to be successful. If Australia is to achieve its emissions reduction targets, a significant increase in rail transport must be part of the solution. Government policy and infrastructure investment must ensure that rail transport contributes as a key solution in reducing transport emissions.

Principles

The ARA proposes that the following principles should guide the development of climate change policies and programs:

- there should be positive environmental outcomes at all levels (not just overall);
- consequences should be equitable and fairly distributed;
- the regulatory burden should be as low and possible;
- any perverse regulatory, market or environmental outcomes should be minimised; and
- compensatory mechanisms should be implemented where these principles are not achieved.

At present there is insufficient information available about the energy and emission policy proposals (including emissions trading), the legislation and the transport systems to determine whether these principles will be achieved.

1. The Rail Industry's Position on Emissions Trading

The rail industry must, and is in a prime position to play a positive role in responding to climate change issues.

- the rail industry must improve the environmental performance of its activities by using existing technology, which will further reduce its emissions to lower levels (zero if using electricity from zero emissions sources)
- increased rail use will positively improve environmental outcomes including reducing the impact of climate change.

Rail industry supports an emissions trading scheme which includes all transport which means:

- excluding transport from the emissions trading scheme will threaten the integrity and viability of scheme and therefore the ability of Australia to reduce emissions to acceptable levels.
- excluding transport from the emissions trading scheme will transfer the burden of cost to other sectors and increase costs in those sectors to higher and disproportionate levels.
- excluding transport will not reduce the cost of emissions trading to Australia, but will merely increase the costs on a narrower group of industries (including domestic electricity).

Railways with substantial emissions should have the choice to purchase and acquire emissions permits directly. Railways with small emissions and other transport (including trucks and cars) should pay for emissions permits downstream (eg at the point of purchase of fuel).

The government should use the revenue from the auction of the emissions trading permits to facilitate even greater environmental benefits by supporting energy efficient industry, including rail.

2. Liquid Fuels

The emissions that result from liquid fuels are a considerable part of Australia's greenhouse gas emissions. These fuels, by their nature of being easily transportable, are used significantly in the transport sector. The Green Paper suggests a number of design elements specifically related to liquid fuels. The rail industry has concerns with some of these elements which it believes diminishes the aims of the Scheme.

One new and surprising introduction into the Carbon Pollution Reduction Scheme which appears at odds to its whole economic principle, relates to the protection of road users and in particular Heavy Vehicle Road Users of the carbon costs.

Including all Transport in the Carbon Pollution Reduction Scheme

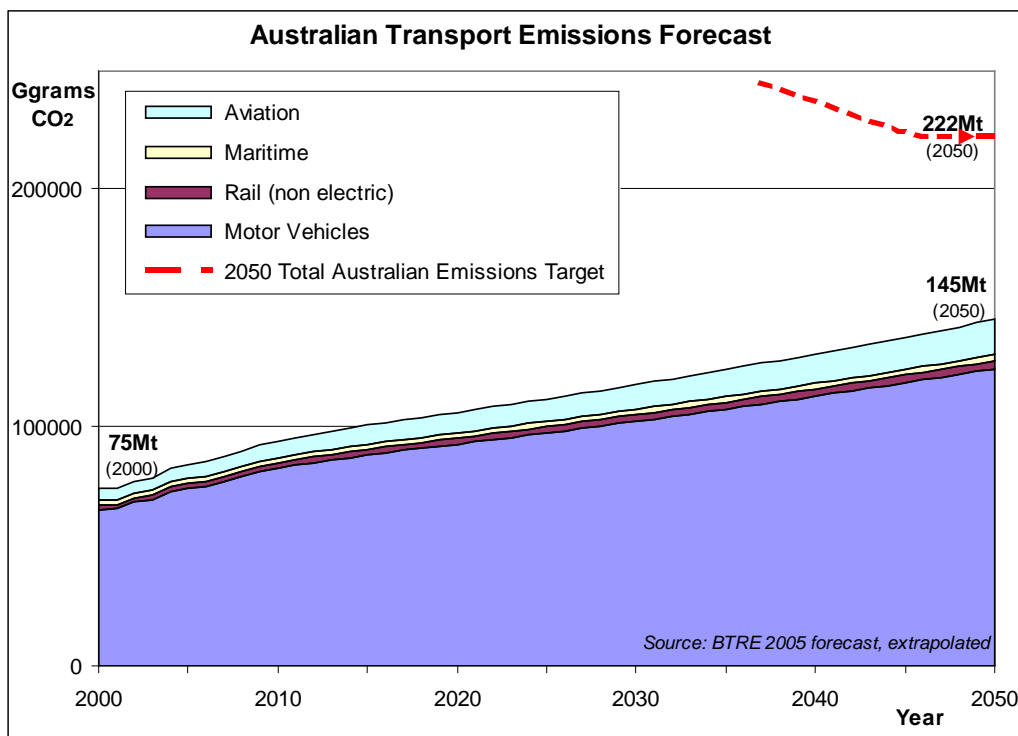
It is self evident to market economists and transport planners that transport should be included in the Carbon Pollution Reduction Scheme. Professor Ross Garnaut in his Draft Report (June 2008) states:

"an effective market-based system will be as broadly based as possible, with any exclusions driven by practical necessity and not by short-term political considerations. It will include transport and petroleum products. This will allow abatement to occur in the enterprises and industries and regions in which it can be achieved at lowest cost."

"The emissions trading scheme and associated mitigation policies will contribute to large structural change throughout the Australian economy. The changes will be most profound in the sectors in which emissions are most important—first of all energy, and then transport, and agriculture and forestry."

"The more sectors included in the emissions trading scheme, the more efficiently costs will be shared across the economy. The transport sector should be included."

Interpretation of Australian Government data⁷ indicates that if there is no significant new intervention, emissions from the transport sector alone will comprise over 66% of the target for all Australian emissions in 2050 (ie 40% of year 2000 emissions).



Clearly, incremental changes alone will not achieve the target required and fundamental structural changes to Australian transport systems are essential. Therefore, the rail industry accepts the policy agenda to address climate change issues and the general parameters of the policies outlined by the Australian Governments various activities.

Protection of Heavy Road Vehicles Users

The Green Paper has devoted much thought and consideration to the protection of vulnerable business. These vulnerable businesses have been categorised as Trade Exposed Emissions Intensive and Strongly Affect Industries. Contrary to the proposed Carbon Pollution Reduction Scheme design in having mechanisms to assist these businesses in transitional phases of the Scheme, the Government has introduced a new category of vulnerable businesses, namely those that operate heavy road vehicles.

The concept of having a Scheme that embraces as many sectors as practically possible in the economy is immediately compromised by removing categories of energy use from the Scheme and the protection of a select part of an Industry. Other members of the Transport Industry who compete with Heavy Vehicle Road Users are immediately put into a position of competitive disadvantage with an industry sector that is the most inefficient transport mode in respect of emission per tonne kilometre.

Intermodal rail, which carries container freight between the interstate capital cities is much more energy efficient than heavy vehicle transport. Intermodal rail emissions are at least

⁷ *Greenhouse Gas Emissions From Australian Transport: Base Case Projections to 2020*, Bureau of Transport and Regional Economics (BTRE), Report for the AGO, DEH, August 2005

three time lower than heavy vehicle road transport, even when the road pick up and delivery of the goods at either end is taken into account. Therefore, the introduction into the Carbon Pollution Reduction Scheme of a new design element that lowers the competitive position of the most greenhouse favourable mode of transport is absolutely incongruous with the intent of the Scheme.

The protection of Heavy Vehicle Road Users in the Carbon Pollution Reduction Scheme will result in the rail freight industry losing market share to road, which achieves the total opposite of the desired outcome. While the protection to road may be reviewed after one year, such protection is notoriously difficult to remove. It is rail's experience that after such price corrections, it still takes many years for rail freight market share to recover.

The key climate change ramifications of this decisions is that this resulting transfer of rail freight to road will result in an additional 10,500 tonnes per annum of greenhouse gases emitted into the atmosphere each year. With a number of years to recover market share, this amount will extend to an estimated 28,500 additional tonnes as a result of one year of protection of the heavy vehicle road users, in addition to the lost opportunities of decreasing emissions during this period.

The ARA concurs with Professor Ross Garnaut who stated in his presentation of his Supplementary Draft Report on 5 September 2008, that all fuel should be included in the Carbon Pollution Reduction Scheme from day one and there are no good reasons not to do so. While the government may be reticent to remove the protection of the fuel carbon costs from road users, on-road business users and heavy vehicle road users, then at least parity on this position should be given to those in direct competition.

The ARA submits that any compensation for the ETS impacts should be delivered independent of fuel costs (ie nil or minimal fuel subsidies) so as to ensure parity between and greater incentives to reduce emissions across all sectors of the high-emitting transport industry.

Market Failures and Distortions

Government policies and the decision to offset the emissions cost for road transport results in some bizarre market failures and distortions, including:

- car driver's costs will not change, but rail public transport costs will increase;
- road freight charges will not change, but rail freight costs will increase;
- CPRS charges are not market linked to public transport pricing or provision of infrastructure;
- car owners CPRS costs are discounted by tax rebates or payments by others (eg when used for business purposes);
- international flagged shipping carrying domestic cargo won't pay the CPRS charge, but competing rail and local shipping will incur the charge.

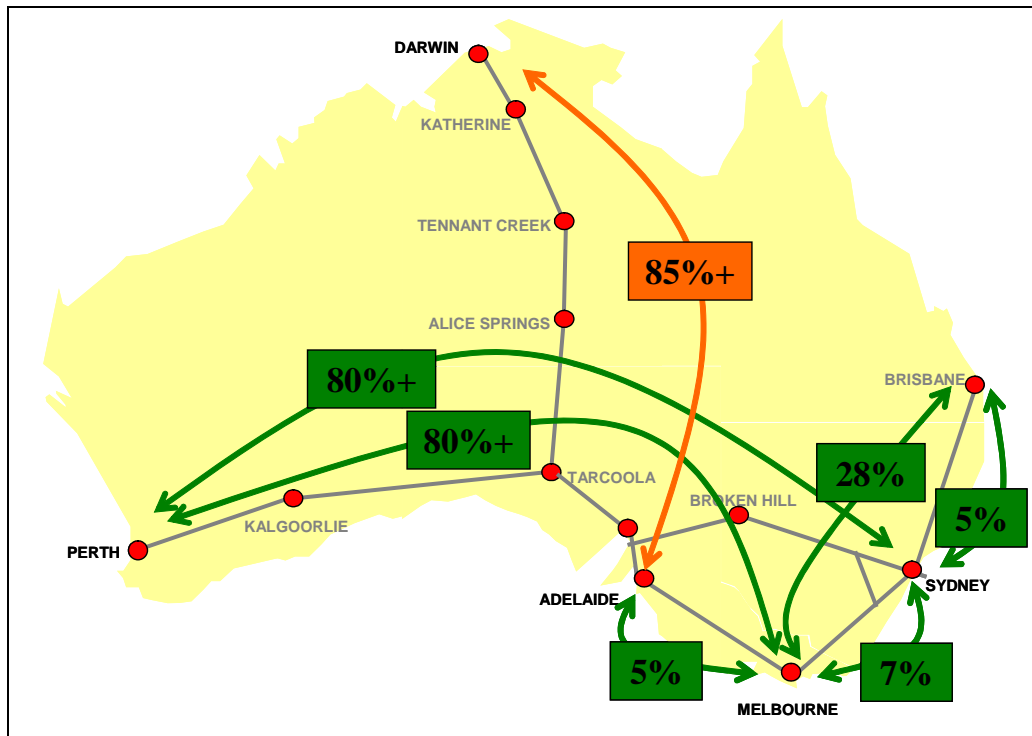
The changes in behaviour that the market costs are intended to achieve cannot occur if the market is distorted in these ways. The result of these distortions is that the CPRS will be inefficient and the outcomes will be more costly to achieve.

Road and Rail Competitive Freight Environment

The competitive position between road and rail is active and real on the main North South transport corridor. This corridor covers the goods moved between Melbourne – Sydney, Melbourne – Brisbane, and Sydney – Brisbane. Due to underinvestment in the rail infrastructure on this North South corridor, the market share held by rail is very low

compared to the Intermodal market share held on the corridor between Perth and the Eastern States.

Rail Market Share of Interstate Freight Movements



The nature of the success in market share for rail on the North South corridor is in direct proportion to:

- its ability to meet key delivery timeframes of the freight market;
- its ability to provide freight goods on time; and
- its ability to carry large volumes and therefore to gain a cost advantage over road.

The introduction of protection to a competitor to intermodal rail will lessen the cost advantage of rail over road, and reduce rail’s competitive position and market share.

The mechanism to protect Heavy Vehicle Road Users from carbon price impacts and not intermodal rail will result in an increase in greenhouse gas emissions. As a bare minimum, parity for these two freight transport industry modes must be maintained to prevent this increase in greenhouse gases.

Optimising Rail's Economic and Environmental Credentials

Intermodal rail carrying contestable freight should be granted the same offset of emissions costs which are to be granted to heavy road transport. A subsidy of the carbon price for heavy road transport provides competitive cost advantage to road over rail. This subsidy will drive shippers to use energy intensive trucks increasing greenhouse gases, and result in further market share loss from rail, which is a significantly more carbon efficient mode than road transport, that will take many years to recover. **Therefore the Government should offset intermodal railways fuel to match heavy road transport.**

The average age of Australian rail rolling stock is more than 30 years resulting in opportunities for significantly improving environmental performance. Sympathetic taxation arrangements will encourage the introduction of new technology to speed faster deployment of environmentally efficient investment.

Accelerated taxation depreciation should be introduced for new, environmentally friendly locomotives and wagons, and for infrastructure within the rail industry. **The Government should introduce accelerated taxation depreciation for environmentally friendly rolling stock and infrastructure.**

Freight forwarders should be encouraged to use rail for contestable freight instead of more emissions intensive transport. This arrangement places the incentive on those who decide the mode of transport, and equalises the offset provided to road transport industry. Taxation measures should be introduced to provide incentives for freight forwarders to use rail instead of more emissions intensive transport, by offsetting emissions costs. **The Government should provide a Climate Change Credit.**

Employers should be encouraged to maximise the environmental advantages of using public transport. Taxation measures should be introduced to provide incentives for employers to encourage employees to use rail public transport. **The Government should provide incentives to use public transport.**

Recommendations

Optimising Rail's Economic and Environmental Credentials

- **Offset intermodal railways fuel to match heavy road transport**
- **Accelerated taxation depreciation for environmentally friendly rolling stock and infrastructure**
- **Provide a Climate Change Credit**
- **Provide incentives to use public transport**

3. Contracts & Carbon Permit Cost

While many contracts have some mechanism to pass on increases in energy prices, as these can be a key cost element within the contract, it is likely that very few contracts at this point in time have a mechanism to pass on a carbon permit cost.

The need to consider a carbon permit cost in customer contracts is only a recent consideration for energy users, where for energy creators or suppliers this has been a consideration for some time. As a result, few would have any mechanism for a carbon permit cost pass through to customers at commencement of the Carbon Pollution Reduction Scheme.

When the permit cost remains the liability of the energy supplier, the outcome is an increase in the energy costs which in most cases will be easily pass through the contractual chain from customer to customer.

With the ability for large energy users to Opt In to manage direct carbon permit liabilities, this will only be desirable if the company has the contractual means to pass on this cost. Likewise, where companies have industrial or fugitive emissions for which they must purchase permits and therefore recover costs from customers, they must be able to recover these costs.

Consideration should be given by the Government for legislation that allows companies to pass on reasonable permit costs to customers where there is no existing contractual method to do so.

The government should include in its legislation the ability for companies to pass on reasonable carbon permit costs if contracts don't have existing means to do so.

4. Reporting

The Green Paper canvases the option of requiring facility level reporting of emissions for permit liabilities. Such a requirement is onerous and does not neatly match the reporting requirement for National Greenhouse and Energy Reporting System. The reporting requirements of the National Greenhouse and Energy Reporting System are comprehensive and this System has adequate public reporting requirements.

Total entity emissions reporting for entities managing permit liabilities in the Carbon Pollution Reduction Scheme is more than adequate.

Therefore emissions reporting for companies with a permit liability should not be required at facility level and is instead reported at entity level.

5. Complementary Policies

The transport sector faces unique challenges in achieving emissions reduction. A paucity of alternative fuel options and technologies, and reliance on government investment and policies in support of transport infrastructure all shape the transport choices made in Australia.

The rail industry submits that the government implement complementary policies as an integral element of the Carbon Pollution Reduction Scheme in assisting the achievement of the National emissions target at the lowest cost.

The rail industry proposes the Government introduce a tax credit to freight forwarding companies that use and therefore support lower emissions rail and shipping transport modes. Such an incentive would complement shifts in transport emissions in a sector where the carbon price will have limited effect.

The government should use the revenue from the auction of the emissions trading permits to facilitate even greater environmental benefits by supporting energy efficient industry, including rail.

6. Climate Change Action Fund

There is a need to make structural changes to transport infrastructure in Australia to place it in a position to provide lower emissions solutions. The Climate Change Action Fund would be a useful mechanism in funding some of this structural change.

Transport efficiency is affected by the whole of the logistics chain. Efficient intermodal terminals and ports are essential to maximise efficiency. The interaction between terminals and other transport modes and the removal of barriers to ensure that these transport hubs operate efficiently, can provide greenhouse gas reduction gains in transport. Funds from the Climate Change Action fund should be available to fund the acquisition of land by government to provide transport facilities and corridors in metropolitan areas.

The capital cost of new rail rolling stock is high which has led to the age of the rail fleet in Australia to be above 30 years, where the United States average is 8 years. The low rate of growth of the carbon price expected in the first years of the Carbon Pollution Reduction Scheme will have no effect on modernising the Australian rail fleet. A program of accelerated depreciation on existing rolling stock with funds to be committed to new

rolling stock would introduce lower emissions equipment into the rail fleet. This accelerated depreciation could be funded from the Climate Change Action Fund.

The trial on alternate fuels in locomotives is a prohibitively costly exercise due to the expense of the capital equipment. Some of the solutions being examined internationally may not apply well in an Australian energy context. It is recommended that the Climate Change Action Fund be used to assist in developing future fuels and their application in the rail industry.

Climate Change Action Fund (CCAF)

Investment in railway facilities and rolling stock would advance the climate change agenda and improve productivity. The CCAF should be available to acquire and develop transport facilities and corridors in metropolitan areas, fund the accelerated depreciation of the existing rail fleet to fund a fleet renewal program, and assist the development of alternative fuel or energy solutions in the rail industry. **The government should allocate CCAF funds for targeted rail investment**

There are several products which provide information to users about the consequences of their travel choices. Schemes such TravelSmart and internet carbon calculators change user's behaviour resulting in cost effective environmental benefits. Other transport and environmental information would assist freight forwarders and developers to better integrate land use and transport resulting in lower emissions. **The government should allocate CCAF funds for programs to inform transport choices**

Recommendations

Climate Change Action Fund (CCAF)

- **Allocate CCAF funds for targeted rail investment**
- **Allocate CCAF funds for programs to inform transport choices**

7. Climate Change is Hurting Business

In providing an essential a national transport system, the rail industry is affected by most extreme weather events across Australia, which critically affect national business and the Australian community. Climate events are increasingly impacting on business operations and causing operational disasters for railways.

Extreme heat causes the potential rail buckling and therefore trains are slowed to reduce the potential for this buckling unless the rail track is of excellent standard. This means that transit times are extended, train plans are affected and operational costs increase. When buckling occurs there is significant risk of train derailment.

Drought conditions also encourage animals to enter the rail corridor in search of food, increasing the number of incidents of trains striking single or large mobs or animals. This is becoming greater than a weekly occurrence leading to delays and equipment damage as well as livestock deaths.

Extreme wind from storm events blow obstructions onto track and can topple double stacked containers off trains. The heavy rain from these storms creates flash flooding that erodes the track structure causing potential derailments or completely flooding the track resulting in complete stoppages.

For instance in the 2008 – 2009 year, a major rail operator experienced a number of significant incidents directly attributable to extreme climate events: Significant incidents include derailments from heat buckling of track, flash flooding destroying track and extreme wind cause double stacked containers to topple, with all of these incidents causing derailments that cost the rail operator in excess \$11.4m in damages. Significant lengthy obstruction on main rail corridors, lost revenue and damage to rail network infrastructure costs are additional to this \$11.4m of direct damage to rail rolling stock.

‘Minor’ climate events such as diversion due to the Victorian bushfires, collisions with livestock and native animals, flooding in north Queensland and bad weather affecting port operations have also impacted on the costs of operating a transport company in Australia.

Across all track owners and rail operators, these impacts and the cost of climate change will be much higher. While the Carbon Pollution Reduction Scheme will have economic costs, Australia should not be ignoring the economic costs to businesses of climate change and the adaptation that will be necessary.

ATTACHMENT E

**Australasian Railway Association Submission to
*Strategic Review of Climate Change Programs***



AUSTRALASIAN RAILWAY ASSOCIATION INC
Association Number A03958 ABN 64 217 302 489

20 May 2008

Strategic Review of Climate Change Programs
Department of Finance and Deregulation
John Gorton Building
King Edward Terrace
PARKES ACT 2600

Submission to the Strategic Review of Climate Change Programs

I refer to the request for submissions to the Strategic Review of Climate Change Programs. This submission is made by the Australasian Railway Association on behalf of its membership. The rail industry submits that climate change policy concepts and programs need to be carefully considered in order to achieve the best benefits for all Australians.

The rail industry accepts that it has a dual role to play in positively responding to climate change issues by improving its environmental performance and also by carrying a greater share of transport more environmentally efficiently. However, the rail industry submits that there are a range of general and specific issues which need to be addressed during the development and refinement of policy and legislation in response to climate change.

At present there is insufficient information available about climate change policy proposals and the transport systems to determine whether the desired objectives will be achieved. Depending on the energy and environment policies and implementation which are chosen, the consequences for land transport could either positively or negatively affect environmental outcomes.

The rail industry looks forward to continuing to work co-operatively with the Australian Government on issues relevant to the rail industry. It would be greatly appreciated if in future you could liaise with the ARA's Manager Policy, Brett Hughes on (02) 6270 4508 or bhughes@ara.net.au and our other rail industry members throughout Australia.

Yours sincerely

Bryan Nye
Chief Executive Officer



AUSTRALASIAN RAILWAY ASSOCIATION INC
Association Number A03958 ABN 64 217 302 489

Strategic Review of Climate Change Programs

Submission

20 May 2008

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1. Introduction

Rail Industry Overview

Rail should be the preferred mode of transport for mass public transport and high volume, long distance freight. The Australasian Railway Association submits that greater use of both passenger and freight rail will benefit business, the environment and the Australian community in general. Increased rail transport in Australia can result in reduced environmental impacts, fewer deaths and injuries from crashes and health effects, cheaper transport and reduced negative community impacts.

Currently in Australia rail carries 183 billion tonne-km or 53% of the land freight task and 616 million public transport passengers per annum¹. Unfortunately, despite the benefits of rail transport, its mode share for most tasks is not increasing and is decreasing in some critical areas such as east coast intermodal freight and grain transport.

The rail industry does not argue that because it produces only a tiny proportion of transport emissions, which are themselves only a small proportion of Australia's emissions, that it should be excluded in an emissions trading scheme or other government climate change policies. The rail industry accepts that climate change will require many separate interventions jointly contributing to a total solution; there is no 'silver bullet'. The rail industry further accepts that climate change will not be improved by only addressing the large emitters, but also as many of the small emitters as possible.

The rail industry accepts that it has a dual role to play in positively responding to climate change issues. Firstly, the rail industry accepts its responsibility to improve the environmental performance of its activities. Secondly, the rail industry accepts that increased rail transport will positively improve environmental outcomes including reducing the pressure on climate change.

Climate Change Background

Australian transport emissions are increasing at a dramatic rate and at a rate greater in scale than national emissions. With national emissions increasing by Kyoto obligations of 8% between 1990 and 2012, transport emissions increases are significantly out of proportion and have instead increased at a rate of 29% between 1990 and 2005. In a world where there is an urgent requirement to reduce emissions by large amounts, the transport sector with its emissions growth rate will require significant focus and support to move to a negative emissions trajectory and assist Australia in achieving emissions reductions.

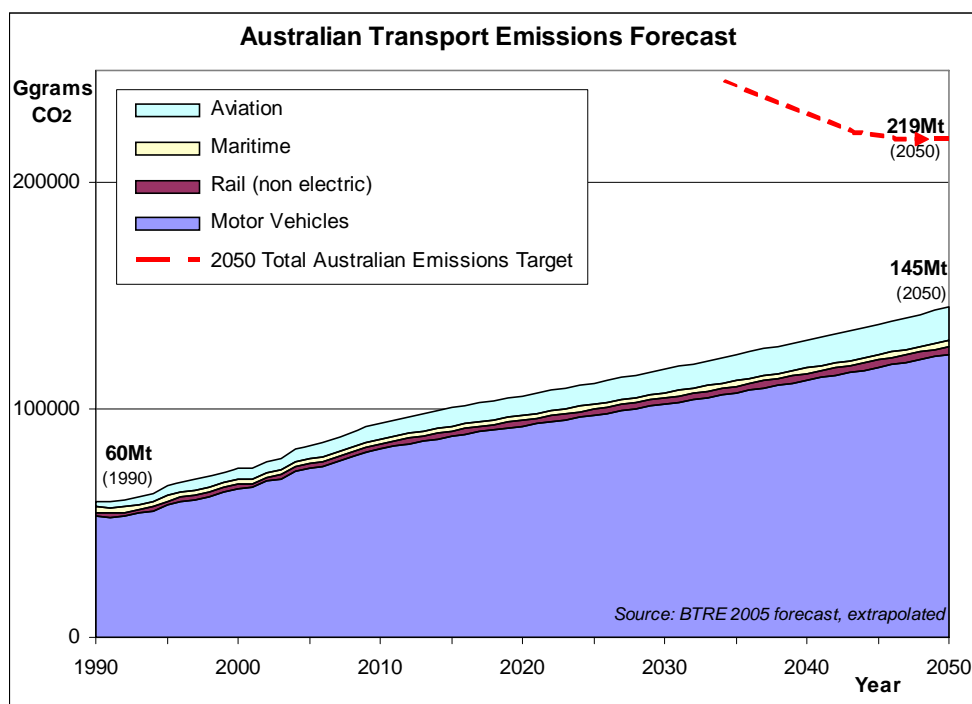
Transport emissions from cars, trucks, trains and aircraft are all increasing and the two key markets for these emissions are the transportation of passengers or freight. Growth in emissions from road transport is projected to be seven times higher than all other forms of transport, between 2010 and 2020, and it is this road transport

¹ *Australian Transport Statistics*, Bureau of Transport and Regional Economics (BTRE) 2007.

emissions growth that can be reduced through appropriate shift of passengers and freight to rail.

The benefits of rail in providing a low emissions rail solution are globally recognised. The United Nations Intergovernmental Panel on Climate Change in their AR4 report released in late 2007, support the use of rail as a transport policy for emissions reduction.

Interpretation of Australian Government data² indicates that if there is no significant new intervention emissions from the transport sector alone will comprise over 66% of the target for all Australian emissions in 2050 (ie 40% of 1990 emissions).



Clearly, incremental changes alone will not achieve the target required and fundamental structural changes to Australian transport systems are essential. Therefore, the rail industry accepts the policy agenda to address climate change issues and the general parameters of the policies outlined by the Australian Governments various activities.

Principles

The Australasian Railway Association proposes that the following principles should guide the development of climate change policies and programs:

- there should be positive environmental outcomes at all levels (not just overall);
- consequences should be equitable and fairly distributed;

² *Greenhouse Gas Emissions From Australian Transport: Base Case Projections to 2020*, Bureau of Transport and Regional Economics (BTRE), Report for the AGO, DEH, August 2005



- the regulatory burden should be as low as possible;
- any perverse regulatory, market or environmental outcomes should be minimised;
and
- compensatory mechanisms should be implemented where these principles are not achieved.

At present there is insufficient information available about the energy and emission policy proposals (including emissions trading), the legislation and the transport systems to determine whether these principles will be achieved.

2. Climate Change Policies

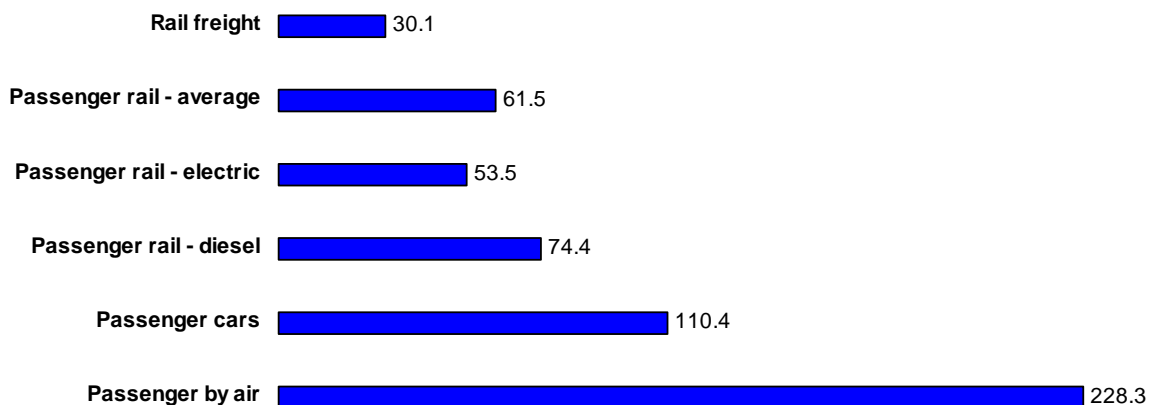
Australia has a challenging task to reduce the forecast dramatic increase in transport emissions, while at the same time not constraining economic activity as a result of prohibitive transport costs. Modal shift to lower emissions transport such as rail can assist in achieving the necessary emissions reduction.

In addition, the transport industry (including the government sector providers) will respond to the changing physical, community and business environment. Climate change will have a range of effects, including different physical conditions for infrastructure and operations, and changing transport demand due to user choices and commodity production (especially agriculture).

Modal Shift Benefits

The lower emissions of rail transport compared with trucks and cars are significant, with rail emissions one third to a half of the emissions from road. While the information below is from the United Kingdom, which has different emissions factors for electricity generation, it highlights the immediate emissions reduction benefits available from modal shift.

Average CO2 emissions by transport mode (grams per passenger/freight tonne kilometre) - United Kingdom

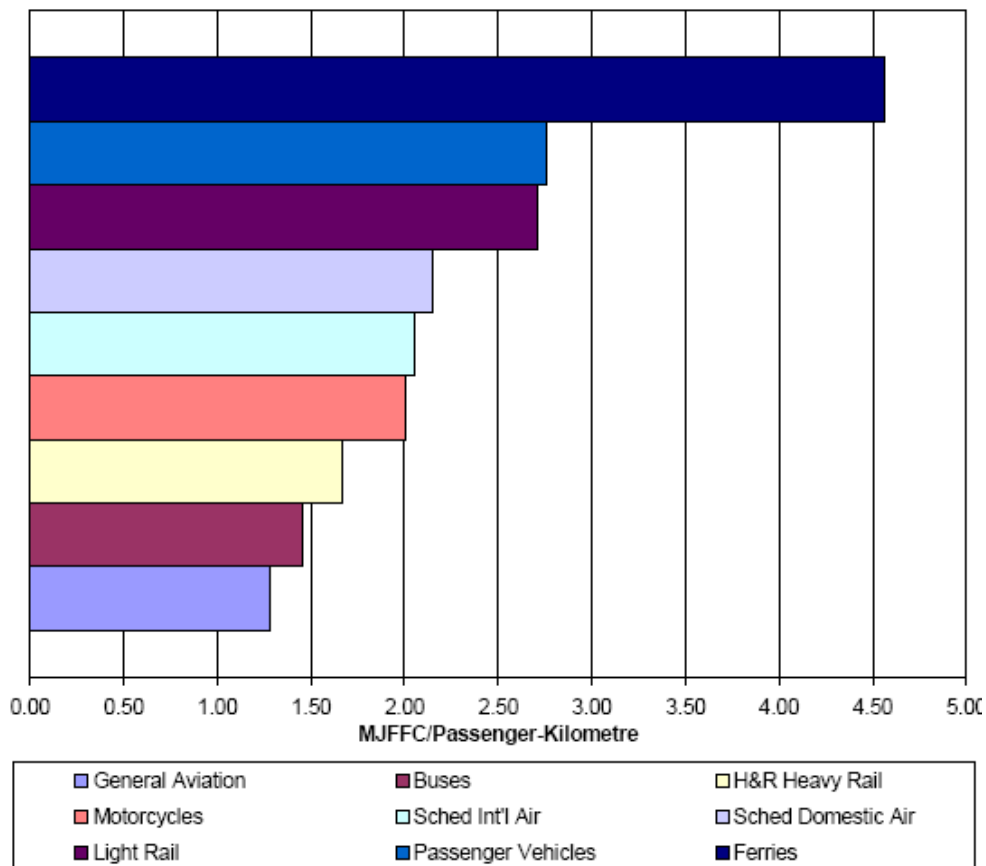


Source: UK Case for Rail 2007

The passenger road versus rail comparisons for Australia as shown in the diagram below show the benefits of rail transport.



Energy Intensity in Undertaking Passenger Task 2004/05



Source: Australian Rail Transport Facts 2007, Apelbaum Consulting Group

Passenger Rail

Barriers for the adoption of low emissions rail transport unless addressed, will prevent the use of low emissions rail solutions. The key barriers for increased passenger rail use are the lack of infrastructure and availability of services to widen the catchment area of public transport.

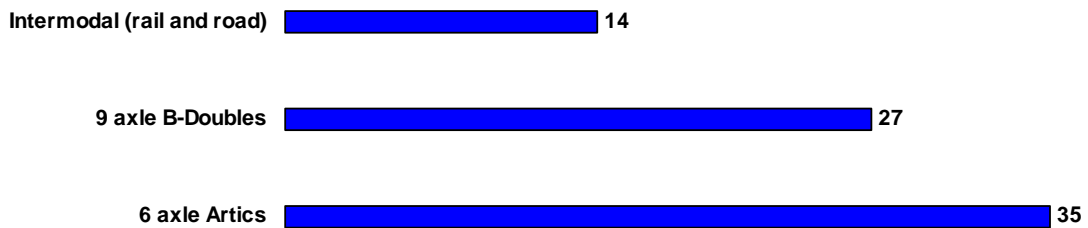
If sufficient infrastructure were in place rail would have the ability to command a greater percentage of the national transport market and therefore lessen the demand for Australia's energy resources and reduce transport's greenhouse, environmental and social impacts.

Land use planning and the built environment can be managed more effectively through Transport Orientated Development (TOD) with appropriate design of modal points to allow transport interchange with higher reliance on public transport. Built environments that support the creation of 'Sustainability Hubs', where people can both live and work in close proximity to public transport would see patterns of transport behaviour change over time.

Freight Rail

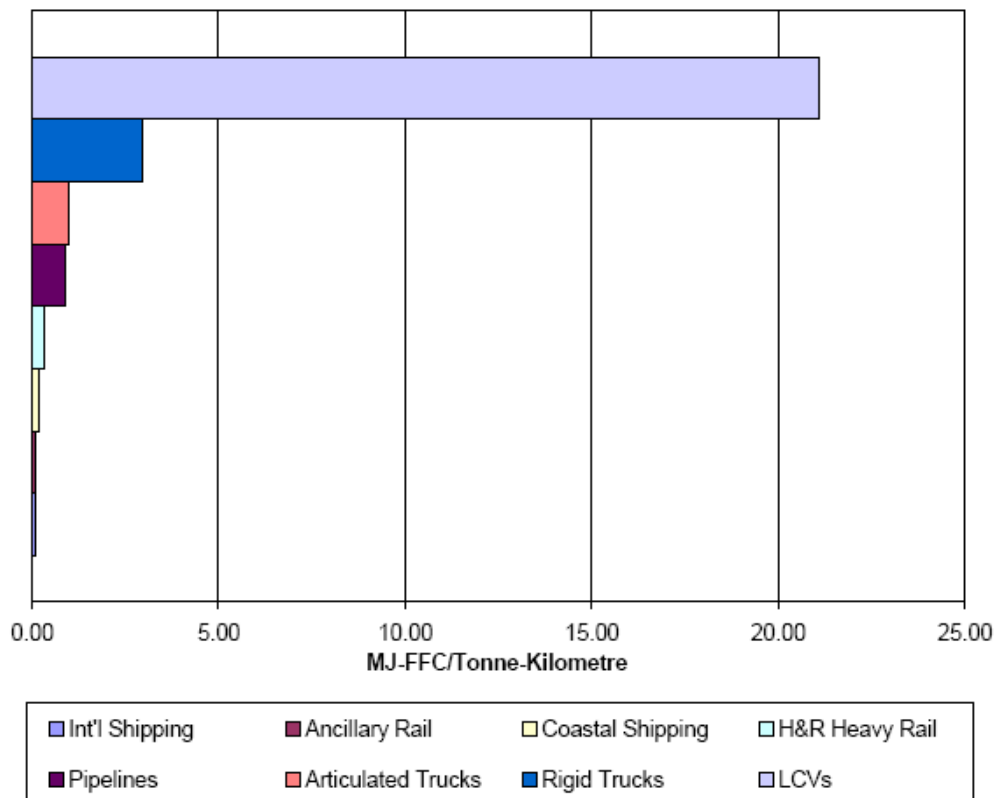
In comparing rail freight emissions with road freight, and including additional emissions for rail with road pick up and delivery of goods at the origin and destination, rail provides a marked emissions reduction benefit for the same quantity of goods moved.

Average Australian CO₂-e emissions Road and Intermodal Rail Freight (grams per net tonne kilometre)



Source: QRNA Oct 2002 Report – Comparison of Greenhouse Gas Emissions by Australian Intermodal Rail and Road Transport

Energy Intensity in Undertaking the Freight Task 2004/05

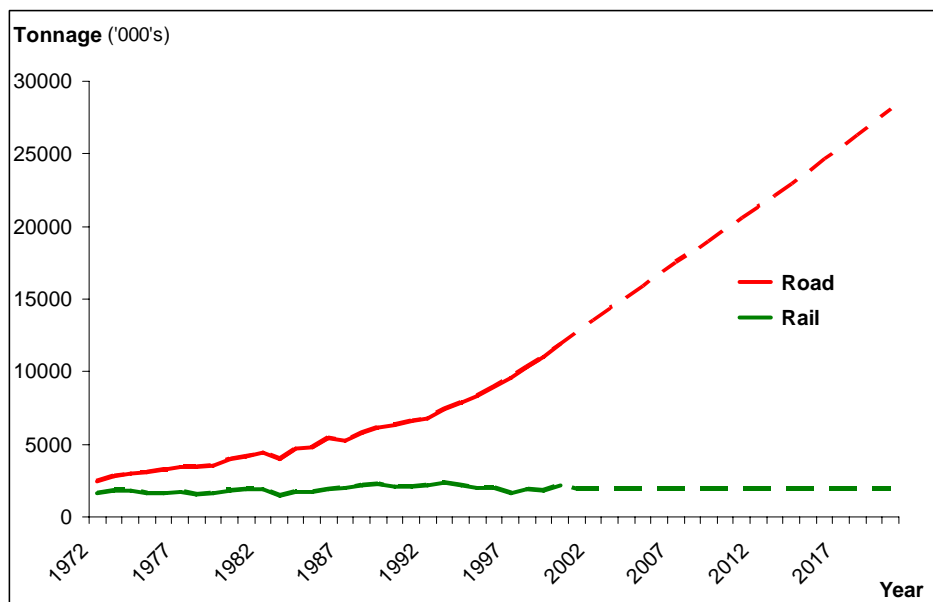


Source: Australian Rail Transport Facts 2007, Apelbaum Consulting Group



Interstate rail freight for many demands has been declining, especially on the East Coast of Australia and for lower tonnages in regional areas. Even for long distance intermodal transport, rail demand between Melbourne, Sydney and Brisbane has only marginally increased, while road transport has dramatically increased³. Without significant government intervention, this unsustainable trend is expected to continue, as shown in the following diagram. In 1972 the proportion of land freight carried by rail between Eastern States capital cities was 39%, which is expected to decline to 6.5% by 2020 if current directions and initiatives continue. Over the period 1972 to 2020, rail freight is anticipated to increase by 21%, while road freight is anticipated to increase by 1038%.

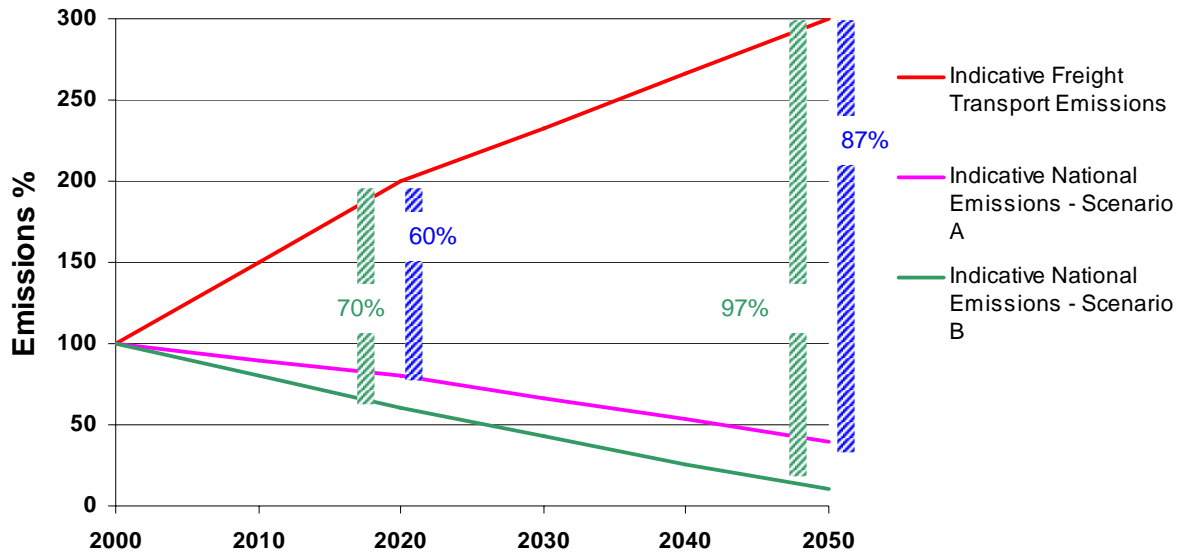
Eastern Corridor Land Freight Task



The modal transport shift from road to rail cannot be under valued. With the freight transport task to double between 2000 and 2020, this increases the quantum of emissions cuts required in the freight transport sector to meet national emissions reduction targets. It will not be possible for road transport to provide the reductions required. The diagram below shows the extent of emissions cuts needed for freight transport in 2020 and 2050 to meet low and high national emissions reduction targets.

³ Extracted from *Freight Measurement and Modelling in Australia*. Report 112, Bureau of Transport and Regional Economics (BTRE) 2006.

Emissions Gap - Freight Transport BAU vs National Emissions Reduction Scenarios



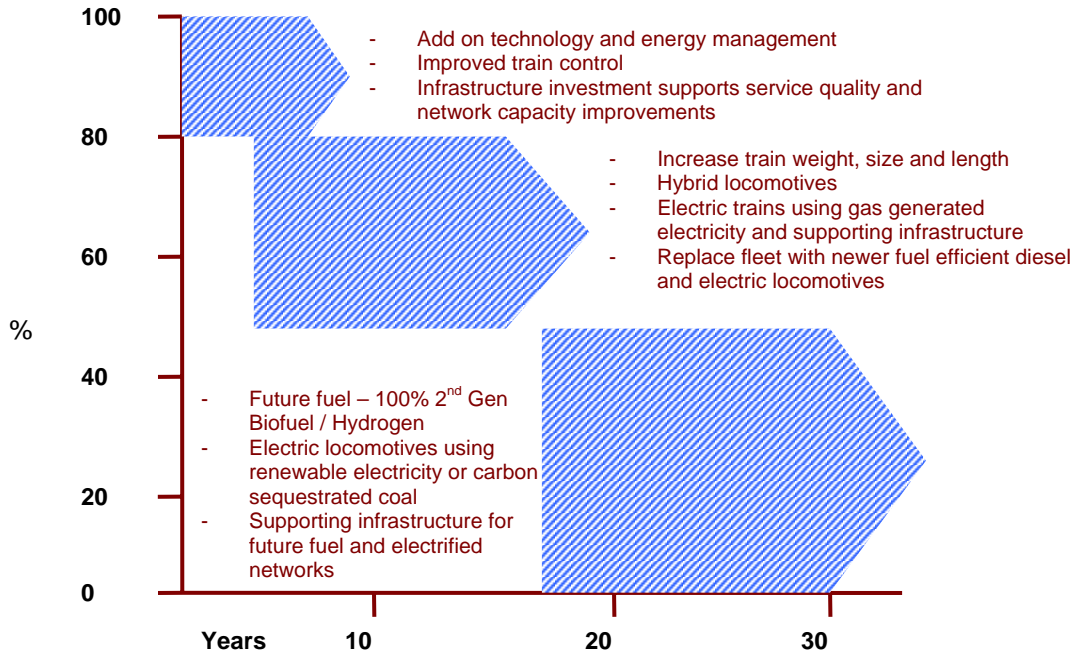
With rail emissions 66% to 50% lower than road, rail can provide the scale of cuts required and meet 2020 targets for the transport sector, if supported with appropriate infrastructure and policies.

Future Emissions Pathway

To meet 2050 emissions reduction targets, rail is in a position to provide further emissions reductions.

There are a number of existing technological options for rail to reduce emissions from their current levels per unit of goods transported. The options involve investment in above rail operations in the operation of trains and below rail investment in the supply of rail network. The following diagram shows options that will reduce rail emissions and allow these to provide a freight transport solution for Australia that meets 2050 national emissions reduction targets.

Indicative Rail Emissions Reduction Options showing Percentage Emissions Reduction and Implementation



3. Policies for low cost freight transport emissions

Policies to support early change to low emissions solutions are needed in the transport industry. The rail market experience is that unless it has the infrastructure to meet market service quality requirements, the price differential between road and rail will need to be quite high, before significant modal shift occurs. Conversely, it is the rail experience that when rail costs increase and the gap between road and rail pricing closes, the rail market volumes quickly transfer to road and are extremely difficult to bring back.

An emissions trading scheme cost will increase the price differential between road and rail transport over time. Delays in waiting for the price point at which significant modal shift occurs, will only serve to delay the early emissions cuts required to reduce transport sector emissions and allow the achievement of national targets. Therefore, policies to support modal shift prior to any emissions price signal are required. The diagram below shows the freight transport emissions at its current business as usual (BAU) trajectory, and the national emissions targets with a low and high reduction path trajectory.

In waiting for emissions price signals only, the freight transport emissions trajectory risks being delayed. Without clear policies on planning, or to support investment and infrastructure, the downward curve of the emissions trajectory will be uncertain. With suitable supporting policies, early action in reducing emissions will occur and allow a greater contribution in meeting reduction targets.

The current example of the coal ship queues in Australia indicates the result when supply chains are not supported by policy, planning or investment certainty and instead rely on price signals. The lag effects in investing in supply chain infrastructure and changing processes and the lack of integrated planning have resulted in lost economic opportunity and additional cost.

Allocation of Emissions Permits Revenue

It is likely that the Australian ETS in isolation will not achieve the full potential to reduce emissions from transport. There are a range of impediments to overcome and initiatives for adaptation which can be implemented which require Government support to accelerate reductions in emissions. The Australasian Railway Association supports the Prime Minister's Taskforce on Emissions Trading suggestion:

"there is merit in the broad principle that revenues raised are best directed to meeting the abatement challenge that has prompted Australia to consider adopting emissions trading."



The commercial environment which rail operates in results in different investment and operating decisions compared to its competitors, which may not always produce optimal economic or environmental results⁴:

The Inquiry recognised that road and rail transport occurs in quite different regulatory, operating and commercial environments. This results in different outcomes for infrastructure investments. In general, governments provide road infrastructure, while a considerable amount of rail infrastructure is provided commercially and privately.

One mechanism is for governments to take some of the risk for new rail investment in the form of rail subsidies, provided there are protections from other pricing distortions, such as profit above a commercial rate.

In general, investment in private railways:

- accepts the risk for investment and charges a commercial premium;
- requires returns over a shorter time period;
- targets a rate of return commensurate with risk;
- are often based on single customers who must therefore pay a risk premium;
- considers internal company returns and ignores external effects such as the environment, unless regulated to do so;
- require a commercial return upon commencement of first use; and
- generally depends on private company capital capacity.

These arrangements are in stark contrast to government funded road investment.

The rail industry operates within sound commercial frameworks and stringent safety and access regulation which result in considerable financial pressure. Business analysis recognises that the lowest volume railway lines may be uneconomic from a commercial rail perspective and more appropriate for road transport. However, environmental and community benefits can accrue if rail is used for transport. Therefore, the challenge is to identify what is financially viable and what in addition, is justified to achieve valuable community and environmental outcomes facilitated by government assistance, which may not necessarily be financial contributions. Given that assistance is required in some circumstances, the challenge is to identify the most appropriate mechanisms for optimising the transport of freight on rail and where they should be applied.

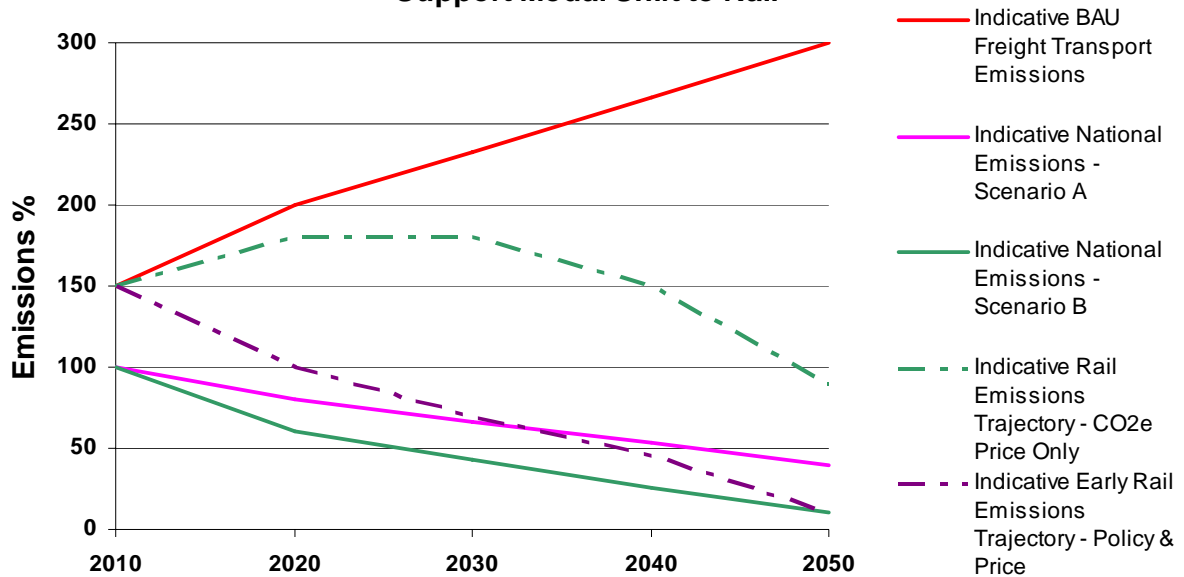
Therefore the rail industry submits that government funds received from permits be allocated to enhance the benefits of the Australian ETS and environmental outcomes generally. Some opportunities for such allocation include:

⁴ WA Government Submission to the Productivity Commission Inquiry on Review of Economic Costs of Freight Infrastructure and Efficient Approaches to Transport Pricing, Submission 122, 2006.



1. An **Interim Track Access Discount** to ensure that above-rail capacity on the Eastern States north-south corridor routes is retained and developed ahead of the AusLink/ARTC investment in the track achieved by offsetting some of the rail track access costs incurred by rail operators on the east coast route. This scheme will retain up to 1.7 million tonnes of freight per annum by rail instead of road increasing the market mode share by up to 1.2 % between Melbourne and Brisbane at a cost to Government of \$35.6M. The scheme will ensure freight on rail instead of over 80,000 B-double truck movements each year on north -south routes on the east coast.
2. A **Rail Advantage Scheme** to encourage transfer of road freight to rail based on environmental, social and economic benefits external to the rail industry, targeted to rail customers and service providers. This scheme will shift over 300,000 tonnes of freight per annum by road instead of rail increasing the market mode share by up to 3.7 % between Melbourne and Brisbane at a cost to Government of under \$4M. The scheme will remove over 8,200 B-double truck movement each year from north -south routes on the east coast.
3. A **Freight Facilities Grant** to encourage transfer of road freight to rail by overcoming initial cost impediments by investment in off-track infrastructure, for the purpose of developing new facilities, or buying additional rolling stock (locomotives and wagons) to be available to rail customers, terminal and train operators. If there was investment of \$20M per annum for each of 5 years, it is estimated that greenhouse gas emissions would be reduced by 38,500 tonnes each year through the saving of 67.3megalitres of fuel by taking 63,500 trucks off the roads each year .
4. An **Environmental Incentive Scheme** to encourage investment in new, environmentally friendly intermodal locomotives, wagons and of intermodal locomotives, wagons and handling equipment, to be available for a limited period for existing assets, and for an extended period for new assets, designed equipment. It is estimated this scheme will reduce locomotive greenhouse gas emissions by 56,500 tonnes and fuel use by 45 megalitres per annum at a cost of \$34M.

Emissions Trajectories - Freight Transport and Rail Policy to Support Modal Shift to Rail



Infrastructure Investment

The key attributes of service quality for rail are service transit time and service reliability. Service transit time is the ability of the particular service to meet its planned transit time and for these transit times to meet market capacity requirements. Service reliability of on-time departures and arrivals through the whole supply chain are important in ensuring complex supply chains function well, and that trains are able to meet follow on transit departure windows.

Currently rail has difficulty in providing the service quality it requires to gain market share from modal shift. Transit times for the carriage of freight between capital cities in Australia are generally not competitive with road. Market requirements for freight delivery at certain times and or on certain days can condense rail traffic into peak periods, placing a strain on infrastructure capacity that can negatively affect transit times and reliability. With limited alternative route options in the event of disruption to the rail network, reliability and transit times also suffer. These issues also significantly impact on passenger’s decision to use or avoid the use of rail.

The reliability in being able to provide on time freight departure and arrival in the supply chain is also critical. Rail’s ability to provide reliable services that can deal with track maintenance, incidents affecting track access, weather effects and changes to the planned operation is critical.

With significant investment earmarked for road construction and improvement versus the investment commitment for rail, the service quality competitiveness of rail is currently at a disadvantage.



The National Transport Commission's (NTC) February 2008 paper, *A New Beginning*, is an admission of the previous failings of an integrated transport planning framework in Australia. This NTC report is welcomed as it recognises the need for integrated planning on a national scale. The lack of integration between transport modes, and ineffective planning for freight corridors and whole of supply chain planning has led to a network of separate transport plans lacking the benefits of integration.

Significant immediate increases in investment in rail infrastructure to improve service quality and to provide capacity for the large modal shift from road to rail is required to achieve national emissions reduction targets. Similarly, investment in rail to provide new passenger catchment areas and integrate passenger transport planning in urban development and supporting transport hubs is required.

Governments have used direct interventions, substantial investment and the National Transport Commission (NTC) to develop and implement operational reform for the road transport industry to improve productivity. The same types of improvements have potential to provide substantial benefits to the rail industry. Governments and the NTC have argued that the rail industry is in a position to make such changes, whereas the road industry has not. For a variety of reasons, it is evident that such productivity improvements have not occurred in railways, so government intervention is required in co-operation with the rail industry.

In simple terms, there would be economic, environmental and social benefits if trains were bigger, faster and heavier. However, it is not yet clear how this can be achieved in practice. Therefore, initial exploratory work is required to identify where the existing impediments are and which would be beneficial to improve.

Subsequently, the most promising initiatives would be developed and implemented. Some suggested areas for investigation could include:

- heavier axle loads;
- new styles of wagons;
- engineering requirements to enable longer trains (eg more powerful locomotives);
- a national rail network plan (including the future required coverage of double stacking and standard passing loops);
- removal of clearance limitations (eg widening through tunnels);
- more extensive use of double stacking containers;
- ability to purchase 'off the shelf' overseas equipment without modification to meet Australian train outline and track strength limitations;
- deployment of new ITS technology to improve reliability, increase speed and reduce times between trains; and
- reallocation of staff to improve productivity.

These issues need to be developed in the light of, or as part of a comprehensive strategy for land transport, as discussed under the need for strategic direction.

Land Availability

To grow the capacity of freight rail and meet market growth, there is an urgent need to increase the availability of land for terminals. Identifying and zoning land for transport use would be a powerful supporting policy.

Government land releases should set aside and rezone portions of land available for transport corridors and supporting terminals. Such action would be low cost with the only cost to government being the lower revenue they may receive from leasing/selling this land for transport use than for other development use.

This single policy would contribute greatly in supporting the capacity growth and service quality of rail.

Security of Land Tenure

The security of land tenure for transport infrastructure and supporting freight terminals must be increased. Longer leases are needed to encourage the significant investment required to develop these terminals to provide capacity and improve efficiency. Security from third parties seeking access also needs to be resolved as such issues create investment uncertainty.

Companies will be reticent to invest in infrastructure if this only then supports competitor claims to its use. Clear policy to provide longer term lease options, security of tenure and access to infrastructure assets, is needed to support a national transport plan.

Asset Depreciation

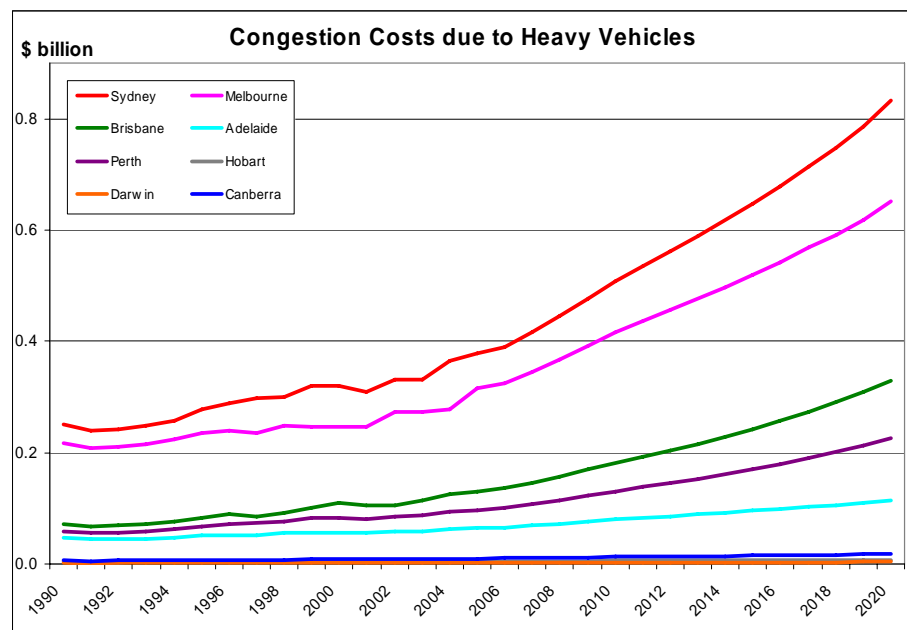
The rail industry operates under very long investment periods for high cost rollingstock. Encouragement for early investment in more efficient and low emissions rollingstock prior to any pricing signal is required. Changes to reduce current depreciation times of 20 to 30 years to much shorter periods, would improve the financial justification for earlier technology change.

To encourage early retirement of a large locomotive fleet and its replacement with newer lower emissions locomotives, financial incentives through taxation policy are required.

Accelerated depreciation may also be applied to rail network infrastructure to encourage earlier upgrade to infrastructure that provides emissions reduction opportunities.

Congestion Charges

There are several forms of pricing of road capacity which can be employed, including congestion charges (including cordon pricing) and road user charges (see below). Key road transport corridors experience congestion which will increase with time. It is estimated⁵ that heavy vehicle congestion costs (including environmental effects) in Australian capital cities increased by 53% between 1990 and 2005, whereas these costs are expected to increase by an additional 234% between 2005 and 2030. This represents congestion costs of \$2.19 billion per year.



Several cities around the world have introduced or are intending to introduce cordon schemes to reduce congestion in city centres, including London and Singapore. The London congestion charge has resulted in significant reductions in congestion costs, partly due to a modal shift from cars to public transport. Applying a similar congestion charge either for key road transportation routes or for large truck entry within metropolitan limits, would encourage modal shift to rail.

Appropriate Truck Sizes

It can be argued that the introduction of B-triple trucks in Australia has benefits in moving large quantities of goods with lower emissions. Nevertheless, the carriage of the type of goods most likely carried by B-triples between capital cities is such that these could equally be transported by rail with even lower emissions.

⁵ Extracted from data provided by BTRE and Working Paper 117, Bureau of Transport and Regional Economics (BTRE) 2006.

The United States has banned B-triple truck movements on federal interstate highways due to safety concerns and on the grounds that these goods can equally be carried by rail. Indeed the carriage of large quantities of goods long distances is the core strength of rail.

In seeking low emissions modal choices, and addressing other externalities such as road congestion, air quality and safety, the most appropriate modal choice must be used for each market. In some cases larger road vehicles will provide justifiable advantages in relieving congestion in port areas or a low emissions solution in the carriage of goods in areas not supported by rail. Further investigation on a policy regarding road vehicle sizes to encourage larger vehicles in the most appropriate circumstances is required.

Mandatory Rail Use Target (MRUT)

The Federal government has introduced a key instrument to drive behaviour outside of the emissions trading scheme. The MRET (Mandatory Renewable Energy Target) as imposed on the energy generation sector with a 20% MRET by 2020, has given a clear signal to this industry well before any emissions trading price signal is available.

An MRUT is an equally viable instrument to drive road transport to rail. Currently, Victoria and New South Wales state governments have MRUT's for rail to and from ports. The NSW government has set a target of 40% of freight on rail to and from Port Botany by 2010. The Victorian government has set a MRUT of 30% freight on rail to and from Victoria's ports by 2010.

These State targets are unlikely to be achieved through lack of appropriate rail infrastructure investment, terminal access and capacity, road charging mechanisms, and other policies to drive freight from road to rail. This reinforces that supporting policies on rail infrastructure transport planning, terminal land availability and security of tenure are needed.

Restrictions in road vehicle movements or costs to access ports would also assist in driving modal shift to meet the MRUT.

Extension of such a scheme to key interstate freight corridors would require similar supporting transport planning policies. Consideration is also needed on whether financial penalties or incentives would be appropriate tools to encourage accurate compliance and reporting and increase the price differential between road and rail to drive this modal shift to achieve the MRUT.

Membership inclusion to the scheme would also need to be carefully designed but could include any company that has a distribution task over a certain threshold between the capital cities.

Mass Distance Charging

Currently rail access charges for freight are based on the amount being carried (mass) and the distance travelled; a mass-distance charge. Road infrastructure charges are based on a combined registration (access to network) charge plus a fuel levy which is proportional to the distance travelled. For a variety of reasons this is an imperfect proxy for a mass-distance charge, but particularly because it averages vehicle use over different classes. So vehicles which travel much greater than average are undercharged, being subsidised by vehicles travelling less than average distances. In addition, there is no reflection in the road charges for local effects, such as noise and urban amenity impacts.

A significant proportion of railways are either in private ownership, privately managed or corporatised, whereas road infrastructure is almost universally owned by governments, which introduces two additional commercial disparities, with respect to pricing rail infrastructure usage:

- the risk of investment; and
- a commercial profit to shareholders return on investment.

Charges for road infrastructure usage do not reflect either of these commercial requirements which results in a discount of road freight pricing.

There have been discussions amongst government about moving towards mass-distance-location charging for road freight user charging. The Australasian Railway Association favours moving towards mass distance charging as soon as possible and is frustrated at the slowness of the progression towards it (New Zealand introduced a form of it in the late 1970s). The NTC and governments consistently agree with mass distance charging in principle. However, they appear transfixed on achieving this through a 'perfect' solution based wholly on modern electronic, information and communication technology. The evidence is that:

- such modern technology is available for implementation for the distance component immediately;
- the technology is not yet sufficiently advanced for mass measurement;
- there may be outstanding charging issues with respect to mass distance charging which remain to be resolved;
- there are alternative mass measurement and monitoring techniques suitable for application which have not yet been considered (eg self reporting, weighbridge reporting, permit approvals based on project outputs, independent assessment, etc.);
- staged introduction of mass distance charging to the competitive element of the heavy vehicle fleet is desirable for all stakeholders and to minimise risks during the roll out of new technology.

The Australasian Railway Association proposes that mass-distance-location charging for road freight usage as a matter of urgency and priority.

Consolidate and Reduce Overlapping Government Policy

The Strategic Review of Climate Change Programs recognises, and now needs to address programs which are overlapping in either their scope and objectives, or their practice in terms of information management, business practices or other government administration.

In addition, rail is one of the most regulated industries in Australia. A national rail operator may potentially have to deal with: seven rail safety regulators with nine different pieces of legislation; three transport accident investigators; fifteen pieces of legislation covering occupational health and safety of rail operations; six access regulators; and seventy-five pieces of legislation with powers over environmental management.

Excessive regulation clearly places an extra cost and resource burden on rail operators which can only detract from competitiveness. Rail requires a streamlined approach under which operators can move quickly to single national regimes.

Improvements in administrative efficiency with respect to government programs or regulation reduces costs and can therefore be translated to improvements in competitiveness of the rail industry resulting in more freight on rail and therefore reduced environmental impact.

Rail Access Pricing

Rail access prices add significant costs to rail operations and can make up to approximately a third of operating costs for rail freight companies. Rail network providers in Australia have a legislated responsibility or market requirement to seek a commercial return on their investment, which can lead to pressure to increase rail access charges and or underinvestment in the rail network.

The road industry is in an enviable position where it does not have to pay to access roads at a rate that covers the full cost and also provide a positive return to the road owner. This pricing disparity between the two transport modes has reduced the price differential between road and rail and protected the road industry, despite government investments in rail also.

An immediate price incentive to encourage modal shift and a low freight transport emissions trajectory is needed. Two possible mechanisms are government support to relieve the burden from access providers in seeking revenue from access fees to recover costs and provide a return on investment, or increased road user charges for road freight transport.

Intermodal Transport Improvement

Efficient transport is generally contingent on the efficiency of integrated movement across more than one mode of transport. A 'supply chain' approach yields efficiencies which cannot be achieved by improving individual transport modes in isolation. Improvements to intermodal transport have been identified⁶ as:

- Develop the rail network that is needed to serve a rapidly growing resources sector.
- Improve the service standards on the main North - South rail corridor to permit it to operate at a level at which rail will become the predominant mode for Melbourne – Brisbane traffic.
- Expand the capacity of the East – West rail network to ensure that future growth can be accommodated without a deterioration of service standards.
- Clearly define the role of rail in the future carriage of grain exports and upgrade the grain network to ensure that this role can be performed efficiently.
- Identify the sites for strategic IMT development in all major cities and ensure that these sites are protected for future development.
- Define and protect the road and rail access corridors to all significant ports and strategic intermodal terminals.
- Develop short haul rail routes linking urban intermodal terminals and container ports to allow efficient rail operation, including where possible freight only tracks and provision for double-stacking.
- Build on and integrate the AusLink corridor strategies to provide a clear and comprehensive plan for transport infrastructure of national importance, including port access links.
- Develop comprehensive freight and logistics strategies covering both rural and urban freight movements in all states.
- Effectively implement in each State fast-track planning processes for transport infrastructure of strategic economic significance.
- Undertake a comprehensive national assessment of the effect of climate change on transport infrastructure and develop strategies for managing this effect to minimise the impact on infrastructure cost and reliability.
- Ensure that, wherever practical, all significant new transport infrastructure is subject to an open access regime, and develop improved regulatory processes to reduce the delays and costs to both access seekers and access providers.
- Develop streamlined PPP approval processes to facilitate private investment in transport infrastructure.

⁶ *Infrastructure Programs for Addressing Supply Chain Blockages* (Draft), Meyrick & Assoc. February 2008 for the Australian Logistics Council

- Implement nationally uniform technical, safety and communications standards for rail operations.
- Reform road pricing to facilitate the efficient use of road vehicles and appropriate allocation of the freight task between road and rail.

Research and Development

Significant improvements to the transport system to reduce climate change and its impacts can occur by applying existing knowledge. However, it is certain that research and development (R&D) can provide new inventions which can be deployed and new information which can be applied. Therefore, R&D should be aligned to the challenge of climate change and further investment in R&D be made, facilitated through incentives and other initiatives.

Infrastructure Susceptibility to Climate Change

There have been substantial amounts of work investigating the effects of climate change and expectation of the future consequences. However, there is very little understanding about the effects of climate change on rail transport systems, particularly the infrastructure.

The following examples identify some possible consequences of climate change:

- higher temperatures may cause more rail track buckling,
- greater rainfall in tropical areas may cause more track flooding,
- more frequent extreme weather events may cause catastrophic track failures, closing tracks for extended periods of time.

All of these consequences would result in reduced speeds and lower service reliability. If current levels of performance and service are to be maintained, there will need to be higher levels of investment, and maintenance leading to higher transport prices. Unfortunately, more definitive information is not available on this issue.

Therefore, the following actions are likely to be required:

- identify consequences of climate change on the transport system;
- develop managed responses, such as additional investment, mitigation measures, maintenance regimes, etc; and
- implement required measures, monitor and review results.

4. Emissions Trading Scheme Design

The Australian Emissions Trading Scheme and its related reporting mechanism, the National Greenhouse and Energy Reporting (NGER) Act 2007 will introduce new costs and compliance reporting on Australian business.

As a large energy user, the rail industry is concerned that an Australian ETS:

- fulfils the best outcome for national interests;
- addresses climate change by reducing national and international emissions; and
- provides a framework that is manageable for railways and all sectors of Australian society.

The Australasian Railway Association has the following comments in relation to the design of an Australian Emissions Trading Scheme.

Greenhouse Gas Coverage

The six major greenhouse gases as defined by the Kyoto protocol must be included in the scheme. Diluting the scope of greenhouse gases measured and accounted for as greenhouse gas emissions does not serve to achieve the goal of emissions reduction to address climate change.

The use of default values provided by the Department of Climate Change, in reporting these major gases is acceptable from an administrative and equity perspective. Technical guidelines that allow measurement and reporting of actual emissions from equipment used, instead of default values based on fuel usage, should be an optional choice for organisations with permit liabilities. This would allow the benefits from lower emissions equipment to be realised, when compared to emissions reductions that may result from using the default values.

Sector Coverage

Given that transport emissions make up a significant portion of Australia's emissions and are set to dramatically increase in the future, it is essential that the whole transport sector is included in the Australian ETS on the Scheme's commencement.

It is right in principle, and consistent with proper economic and environmental practice, for transport to be included in the Australian ETS in order to meet national emissions reductions requirements. While transport could be excluded by focussing emissions reductions wholly on other sectors, such as position is unreasonable and inequitable. The transport industry must accept its responsibility in contributing to meeting environmental outcomes.



Any delay in including the transport sector in emissions trading will only serve to create difficulties in lowering transport emissions at a later date and would unfairly pass this task on to other sectors. Transport emissions would quickly increase from being 14% of our national emissions to a much higher level. Without appropriate price signals and supporting policy, increases in transport emissions would offset the reductions gained by other sectoral emissions reductions, making their reductions a wasted exercise.

Excluding certain sections of the transport sector from an AETS, for example by including energy users that cross NGER Act 2007 reporting thresholds in the AETS and excluding those who do not cross this threshold, will only create distorted market behaviour to avoid emissions costs and undermine the objectives of the Scheme. This is particularly true when many small users (such as trucks and cars) do not exceed the thresholds for inclusion individually, but together make a significant contribution to emissions.

Point of Liability of Emitters

As a large diesel energy user, the rail industry prefers a scheme that provides the most transparency regarding emissions costs as part of energy costs, and therefore give it greater control in managing these emissions. The principle of liability and obligation for emissions at the point of emissions supports transparency in emissions costs for fuel.

A point of emissions obligation at fuel refineries or suppliers, with these parties to hold the liability for emissions permits, provides greater simplicity in the management of permits, and covers the whole transport sector.

To provide greater transparency and control of emissions costs, emitters that cross the NGER Act 2007 reporting threshold, should then have the option to purchase their own permits and have control of managing this liability. This approach would not be inconsistent with reporting requirements under the NGER Act 2007 where emission levels must be reported irrespective of any holding of a permit liability.

This approach would also allow large fuel users who opt to manage their own permit liability, to accurately report and cover emissions with permits for actual emissions, versus the use of default values in measuring emissions.

Permit Purchase

The Australasian Railway Association has the following comments regarding permits.

Time Frames

The proposal to auction permits and to release permits for auction at short regular periods is supported. Given the costs associated with purchasing permits for large energy users, the ability to purchase these at weekly or monthly periods would assist organisations in being able to cover their immediate emissions liability instead of

purchases in advance of requirements. This would provide subsequent cash flow benefits in managing this cost throughout the year.

Free Allocations

The free allocation of permits is not supported. All parties in the transport sector (and indeed other sectors) should be treated equally. All parties in competition must have consistent regulation or undesirable market outcomes will occur resulting in suboptimal environmental consequences.

Trade Exposed Energy Intensive Industries

The Australasian Railway Association believes it is essential that trade exposed emissions intensive industries (TEEIs), who are unable to pass the costs of emissions through to customers, receive financial assistance for the period that major trading competitors do not have the same emissions trading price impacts.

International Linkages

Linkage to international schemes is supported with Australia adopting a separate unit of trade permit for the Australian ETS.

There should be caps on the use of international units, for both Kyoto units and or non-Kyoto units. The use of Kyoto and non-Kyoto international permits would allow low cost permits to be internationally purchased thereby providing other low cost emissions permit options and encourage actions in activities not yet recognised under Kyoto, such as avoided deforestation. A cap on the use of international permits would ensure that large scale emissions reduction initiatives were still achieved within Australia.

International Maritime Transport Competition Equity

Under the Australian Emissions Trading Scheme arrangements being currently being considered a market inequality will be introduced in competitiveness between Australian based transport and internationally based shipping which carries cargo between Australian ports on Single Voyage Permits (SVP's) and Continuous Voyage Permits (CVP's). This occurs because international shipping will not be subject to the Australian Emissions Trading Scheme, due to boundary issues and international agreements. It is hoped that emissions from international shipping will eventually be covered, but that point is some time away.

Two situations are most evident:

- rail transport will be disadvantaged compared with international shipping carrying freight within Australia, and
- Australian shipping will be disadvantaged compared with international shipping.



With respect to the first of these, BTRE information⁷ suggests that this is most significant for east-west transport (Perth to Eastern States). In 2005 BTRE estimated mode shares to be 59% by rail, 24% by road and 17% by sea. Forecasts are for road transport to hold its share and for sea freight to increase its proportion at the expense of rail transport (56% by rail, 23% by road and 21% by sea). The exclusion of international shipping from the Australian Emissions Trading Scheme will exacerbate this adverse trend for rail. Apparently there is almost no freight carried by sea between east coast capitals at present, and this is not forecast to change.

Vessels carrying cargo in competition to land transport must be included in the Australian ETS if possible. One mechanism may be to include an emissions cost as part of the issuance of SVP's and CVP's.

⁷ *Freight Measurement and Modelling in Australia*. Report 112, Bureau of Transport and Regional Economics, 2006.

5. Conclusion

The Australasian Rail Association supports Government interventions to address Climate Change issues including the Australian Emissions Trading Scheme and the inclusion of the whole transport sector in this Scheme at its commencement. The success of the Australian ETS is dependant on full coverage of all sectors in Australia.

However it is expected that success in achieving national emissions reduction targets is dependant not just on the success of the Australian ETS, but the introduction of complimentary policies to drive national adaptation and mitigation strategies.

Such policies should include:

Infrastructure Investment – to improve rail service quality and competitiveness with road that meets market requirements and rail market growth. This must be part of an integrated national transport plan.

Land Availability – the release and zoning of land for transport to provide terminals and corridors in metropolitan areas to grow capacity and provide service quality.

Security of Land Tenure – by increasing lease periods of terminals and infrastructure and provide security from third parties seeking access. These will increase investment certainty and encourage increased investment in transport infrastructure.

Asset Depreciation – to encourage early investment in newer low emissions locomotives and the retirement of less emissions efficient equipment.

Congestion Charges – on key corridors or metropolitan areas to assist modal shift to rail.

Appropriate Truck Sizes – to ensure the benefits of large trucks in the most appropriate situations and not at the expense of the mode best suited for the task.

Mandatory Rail Use Target (MRUT) – to set targets for mandatory rail use as already done by the Victorian and NSW state governments, but with supporting policies to ensure success.

Mass Distance Charging – to increase the transparency of road rail pricing through the introduction of mass distance charging, for road freight transport.

Consolidate and Reduce Regulation – to reduce compliance costs for the rail industry in line with other transport modes.

Rail Access Pricing – to provide further rail access price relief to rail to encourage modal shift to rail.

Intermodal Transport Improvement - to improve the efficiency of both road and rail transport by managing freight movement as a supply chain or integrated transport system.

Research and Development – to provide for R&D activities in emissions reduction innovation and information.

Infrastructure Susceptibility to Climate Change – to identify the consequences of climate change on rail operations and to make the required investment to protect its operations in the future.

Modal shift has a significant ability to provide immediate and large emissions cuts for the transport sector. The rail industry has the ability to further reduce its emissions using a number of existing technologies and current and future fuels to meet longer term national emissions targets.

Early action is required not only to address the pressing threats from climate change, but to allow the structural adaptation required to provide a low emissions pathway for the transport sector and Australia.

It is submitted to this review that:

- 1. There is a need for urgent early action in reducing transport emissions.**
Delays in waiting for price signals to drive market behaviour and drive the large structural changes required, will delay these transport emissions reductions and impose unnecessary increased emissions costs on society. As climate change and its threat to the human species is an example of market failure, the excessive delays in price signals driving change in a transport sector with increasing emissions levels, will be a failure of the emissions trading scheme in achieving the required outcomes.
- 2. An integrated national transport plan is essential for halting the increase in transport emissions.** This will provide the capacity required to reduce emissions and improve the service quality of supply chains to provide efficient modal change. This includes a need to evaluate the future transport fuel options and provide the respective supporting infrastructure.
- 3. The policy instruments submitted are needed to support modal shift and the required investment.**
Such policies should:
 - allow early structural adaptation of infrastructure, assets and fleet changes;
 - change societal behaviour;



- provide additional financial frameworks to respond to the rapid technological and structural changes faced by transport companies are matters of utmost urgency.
- 4. Investment in rail infrastructure be increased to allow it to provide a viable low emissions solution for Australia to meet market service quality and capacity requirements.**

For further information, please contact the Australasian Railway Association

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ATTACHMENT F

***Transforming Rail: A Key Element in Australia's Low
Pollution Future, Final Report***

Co-operative Research Centre for Rail Innovation, 2009



CRC for Rail Innovation



*Transforming Rail: A Key
Element in Australia's
Low Pollution Future*

Final Report

DOCUMENT CONTROL SHEET

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Executive Summary

To achieve Australia's climate goals sharp reductions in transport emissions are necessary; this requires going beyond emissions trading to a new generation of transport policies.

The Australian Government's recent White Paper implies that Australia can achieve its climate change goals to 2030 without major change in the transport sector. This presumption is incorrect: a sharp reduction in transport emissions will be required if Australia is to pursue even the modest global stabilisation target of 550 ppm CO₂-e. Reducing transport emissions will in turn require a substantial modal shift from road to rail, as well as lower emissions intensity in all transport modes. These changes will not be achieved by emissions trading alone, but need a new generation of transport policies.

There are three reasons why the reduction in transport emissions is necessary. First, the Treasury modelling understates the task of achieving a given stabilisation level, and all countries will need to make bigger cuts than implied to achieve, say, 550 ppm CO₂-e. Secondly, the modelling implies that 30-40% of the reduction in Australia's emissions allocation will be achieved by purchasing permits overseas rather than by reducing emissions in Australia. This level of overseas purchases is unlikely to be either achievable or morally sustainable. Thirdly, the generous free permit allocation provisions in the White Paper for energy intensive trade exposed industries (EITEs) mean that the allocations available for other industries are correspondingly reduced, falling by 30-50% over 2010-20. Transport is responsible for about 27% of non-EITE industries emissions; these will need to be reduced sharply if such reductions in non-EITE emissions are to be achieved.

A modal shift from road to rail will have large economic, social and environmental benefits

The economic and social costs to Australia of current transport patterns are immense. The social costs arising from transport are estimated at A\$52 billion or 5.6% of GDP in Australia in 2005, before including congestion costs. These social costs are mainly due to road transport, and rail contributes only 9% of them. Modernised and efficient rail can also provide lower cost movement of freight between major urban centres than road transport, and move people in cities at a lower average cost per kilometre. Thus a modal shift to enhanced rail will have major economic and social benefits for Australia.

Rail is typically a more energy efficient form of transport than road, with lower energy use per passenger kilometre or per tonne kilometre. Rail's energy intensity can be reduced further by a range of measures, from lighter and more advanced vehicles and improved vehicle/track interactions to more efficient engines and regenerative braking. In the long term rail offers the possibility of virtually zero emissions transport, when rail transport is fully electrified and powered by electricity from renewable sources.

Carbon prices are necessary but not sufficient; other policies are required to support the massive private and public investment implied

The transport system is riddled with market failures, especially externalities, sunk costs and coordination failures. For example, the social benefits created by a new rail system are widely spread, and cannot be fully captured by those who build and run it; heavy sunk costs are required in track, rolling stock and other systems, with uncertain returns; issues of coordination, such as between infrastructure providers and operating companies, are often critical to the returns on investment. This means that, while setting a carbon price through emissions trading is a necessary condition of change, prices alone will have a limited role in driving structural change and reducing emissions in transport. Strong complementary policies are necessary, and the economic and social benefits arising from such change

provide a powerful justification for decisive government action. Policies in the following areas seem most important:

- In freight transport, the costs generated by large long distance trucks are not passed through fully to users. There is a widely recognised case for *mass-distance-location charging* to be introduced, as in other countries, to correct this market failure.
- Direct public investment is required in *major rail infrastructure* (such as rail track and associated works and equipment) which suffers from all three forms of market failure. Support for private and public investment in areas such as *signalling and control systems, advanced modal interchanges and other forms of coordination* is required. There is also a need for the development and implementation of *standards for rolling stock and infrastructure* to improve transport system performance.
- To modernise Australia's rail system, massive investment will be necessary by operating companies, whether public or private, and by firms in supplier industries. Given market failures, *public initiatives in the form of R&D support programs and enhanced depreciation allowances for certain classes of expenditure* are necessary.
- Finally, *investment in the electrification of large scale rail systems*, such as those of the North-South corridor, linked to sources of renewable energy, should be given serious consideration in the light of the long term social returns that can be generated.

High social returns, and lower emissions, will accrue from transforming rail.

The process of reversing the dramatic modal shift to road that took place over 1945-85, and of modernising the Australia rail industry, will be a long term one requiring sustained action. It would involve, by say 2030, the majority of Australia's non-bulk freight movements outside capital cities occurring in modern, highly efficient trains; a significant share (20-25%) of all passenger kilometres travelled in Australia being by rail; and the overall rail system being largely electrified and increasingly powered by renewable energy. Using the model developed by the study team, the economic, social and environmental benefits arising from achieving real progress towards these goals by 2020 have been quantified.

The overall benefits from moving along this path are very high. Using a real discount rate of 10% per annum, the net present value in 2010 of the benefits accruing over 2010-20 is A\$27.4 billion. While there are wide margins of error around these estimates, the basic finding of very large total benefits is beyond dispute. This figure only includes benefits out to 2020, and benefits will continue to accrue for many subsequent years. It has not been possible to undertake a detailed assessment of the investment necessary, by both the public and private sectors, to achieve these goals, but the broad dimensions are known. Taking an upper bound for that investment of A\$20 billion over 2010-20, (or A\$2 billion per annum) the implied social rate of return on this investment is 50%. Again this is the return achieved only from the benefits to 2020, and further benefits will accrue after that time.

Most of Australia's transport emissions come from road transport. Even so, if the path described above is continued to 2030, total transport emissions are about 11% lower than in the base case by 2030. If they are supplemented by further action to reduce the emissions intensity of road and air transport, total transport emissions begin to decline after about 2025 and are close to their 2010 level by 2030. Thus the actions discussed in this report not only generate large economic and social benefits, and high social returns to investment, but also contribute significantly to reducing greenhouse gas emissions. This would represent a major contribution to the achievement of Australia's broader climate change goals.

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Abbreviations and Acronyms

AR4	Fourth Assessment Report of the IPCC
ARTC	Australian Rail Track Authority
BITRE	Bureau of Infrastructure, Transport and Regional Economics
BTRE	Bureau of Transport and Regional Economics
C/ntkm	Cents per net tonne kilometre
CH ₄	Methane
CO ₂	Carbon dioxide
CO ₂ -e	Carbon dioxide equivalent
CPRS	Carbon Pollution Reduction Scheme
CSES	Centre for Strategic Economic Studies
DCC	Department of Climate Change
DIRN	Defined Interstate Rail Network
EITE	Energy intensive trade exposed
GDP	Gross domestic product
GHG	Greenhouse gases
GT	Gigatonnes
HDV	Heavy duty vehicle
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
LDV	Light duty vehicle
MDV	Medium duty vehicle
MWh	Megawatts hour
N ₂ O	Nitrous oxide
Ntkm	Net kilometre
Pkm	Passenger kilometres
Ppm	Parts per million
QR	Queensland Rail
REC	Renewable Energy Certificate
Tkm	Tonne kilometres
TPC	Train Protection and Control Systems
Vkm	Vehicle kilometres

1. Introduction

This document constitutes the final report of a project, undertaken for the CRC for Rail Innovation by the Centre for Strategic Economic Studies at Victoria University, to study the implications of the introduction of an emissions trading scheme, and of potential responses to climate change more generally, on the rail industry in Australia. The purpose of this final report is to summarise the main arguments, conclusions and recommendations of the study. The analysis reported here is backed up by more detailed work contained in ten supporting papers, which are also available from the CRC for Rail Innovation. A list of those papers is provided in Appendix.

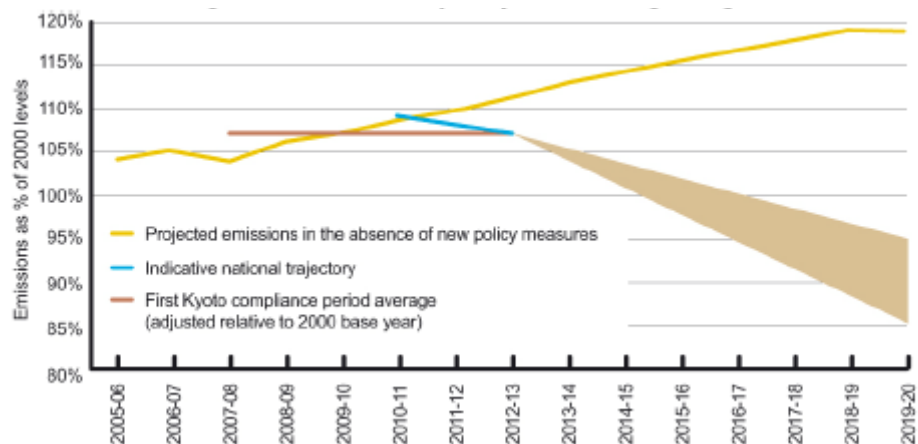
2. The Role of Transport in Australia’s Low Pollution Future

2.1. The Australian Government’s White Paper Proposals

On the 15 December 2008 the Australian Government released the details of the Carbon Pollution Reduction Scheme (CPRS) that it will submit to the Australian Parliament for approval in 2009. The main features of the CPRS are as summarised below.

The target is for emissions reductions of between 5-15% by 2020 relative to 2000, with the final decision to be made after the 2009 UNFCCC conference in Copenhagen. The 15% target will be adopted if all major countries commit to restrain emissions and developed countries accept comparable targets. A trajectory involving a 1% per annum reduction in total emissions has been established for the first three years starting with 2010-11, with subsequent trajectories to 2020 to be set when the final target is established. As shown in Figure 1, the impact of these targets relative to business as usual emissions will be substantial – if the 15% target for reduced emissions is adopted post Copenhagen then, taking account of expected growth in the business as usual case, the emissions allocation for 2020 will be about 28% below that unchanged policy base.

Figure 1: Indicative trajectory and 2020 target range



Source: DCC (2008, Chapter 4, Figure 4.4).

Permits will be either auctioned or given freely in some cases, to be fully tradeable and bankable, with a 5% per annum borrowing allowance. The permit price will be determined in the market, subject to a price cap on permits of A\$40 per tonne of CO₂-e in 2010, rising by 5% per annum in real terms. Emissions will be internationally tradeable, both through Kyoto mechanisms and through linkage to other defined trading schemes.

There is a high formal coverage, with about 75% of emissions included, but this is reduced by the effect of other provisions. Permits will be issued freely to energy intensive trade exposed (EITE) industries, at two levels (90% and 60%) based on the energy intensity of production, with the eligible base declining by 1.3% per annum, and will be available for new or increased production. They can grow by up to 5% a year, and at that rate would account for 57% of emissions by 2020. Substantial support has also been provided for coal based generators through the issue of free permits, subject to maintaining their generation capacity.

Transport is included in the CPRS, but the arrangements to offset the impact of the CPRS on fuel prices for heavy road vehicles, on-road business users and private vehicle use are retained as in the Green Paper, as are those for assistance to households and for the Climate Change Action fund. This offset has not been extended to rail. The offsets for passenger cars and for trucks will be reviewed after three years and one year respectively. The Government has decided that all shipping (international and domestic) that carries domestic cargo will face an equivalent carbon cost to that emerging from emissions trading.

2.2. The Apparent Implications for Transport

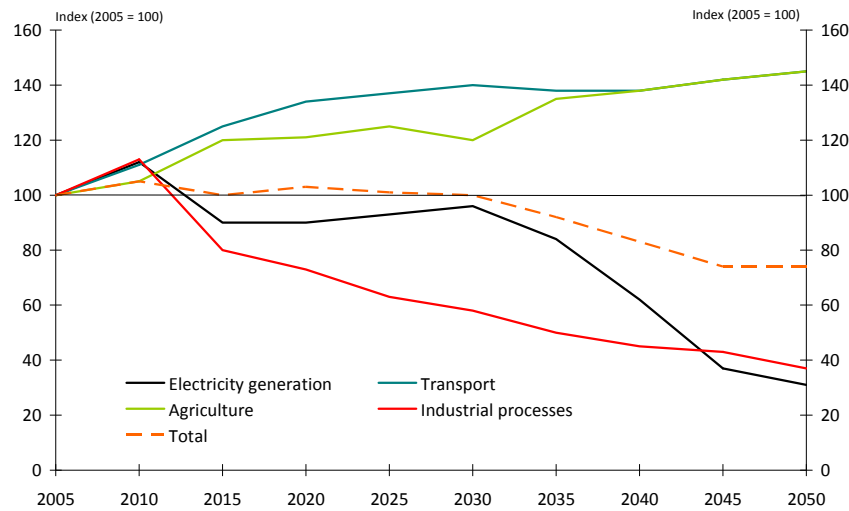
Even though transport is responsible for 17-18% of Australia's emissions on a full life cycle basis, the reduction in transport emissions plays a limited role in expected CPRS outcomes over the next few decades, and there is limited discussion of transport issues in the White Paper, although a supplementary paper is provided (BITRE and CSIRO 2008).

While transport providers – in road, rail and air modes – will be affected by emissions trading in many ways, its impact on the overall level and structure of transport activity in Australia is presented as being modest through to 2030. This impact will be through prices, but even a carbon price of A\$50 per tonne of CO₂-e amounts to an increase of only about 20 cents per litre on the fuel price, a modest change in terms of recent price movements. The elasticity of motor vehicle use with respect to the fuel price is low, in part because of limited alternatives in many areas and also because fuel costs are only a small proportion of the overall cost of owning and using a car.

Given the much higher impact on electricity prices (a carbon price of A\$50 per tonne of CO₂-e will lead to an increase of about A\$50/MWh in wholesale electricity prices, an approximate doubling) than petrol prices, in some cases rail's competitive position vis-à-vis road could deteriorate. There is likely to be a substantial impact on individual owner-operators in the road freight industry, where margins are very tight and higher costs could force many out of the industry. But with lags in the adoption of new technologies for motor vehicles, transport emissions are unlikely, on proposed policies, to deviate

much from the unchanged policy case through 2020 if the only policy mechanism at work is the carbon price generated through emissions trading.

Figure 2: Industrial sector emissions for Australia, CPRS-5 scenario, 2005-2050



Source: Adapted from Treasury (2008).

This conclusion about the impact of emissions trading per se is confirmed by the modelling undertaken by the Australian Treasury and released prior to the publication of the White Paper (Treasury 2008). Figure 2 summarises the Treasury projections for domestic emissions for the 5% reduction target, with emissions by industry expressed as an index with 2005 levels equal to 100. By 2030 total Australian domestic emissions will be at the 2005 level, with the required reduction in emissions relative to 2005 levels achieved by purchases of emissions overseas. By 2020 emissions from industrial processes are projected to be more than 40% below 2005 levels and those from electricity generation nearly 10% lower, but transport emissions are projected to be nearly 40% higher and still very close to the business as usual case. Thus the modelling of this case implies no substantial reduction in transport emissions relative to unchanged policies prior to 2030.

2.3. Three Reasons for a Larger Impact in the Transport Sector

Nevertheless, there are, in our view, three related reasons why Australia will need to, and probably will be forced to, achieve a much greater reduction in domestic emissions, and hence in transport emissions, than is implied in this analysis. The first is that the Treasury modelling starts from an unrealistically low base of current global emissions, so that any given stabilisation path (say 500 ppm CO₂-e) is more difficult to achieve, in the sense of requiring deeper cuts in emissions. The second is that the modelling framework allows up to 50% of Australia's reduction in emissions relative to the base case to be achieved by net purchases of emissions permits overseas, rather than by reductions in domestic emissions, and in the CPRS-5 cases about 40% of the reduction is achieved in that manner by 2030. Especially in the context of a more difficult global challenge than anticipated in the modelling, this outcome seems unrealistic and Australia is likely to be required to achieve a substantial reduction in domestic emissions. Thirdly, the White Paper proposals for the issue of free permits to energy intensive trade exposed

(EITE) industries are extremely generous, amounting to up to 57% percent of all permits available in 2020 on some assumptions. This generous EITE allocation, which was not included in the Treasury modelling, means that the reduction in emissions required from other industries for a given emissions target is much greater than would otherwise have been the case.

Table 1 provides a number of estimates of total global greenhouse gas emissions for 2005. The Fourth Assessment Report of the International Panel on Climate Change (IPCC 2007) published an estimate of total global greenhouse gas emissions in 2004 of 49.0 Gt CO₂-e, of which some 44.3 Gt CO₂-e were for all emissions other than CO₂ emissions from biomass decay and peat, and about 4.7 Gt CO₂-e from that latter source. The International Energy Agency (IEA 2008) provides estimates of all emissions (excluding CO₂ emissions from biomass decay and peat) on which the IPCC draws, and has provided updated estimates for 2005. Other non-Treasury estimates shown in the table include unpublished estimates prepared by the present authors for the Garnaut Review (Garnaut et al. 2008).

Table 1: Estimates of global greenhouse gas emissions, 2005 (Gt CO₂-e)

	IPCC AR4 ¹	IEA	Treasury (Gt CO ₂ -e)	Garnaut et al.	CSES
CO ₂					
<i>Energy use</i>					
Fuel combustion (including fugitive emissions)	27.7	27.3	27.0	26.7	27.3
Industrial processes and waste	1.4	1.3	1.2	1.0	1.3
<i>Land use and forestry</i>	3.8	3.3	2.8	3.5	3.5
<i>Total CO₂ (excluding biomass and peat)</i>					
CH ₄	7.0	6.8	5.3	6.6	7.1
N ₂ O	3.9	3.9	2.4	3.3	4.1
Other Kyoto gases	0.5	0.8	0.4	na	0.8
Total (ex biomass and peat)	44.3	43.4	39.1	41.1	44.1
CO ₂ biomass decay and peat	4.7	na		4.0	4.0
Total emissions	49.0	na	39.1	45.1 ²	48.1

Notes: 1. For 2004. 2. Excludes other Kyoto gases.

Sources: IPCC (2007), IEA (2008), Treasury (2008), Garnaut et al. (2008) and unpublished estimates of the authors prepared for the Garnaut Review.

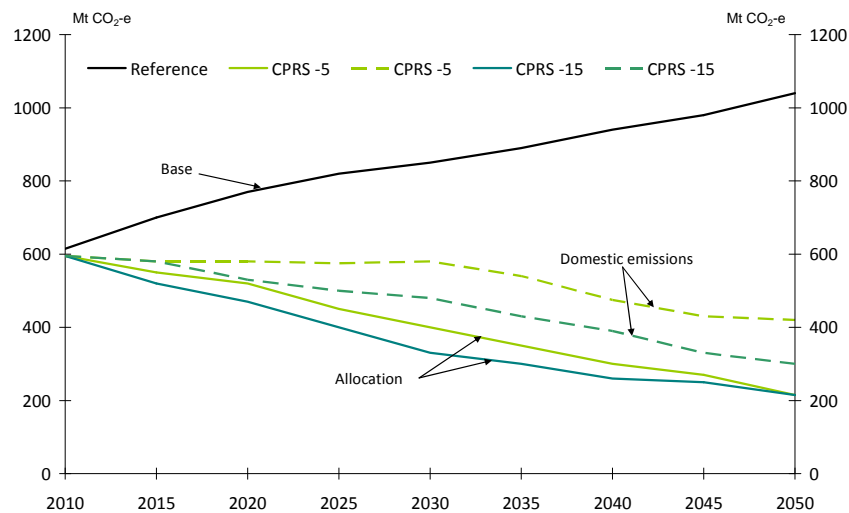
While there remains considerable uncertainty about total global emissions, Table 1 suggests that the best available estimates of all emissions excluding CO₂ emissions from biomass decay and peat are in the region of 43-44 Gt CO₂-e. With CO₂ emissions from biomass decay and peat put at 4-5 Gt CO₂-e, the best estimate of total global greenhouse gas emissions in 2005 is 47-49 Gt CO₂-e. By comparisons, and for reasons that remain unclear in the document, the Treasury base figure for 2005 is 39.1 Gt CO₂-e. The best estimate range is 20-25% higher than this figure, with the IPCC figure for 2004 25% above the Treasury figure for 2005.

This underestimation of the base emissions level in the Treasury modelling has many important ramifications. A particular atmospheric concentration level for greenhouse gases is related to the total historical stock of emissions and other factors (such as decay and absorption rates). This means that if the underlying path of emissions is higher than projected then the

reductions that must be made relative to that path, by all countries, to achieve a given concentration level (say 550 ppm CO₂-e) will be larger than anticipated. Not only does this mean that Australia will probably be required to accept a greater reduction in its emissions allocation than currently planned, but it also implies that global carbon prices will be higher than modelled for a given concentration target, as countries are required to achieve more rigorous reductions.

For this and other reasons it is unlikely that Australia will be able to achieve all of the actual reduction in its emissions allocation by purchasing overseas permits, as is implied by the Treasury modelling of the CPRS-5 case (Figure 3). Australia is likely to be under great pressure to adopt a stronger target, at least the CPRS-15 case of a 15% reduction by 2020, and to achieve much of this by a reduction in absolute emissions levels domestically.

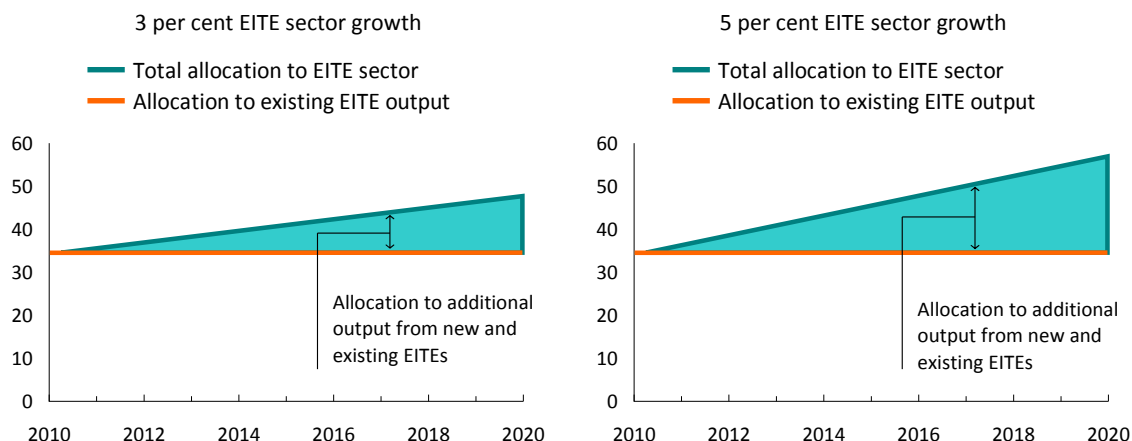
Figure 3: Australian emissions: Reference case and two scenarios, domestic emissions and emissions allocation, 2005-2050 (Gt CO₂-e)



Source: Adapted from Treasury (2008).

The third relevant consideration arises from the arrangements proposed in the White Paper to assist EITE industries, which are much more generous than those included in the Treasury modelling. Figure 4, taken from the White Paper, shows the rising share of permits allocated to the EITE sector (including agriculture, and assuming as the White Paper does that agriculture is admitted to the EITE scheme) on two assumptions about the average annual growth of these industries (3% and 5%, where 5% is the maximum growth rate for which free permit allocation will be provided from this scheme). The chart uses the White Paper specification of a 1.3% per annum carbon productivity contribution, so that entitlement to free permits per unit of EITE output falls by 1.3% per annum. (The Treasury modelling assumed that assistance per unit of output fell by 3% per annum, which would reduce the impact of the scheme significantly.)

Figure 4: Share of permits allocated to the EITE sector, for different growth rates (per cent)



Source: Reproduced from DCC (2008).

One implication of such a generous EITE scheme is that an increasing share of Australia’s emissions allocation is given to these industries over time, with the extent of that increasing share depending on the growth rate of these industries and of Australia’s final target for emissions in 2020. As shown in Table 2, if the EITE industries grow at 3% per annum over 2010-20 and Australia’s target is for a 5% reduction in emissions by 2020 relative to 2000, the allocation for all other industries falls by 29.4% between 2010 and 2020, an annual reduction of 3.4% per annum. If the EITE growth rate is 5% per annum and the target is for a 15% reduction the fall in the allocation for all other industries is 57%, or 8% per annum over 2010-20, which would constitute a very difficult challenge.

Table 2: Implied change in emissions allocations for non-EITE industries, 2010-20, for given emissions reduction targets and EITE industry growth rates (per cent)

Growth rate of EITE industries	5% reduction target		15% reduction target	
	3%	5%	3%	5%
Change in allocation in 2020 relative to 2010 (%)				
Total allocation	-12.8	-12.8	-22.0	-22.0
Free permits for EITE industries	18.1	43.2	18.1	43.2
Allocation for other industries	-29.4	-42.9	-43.5	-57.0

Source: Estimates of the authors based on DCC (2008).

2.4. A Major Transport Response is Required

These three factors – the underestimation of the current level of global emissions, the difficulties in shifting virtually all of the absolute reduction in Australia’s emissions up to 2030 offshore and the profound implications of the EITE scheme for other industries – imply that large scale reductions in domestic non-EITE emissions will be required in Australia over the decade to 2020. Even allowing for some cushioning of the domestic adjustment process by purchase of permits overseas, reductions of 20%-40% in non-EITE emissions are likely to be required over the decade to 2020 if the EITE scheme remains unchanged.

In such a situation the benign world of Figure 1, in which transport emissions effectively continue on a business as usual basis until 2020 and are about 40% higher than 2000 levels in 2030, will no longer apply. On a full life cycle basis transport contributes about 27% of non-ETIE emissions. If non-ETIE emissions are to fall by 20%-40% over 2010-20 substantial efforts will need to be made to reduce transport emissions, not only relative to the business as usual case but in due course in absolute terms.

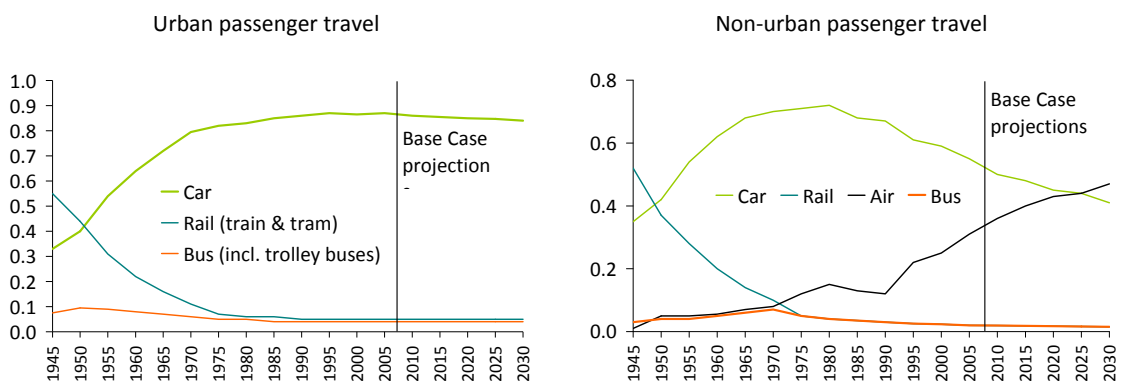
This report addresses the steps that need to be taken to reduce transport emissions, and on the costs and benefits of those steps, but focusing only on those related to rail. That is, the emphasis is on achieving a reduced emissions intensity of rail transport and particularly on achieving lower emissions (and other benefits) through a sustained modal shift to an enhanced, low pollution rail transport system. This is not to deny the great importance also of further steps to reduce the emissions intensity of road transport.

3. Modal Shifts in Australian Transport: Past and Future

If a significant reduction in transport emissions, even relative to business as usual, is to be achieved this will require steps to reduce the emissions intensity of all transport modes – road, rail, sea and air – as well as a sharp modal shift from road to rail transport. Substantial improvement in the emissions intensity of road transport, over and above that likely to be driven by the price mechanisms of CPRS, is both necessary and achievable. But this is beyond the scope of this report, which is focused on rail, as noted above.

The first four decades after the Second World War saw the rise of the car and the truck reshape Australia’s transport patterns. Between 1945 and 1985 the rail share of both urban and non-urban passenger kilometres fell sharply and continuously, from over 50% to about 5%, and remained close to that level in 2005 (Figure 5). The BITRE business as usual projections shown in the figure envisage that over 80% of urban passenger kilometres will be travelled by car through to 2030, while the share of rail in non-urban passenger journeys will decline further, with air travel ultimately becoming the dominant mode.

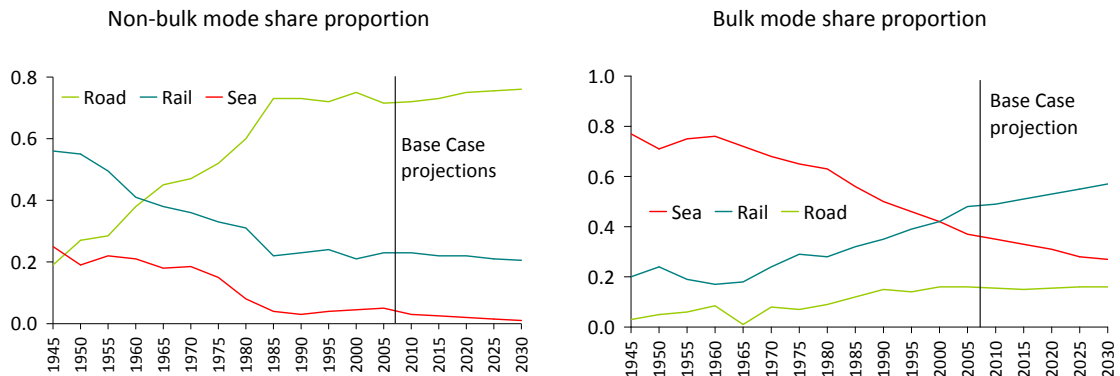
Figure 5: Modal share, Australian passenger travel (proportion of passenger kms)



Note: Urban passenger travel has 'Other road' and 'Ferries' not shown. Non-urban passenger travel has 'Other' not shown. Each of these items is small.
Source: Adapted from Cosgrove (2008).

Over the same period the rail share of non-bulk domestic freight traffic fell from 56% to 22%, and was at about that level in 2005, with the BITRE projecting a further small decline to 2030. Only in the bulk freight area did the rail share rise (from 20% to nearly 50%), as new dedicated rail lines were built to take coal, iron ore and other commodities to port, and this trend is projected to continue. Outside the bulk freight area, this shift from road to rail has been supported by massive public investment in road networks over the postwar period, while rail systems were allowed to deteriorate over most of the country.

Figure 6: Modal share, Australian domestic freight



Note: Non-bulk domestic freight has 'Air' not shown.
Source: Adapted from Cosgrove (2008).

Recent years have seen some signs of renewal in the position of rail – passenger demand has risen strongly in some major cities; new rail investment has been undertaken in Queensland and Western Australia, and foreshadowed elsewhere; rail has captured a high share of non-bulk freight traffic on some long haul routes, such as Melbourne-Perth. But if transport is to contribute its share to meeting Australia's emissions challenge much more will be required, involving a sharp reversal of the historical trend and a substantial modal shift to rail, in both the passenger and the freight areas.

4. The Economic, Social and Environmental Advantages of Rail

In spite of the dominance of road transport in Australia and in many other countries, there is substantial evidence that rail is, in many circumstances, the transport mode with the lowest full economic cost, as well as having much lower social and environmental costs. By 'economic cost' we mean the full financial cost of a given transport mode, measured in the relevant units (such as cents per net tonne kilometre or per passenger kilometre), excluding social or environmental costs. We also speak of social costs rather than externalities, and hence do not consider the extent to which the social costs of a given transport mode are borne by the user (that is are internalised) or borne by society as a whole (that is, constitute an externality).

4.1. The Economic Costs of Freight Movement

For most of the freight tasks currently undertaken by rail, in the movement of bulk goods, rail is so significantly cheaper than road that there is almost no competition. Bulk goods currently represent 84% of the rail freight task and that share is rising, so issues of relative cost are not further considered here. For the remaining freight traffic, in the non-bulk market, the main

difficulty is to get estimates of full economic costs on a comparable basis, preferably on a door to door basis.

Table 3 summarises the cost data available from BITRE, which shows that the average rail freight cost per net tonne kilometre (tkm) from terminal to terminal is much lower than that of road (and very much lower than air) on a door to door basis. True comparisons will clearly depend on the costs, to be added to the rail figure, for the pick up and delivery cost of door to door service. These additional costs are influenced by many factors, such as the pickup and destination markets, the nature of the freight and the scale and efficiency of the freight terminal and delivery process.

Table 3: Unit prices for non-bulk freight, various bases (c/ntkm)

	Air	Road	Rail	Shipping (Perth)
2000-01	111.73	5.66	2.75	2.08
2001-02	117.15	5.72	2.81	2.15
2002-03	121.63	5.93	2.90	2.21
2003-04	126.19	6.04	2.99	2.30
2004-05	131.48	6.58	3.10	2.37
2005-06	135.39	6.98	3.24	2.22
2006-07	136.35	7.10	3.41	2.45
2007-08	135.88	7.53	3.52	2.80

Notes: c/ntkm = cents per net tonne kilometre.

The basis of the rates is: AIR door to door; SHIPPING FCL wharf to wharf; ROAD FCL door to door; RAIL FCL terminal to terminal (i.e. excludes pick-up and delivery).

Source: BITRE (2008a).

A full costing of rail compared with road freight was conducted by Port Jackson Partners (2005), and the results are shown in Table 4. These figures indicate that rail is less than half the cost of road for the East West corridor, where it has about an 80% market share. However, at current efficiency levels it is more than the cost of road freight for the North South corridor. Port Jackson Partners identify a set of initiatives, both of a capital and operating nature, which could reduce its cost to below that of road. Many of these have subsequently been proposed by the ARTC and some are in the process of being implemented (ARTC 2008).

Table 4: Total cost comparison: Road and rail freight, 2004 (cents per ntk)

	Road	Rail (current)	Rail (reduced)
Sydney – Brisbane	6.4	6.6	4.3
Melbourne – Sydney	6.0	6.9	5.5
Melbourne – Brisbane	5.8	5.9	3.8
Melbourne – Adelaide	6.6	3.8	3.8
Adelaide – Perth	6.3	2.6	2.6
Melbourne – Perth	6.1	2.8	2.8
Sydney – Perth	5.7	3.5	2.5

Source: Port Jackson Partners (2005).

The Port Jackson Partners estimates demonstrate that rail would become quite competitive commercially on the various North South routes, and unit

costs might be expected to fall significantly if the market share of rail increased substantially and other operational efficiencies were made. Perhaps more importantly, the figures demonstrate that the total transport cost is significantly lower for efficient rail than road transport on all intercity corridors.

In the body of this study we examine the likely implications of a more wide-ranging set of investments in rail modernisation and expansion than are considered in the Port Jackson study. For our modelling we assume that, subsequent to that investment being undertaken, by 2020 the average full cost of rail freight (door-to-door) is 2.5 cents per ntk lower than for road freight.

4.2. The Economic Costs of Passenger Transport

Travel by car is the overwhelmingly dominant mode for passenger transport for all capital cities, ranging from 90.7% in Adelaide to 82.2% in Sydney. Rail/light rail accounts for only 1% of passenger kilometres in Adelaide and about 9% in Sydney, as shown in Table 5. Nonetheless this may be beginning to change with rail passenger growth of around 10% per annum being experienced in a number of capital cities over the last few years.

Table 5: Travel by mode, 2003/04

Mode	Sydney	Melbourne	Brisbane	Adelaide	Perth
	Proportion by mode				
Car	82.2%	88.4%	85.6%	90.7%	86.9%
Rail/Light rail	8.9%	5.8%	4.5%	1.1%	2.9%
Total public transport	13.3%	8.0%	8.3%	5.3%	7.2%

Source: BITRE (2008b). No consistent data beyond 2003-04 are currently available.

Although the cost of public transport is subsidised to a level below the cost of car travel, it tends to cater best for peak hour travel to the CBD and the car provides superior amenity for many trips in a dispersed suburban or country environment. A comparison of the estimated full costs of both providing public transport, average fare revenue and the full financial cost of car travel is given in Table 6.

Table 6: Estimated travel costs, train and car (A\$ per pkm and A\$ per vkm)

	Sydney	Melbourne	Brisbane	Adelaide	Perth
(A\$ per passenger km)					
Train (system cost)	0.45	0.41	0.48	0.66	0.63
Average train fare revenue per passenger km	0.11	0.12	0.28	-	0.04
(A\$ per vehicle km)					
Car (a)	0.67 (b)	0.71	0.72	0.71	0.72

Notes: (a) Full private costs. (b) 2007 data. Other capital cities 2008.

Source: State motoring organisations, state transport authority and departmental annual reports, state budget papers and BTRE (2008b).

These estimates indicates that the full cost of providing rail public transport ranges from a low of about 41 cents per passenger km in Melbourne and 45

cents in Sydney to over 60 cents in Adelaide and Perth, indicating again that scale and occupancy levels significantly affect unit cost levels. Average fare revenue ranges from 28 cents per passenger km in Brisbane to only 4 cents for the newly extended, but highly subsidised Perth urban train system. Table 6 also shows the available estimates of the full private cost of travel by car, expressed in A\$ per vehicle km. Data on average car occupancy is limited, and occupancy rates probably vary between cities, but the available data suggest average car occupancy is about 1.4-1.5 persons per vehicle (Ironmonger 2008; Transport Data Centre 2008). Using an average occupancy rate of 1.4, car costs consistent with Table 6 are about A\$0.50 per passenger km, 10-20% higher than those in Melbourne and Sydney but lower than those for Adelaide and Perth. Further information on this issue is provided in Paper 5.

There are good reasons for thinking that passenger road costs per pkm may rise relative to those of rail over the next decade, in a context of carbon pricing, higher fuel costs and increasing urban congestion. For the modelling we take a conservative assumption, that by 2020 average rail costs per passenger kilometre are 10% lower than the equivalent average cost for cars. It should be noted that, whereas extensive research has been conducted on the social costs of different transport modes, only limited information is available about the full economic costs of the two modes. Given the importance of an understanding of the full economic costs of road and rail transport modes, further research in this area would be valuable.

4.3. The Social and Environmental Costs of Transport Modes

As just noted, there has been extensive research, both in Australia and overseas, on the social and environmental costs of different transport modes, and these estimates are reviewed in Paper 2 prepared for this report. The main costs included in our estimates are accidents, noise, air pollution and GHG emissions. There has been substantial debate about whether social costs arise from congestion affects and, if so, how such costs should be calculated. In our view there is no doubt that bona fide social costs arise from increased traffic congestion, but in the light of the lack of agreement about both principles and methods they are not included in this study. Our preferred working estimates of the extent of such social costs, which are summarised in Tables 7 and 8 and illustrated in Figure 7, do not include congestion costs.

Table 7: Social and environmental costs of passenger travel (\$A/1000 passenger km)

	Road by vehicle type				Rail	Aviation	Overall
	Car	Bus	Motor cycle	Road total			
Accidents	60.3	4.7	367.8	63.2	1.6	0.8	43.5
Noise	10.1	2.5	31.2	10.0	7.6	3.5	8.2
Air pollution	24.8	40.4	7.4	25.7	13.5	4.7	19.5
Climate change	4.9	2.3	3.3	4.7	1.8	12.9	6.6
Other (ex congestion)	18.9	9.8	12.1	17.8	10.3	3.5	13.7
Total	119.0	59.7	421.8	121.3	34.7	25.4	91.5

Note: 2008 Australian prices @ 1 euro = \$A1.7 and CPI 1.147 from June 2000 to June 2004.
Source: Infrac/IWW (2004).

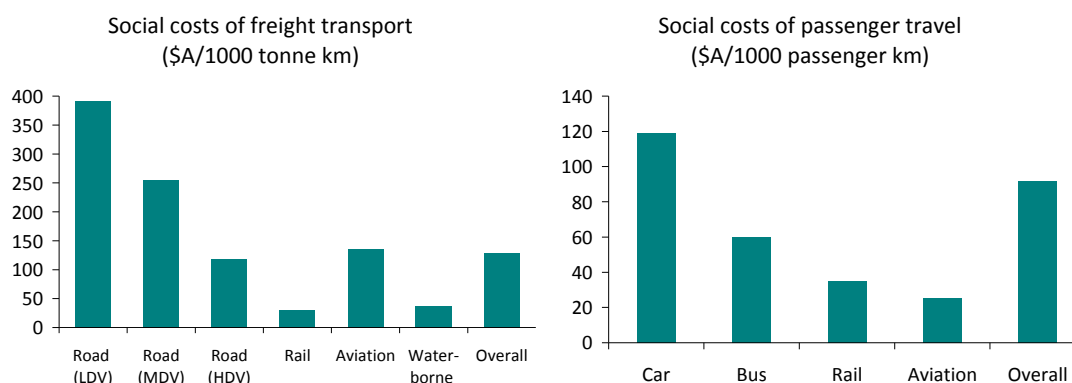
Table 8: Social and environmental costs of freight transport (\$A/1000 tonne km)

	Road by vehicle type				Rail	Aviation	Water borne	Overall
	LDV	MDV	HDV	Road total				
Accidents	68.3	38.8	9.4	14.8	0.0	0.0	0.0	12.7
Noise	63.2	36.4	9.6	14.4	6.2	17.4	0.0	13.9
Air pollution	169.5	122.1	74.7	83.5	16.2	30.4	27.5	75.1
Climate change	16.0	9.8	3.5	4.7	1.0	65.7	1.2	4.7
Other	75.1	47.8	20.5	25.8	6.3	21.8	8.0	23.2
Total	392.0	254.8	117.6	143.1	29.6	135.3	36.7	129.5

Note: 2008 Australian prices @ 1 euro = A\$1.7 and CPI 1.147 from June 2000 to June 2004.
Source: Infrac/IWW (2004).

One feature of all estimates of social and environmental costs (which here include an estimate of the cost of emissions, using A\$50 per ton of CO₂-e, the 2020 estimate of the carbon price in the Treasury modelling of the CPRS-5 scenario) are that they are much higher for road than for rail. For passenger travel (Table 7) social and environmental costs so defined are estimated at about A\$90 per thousand passenger kilometres. Average social costs for rail passenger transport are about 30% of both the figure for cars and for all road transport.

Figure 7: Social costs of freight transport and passenger travel



Notes: LDV = Light duty vehicle. MDV = Medium duty vehicle. HDV = Heavy duty vehicle.
Source: Infrac/IWW (2004).

The picture is similar, and indeed somewhat more striking, for freight transport. Overall, the social costs of freight transport are estimated at about A\$130 per thousand tonne kilometres. The unit social cost figure for rail, of about A\$30, is 23% of the unit social cost for all freight, about one fifth of the figure for all road freight and about one quarter of that for large trucks, the road mode with which rail freight is most directly competitive. Overall the total social and environmental costs of transport in Australia are estimated at A\$52 billion or 5.6% of GDP in 2005, before including congestion costs, of which rail contributes only about 9%.

5. The Role of Electrification and Renewable Energy

Rail is typically a more energy efficient form of transport per unit than road, with lower energy use per passenger kilometre or per tonne kilometre. As discussed in the supporting papers to this report, rail’s energy intensity can be reduced further

by a range of measures. But rail's current lower energy intensity means that even if, as in Australia, both road and rail are powered primarily by fossil fuels (that is, by petroleum or coal-based electricity) rail has a lower emissions intensity. But one of the advantages of rail is that it offers the possibility of virtually zero emissions transport, when rail transport consists of fully electrified rail powered by electricity generated from renewable sources. In France, for example, about 80% of electricity is generated from renewable sources and there is a nationwide grid of electrified rail transport, with an official objective of complete electrification within 20 years. This provides France with an efficient, low emissions component of its overall transport system. Here we examine some of the issues concerning the possible future role of low-emissions rail transport in the Australian transport system.

5.1. Cleaner Rail with the Existing Fuel Mix

Current trends in both passenger and freight vehicles show that a major thrust of the future development effort will be to make vehicles lighter and increase the usable volume. In addition to the obvious measures of exploiting new materials and manufacturing processes, together with intelligent use of the payload space, a major contribution can be made by improvements to the suspension and drive. The suspension and drive will become more compact and lighter, provide good ride quality with lighter car bodies, cope with larger variations of tare to laden mass, and maximise the use of structural clearance gauge.

Other likely initiatives include improvements to vehicle/track interaction, more powerful and energy efficient diesel engines and electric motors, more effective power converters, and the introduction of regenerative braking as a means of supplementing the supply of electricity from on-board generators. Train Protection and Control Systems (TPC) will be one of the most important initiatives. Improving traffic control of trains can increase infrastructure network capacity by allowing more trains to run on the tracks without compromising safety, and reduce fuel usage through trains not being required to stop as frequently.

The pace of implementation of this technological change in railway rolling stock is fairly slow, because railway rolling stock has a long life. Also, Australian railway rolling stock needs to be custom built to make it smaller and lighter due to limitations in the Australian rail network. This limits the adoption of new technology, increases its costs and significantly delays the implementation of existing more efficient technology. However with the correct policy settings this range of both emerging and existing rail technologies could be brought forward to substantially reduce energy use, and hence greenhouse gas emissions for a given fuel mix, and also reduce costs, increase speed and achieve greater reliability. Available estimates suggest that for freight a combination of improved load factors, energy efficiency and operational improvements could reduce greenhouse gas emissions per tkm by 25% by 2020, and reduce emissions per pkm in passenger rail by up to 40%.

5.2. The Competitive Position of Electrified Rail

Operational advantages. One advantage of electrification is greater tractive power output. Electric locomotives can deliver as much as 2½ times the tractive power output of an equivalent diesel. Electric traction is particularly

efficient for ascending gradient, and can generally provide faster acceleration than that of trains using diesel power. Electric traction also means it is possible to further increase efficiency through regenerative braking. In general, electric trains are simpler and cheaper to maintain. For passengers, the advantages of electric traction include less vibration and smoother, quieter journeys.

Local environment benefits but increased accident rates. Electric trains are environmentally cleaner than diesel, especially at fully enclosed stations, where complex waste extractions systems need to be installed for diesel engines. Taking into account life cycle analysis, electric traction also has the advantages of almost completely eliminating emissions of carbon monoxide and hydrocarbon particles, and has a smaller impact via noise levels. But there is also a higher accident risk, arising from the live power line.

Lower fuel and other operating costs, but high capital costs. In principle, as oil prices rise and the cost of carbon comes to be fully reflected in fuel costs, electric rail offers significant savings in fuel and other operating costs. For some freight applications the benefit of lower fuel costs could be increased as a result of time-of-day pricing through the electricity grid. In such applications much of the traffic can take place overnight, in periods of low electricity demand and hence low electricity prices.

But the capital costs are high. The cost of electrifying existing lines is high, although costs vary markedly with conditions and whether what is involved is a greenfield project or the electrification of an existing line. A 2007 report by the UK Rail Safety and Standards Board (RSSB 2007) found that the cost to electrify an existing route was £550,000 to £650,000 (A\$1.2-1.4 million) per single track kilometre, but higher estimates have been cited in Australia. Electric locomotives are more expensive than diesel ones, but in some case there can be savings in capital costs, as fewer electric locomotives may be needed to pull a given volume of freight.

Lower greenhouse gas emissions. Electric traction can generate lower greenhouse gas emissions than diesel traction, in many contexts, even when electricity is generated from coal. If an electrified passenger service carries a passenger load near to optimal levels, its energy efficiency will be significantly higher than for cars or diesel rail services.

Importance of market size and network issues. Given the scale of the capital infrastructure costs, electrification requires significant traffic volumes if these costs are to be recouped. In addition there are important network coordination issues, so that operators may need incentives to switch to electric locomotives and uniform electrification standards are also necessary. Thus electrification needs to be applied to whole, coherent network segments in a coordinated way, and cannot be adopted piecemeal.

5.3. The Existing Pattern of Electrification in Australia

At the present time rail systems in all of the major cities are electrified, but only in Queensland are there major electrified routes in non-urban areas. Queensland Rail has about 1000 kilometres of electrified track, including the line from Brisbane to Rockhampton and the coal routes of central

Queensland. The major new electrified passenger line in recent years has been the Perth to Mandurah railway, and some extensions to electrified lines are planned for Melbourne. Both Victoria and NSW have withdrawn electric locomotives from regional lines over the past two decades. In both cases this seemed to reflect problems with incorporating electric locomotives into a predominantly diesel network, together with low fuel costs at the time of the decision.

5.4. The Role of Renewables in Powering Rail

Two factors influence the potential for the use of renewable energy sources to power rail. One is the fact that rail demand for electricity is intermittent over the full 24 hours of any day and the other is that it is often located in remote or regional areas. This means that power must normally be provided through a grid, although stand-alone generation systems may be viable for large, remote rail networks if the time-of-day issues can be addressed (e.g. by combined systems involving solar and gas power). It would also be possible for dedicated renewable power systems to be connected to the grid, and hence both buy from and sell to the grid. Another approach to ensuring that electricity used by electrified railways is effectively renewable is to purchase Green Power or Renewable Energy Certificates. Green Power is nationally accredited to ensure that electricity accredited by Green Power is renewable and beyond business as usual.

5.5. Options for Further Examination

Four options to increase the use of low-emissions electrified rail in the Australian transport system seem worthy of further analysis.

The ARTC track. Considerable work is underway to upgrade the ARTC track, and this has been supported by a A\$1.2 billion injection of equity into the ARTC under the Government's Nation Building announcement on 12 December 2008. Given the network issues involved, the case for including electrification in the rebuilding process should be given urgent consideration. Time-of-day pricing could offer substantial cost savings to operators (and returns to the ARTC), while electrified track and some renewable power generation to feed into the grid could offer substantial benefits to regional communities.

The Pilbara mining network. Given the likely future cost of diesel fuel, including the cost of carbon, there may be a case for electrifying this 1000 km railway and powering it by gas or gas/renewable energy sources. While this would be primarily a commercial decision, it may be influenced by appropriate public policy settings.

Urban rail systems. Rapid rail passenger growth is occurring in many Australian cities, in part because many are looking for cleaner methods of travel. This advantage of rail could be enhanced if operators purchased Renewable Energy Certificates to ensure that urban rail was low emissions. Such action could assist the renewables industry in the State in question.

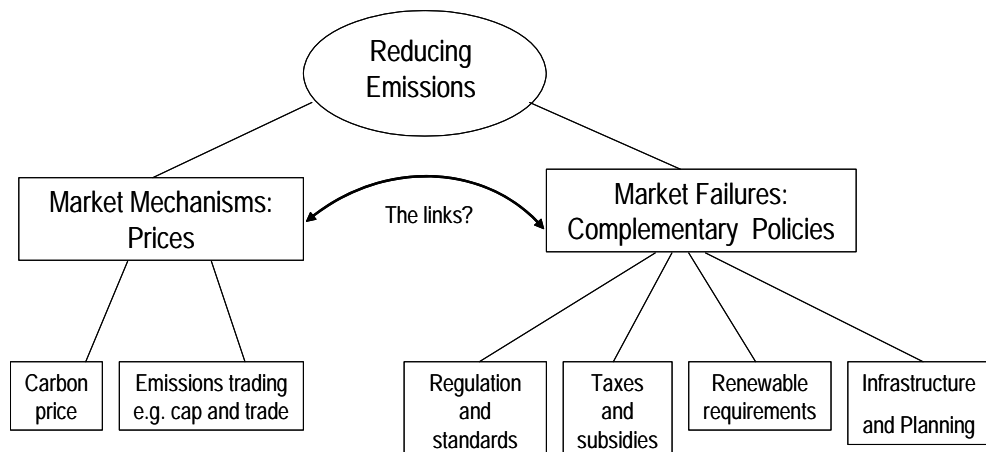
The Queensland rail network. QR has led the way in electrification in recent years, and the issue of reducing the emissions intensity of the power used in that network is now an important one.

6. Climate Policies, Transport and Growth

6.1. Two Approaches to Climate Policy: Prices and Complementary Measures

In the debate about climate policy, as in other areas of economic and social change, there are within a market-based approach two main streams of policy: prices and complementary policies, where by a complementary policy we simply mean a policy designed to influence patterns of energy use or to reduce emissions other than through price mechanisms. This would include policies to promote the development of renewable energy and to encourage a modal shift from road to rail transport by non-price means. As illustrated in Figure 8, prices are an effective instrument to the extent to which markets work effectively. To the extent that markets fail, then complementary policies are necessary to achieve the best outcomes.

Figure 8: Policy options for reducing emissions: Prices and complementary policies



This is a critical issue for climate policy and emissions trading. Many economists argue that if an emissions trading scheme is established there is no place for such policies, and hence that the role of complementary policies is limited in the CPRS. This is an important issue in the case of transport for, as we have seen, the medium term impact of carbon prices on transport emissions will be limited, and a sharper reduction in emissions is likely to require complementary policies in transport, such as infrastructure and other spending, to support a modal shift.

This report argues the contrary case, that complementary policies are necessary to facilitate the most efficient adjustment to a lower emissions path, and to achieve a given reduction in emissions at least cost and with the lowest carbon prices. Some of the various types of market failure involved and of their relevance to emissions reductions, especially in transport, are reviewed below. These issues are further discussed in Paper 4.

6.2. Relevant Types of Market Failure

In a fully competitive market, individual utility or profit maximising agents take decisions on the basis of price, in the face of demand and supply functions, that clear markets and which generate outcomes that are individually and socially optimal. Market failures occur when these results cannot be achieved – that is, prices do not clear markets and/or the outcomes are not both individually and socially optimal. Four types of market failure are most important in the current context:

- (i) *Externalities*: An externality occurs when the costs or benefits of an action are not fully borne by, or cannot be fully appropriated by, the agent concerned. One classic type of externality arises from public goods (goods which are non-rival and non-excludable) such as clean air – if one person uses the air this does not stop others from doing so, and it is difficult to stop others making use of the clean air. One response to externalities is to internalise the costs or benefits, so these costs are borne, or the benefits accrue to, the agent undertaking the activity in question. Emissions trading is an attempt to internalise the external costs of greenhouse gas emissions, by setting a carbon price and making those who produce the emissions bear the cost.

- (ii) *Sunk costs*: A sunk cost is a non-operational expenditure that has been made and cannot be recovered, even if the firm goes out of business. Examples of sunk costs include spending on product innovation or R&D or on fixed assets which have no value outside of their current use (such as railway track or locomotives). Sunk costs are rife in the transport and energy area. For example, much of the spending on tracks, customised vehicles and power stations is sunk, and the assets have little value other than in their current use.

When one participant in a market needs to incur a (new) sunk cost that other participants do not need to incur there will be a market failure – the market clearing price may be well above the marginal costs of the existing producers without being sufficient to induce new entry. In such a situation a significant increase in price might occur without generating any new entry, or any increase in supply. Sunk costs are also relevant to consumer purchase decisions. If an individual already has an (inefficient) car, the market value of which is low so the costs are largely sunk, then even in the face of sharply rising fuel prices she may be reluctant to incur the new sunk costs of purchasing a more fuel efficient vehicle.

- (iii) *Coordination failures*: Coordination failures occur when the decisions of agents, or their activities in separate markets, are interdependent and some factors hinder the coordination of these decisions or activities. In the theory of free markets the agents are independent of one another, but when they are in fact interdependent and the coordination of their activities fails then price adjustment through markets may generate less than optimal outcomes.

Interdependence between agents and markets is central to the energy and transport industries, and hence there is a good deal of scope for

coordination failures. For example, alternative energy supplies can only be added to the grid (and hence supplied to the national energy market) if adequate distribution infrastructure is available; freight operators can shift from road to rail only if rail track and facilities (such as intermodal exchanges) are available, and consumers can shift from road to rail for the journey to work only if there is a train line in their area. Sunk costs can also exacerbate problems of coordination. For example, if there are sunk costs in the electricity distribution industry these may inhibit the provision of the new distribution infrastructure necessary to facilitate the operation of the energy market in the face of a carbon price.

(iv) *Information asymmetries and principal-agent problems*: These market failures occur when participants in markets have access to different levels of information or when a principal is represented in a transaction by an agent, who may have different information or objectives than the principal or may face different incentives.

6.3. The Key Role of Complementary Measures

As is evident above, the transport system is riddled with market failures, especially those of the first three types – externalities, sunk costs and coordination failures. Some of these have been illustrated in the brief discussion above. Some of the social and environment costs of road transport, studied in Section 4 above, are internalised through taxes and charges, but many are not. For example, it is widely acknowledged that the full costs incurred by large, heavy haulage trucks are not fully passed on to users. Many of the key assets involved in transport, such as rail track, locomotives, signalling and other systems and R&D to create relevant know-how, involve sunk costs. This means that market mechanisms driven by prices alone are unlikely to provide sufficient incentive to generate the optimum level of investment in these assets. As, as noted above, coordination failures can be particularly acute in transport generally, and in rail transport in particular, hence limiting the level of investment in any particular component of the system unless these failures are addressed.

In some instances the specific design of the CPRS will exacerbate existing market failures in the transport system. For example, when a traveller has to choose between using his or her car or taking the train, most of the costs of travelling by car are sunk, and the only marginal cost is the fuel cost, which is compared to the train ticket cost. In the initial years of the CPRS road fuel costs will be held unchanged but railway costs will rise, worsening the impact of this market failure.

The presence of such pervasive market failures means that prices will have only a limited role in facilitating structural change and reduced emissions in transport. If such failures are not addressed the carbon price will be higher than necessary for a given reduction in emissions and that a less than optimal set of emissions reductions will be chosen by the market. By contrast, substantial programs to eliminate market failures will both reduce the carbon price required and generate a more efficient response. Thus a carbon price is necessary but not sufficient to achieve an optimal outcome in the transport sector.

In analysing the impact of measures to reduce carbon emissions on the economy, the focus is often on the impact of relative prices within a given industry structure with defined production and investment functions. In such a context introducing a carbon price will inevitably reduce economic activity, as the existing low cost but polluting technologies are taxed and activity is shifted to higher cost but less polluting ones. But if the focus is on the role of complementary policies in creating new goods and industries through R&D, revitalised infrastructure and new investment, then action to reduce emissions may well be a source of growth.

This point is particularly important in the context of the global financial crisis and its aftermath, especially the sharp recession in the USA and some parts of Europe, and the inevitable impact of that on Australia and other countries. New or higher carbon prices alone may indeed tend to slow growth, but strong complementary policies may be growth enhancing, both by reducing the market-based carbon price and also by supporting investment in R&D, new infrastructure and plant and equipment. Thus many of the measures necessary to address key market failures would be strongly expansionary and could be a central part of an appropriate fiscal response to the current slowdown.

Achieving rapid change in transport thus requires strong but appropriate complementary policies, and such policies will both reduce the carbon price necessary for a given reductions in emissions and stimulate growth. An appropriate complementary policy is one that addresses an important market failure in a demonstrably cost-effective manner.

7. Current Issues in Australia's Transport System

7.1. The Freight Sector

The freight sector is divided into two markets – bulk and non-bulk. As measured by tonne kilometres, bulk is most (84.4%) of the total task and in this task rail predominates. It consists of the transport of single products such as minerals and agricultural products. Rail enjoys a substantial cost advantage and undertakes most of the freight task. However, in some freight, such as grain and timber, road transport provides strong competition and has continued to gain market share over many years.

In discussions about rail freight the focus is on the remaining 15.6%, the non-bulk market, which is divided between general and containerised freight, and competes directly with road transport.

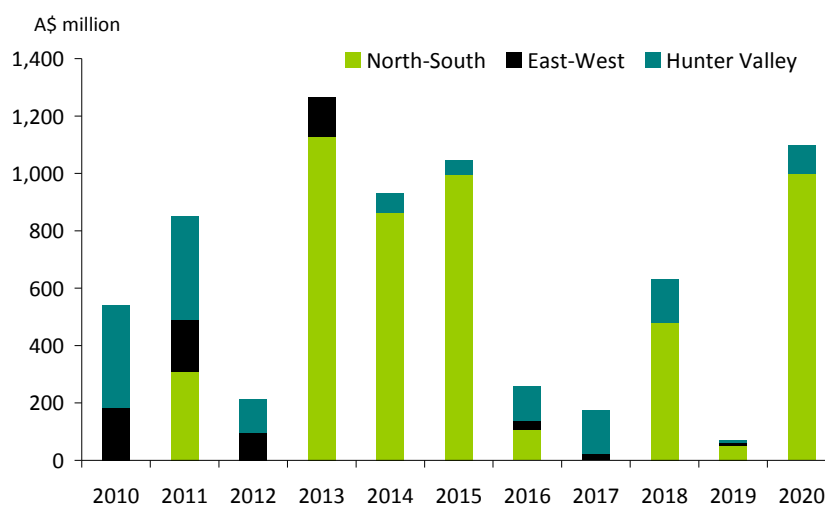
To achieve a modal shift to rail in the non-bulk market a number of issues of costs and reliability need to be addressed. As discussed above rail is generally cheaper on a ntkm basis, but not necessarily so once door to door delivery charges are added on. One means of helping to address this is to increase the efficiency of modal transfers through the establishment of specialist intermodal exchange terminals. Costs can also be reduced by double stacking, longer trains and better train management and communications systems.

Changing the rail network so that it can take USA standard rolling stock will allow greater rail productivity by increasing the payload of a train, allow the quick and cheaper acquisition of more energy efficient rolling stock and allowing the Australian rail industry to quickly capitalise on innovations in the large American rail market.

A second closely related issue is reliability. Freight trains can be subject to unscheduled hold-ups and delays. While better train management systems also help to improve reliability, addressing this issue requires significant infrastructure investment, particularly for the North-South corridor linking Melbourne, Sydney and Brisbane, of the sort outlined in the ARTC submission to Infrastructure Australia (ARTC 2008). The costs of the proposed rail system enhancements include A\$4.9 billion to address the deficiencies of the North-South corridor. The proposed works include duplicating the Seymour – Tottenham line, increasing the capacity of the Sydney – Newcastle link and clearing the Melbourne – Sydney line for double stacking.

Expenditure on the proposed works is scheduled over a 10 year period as indicated in Figure 9. It shows however that many of the major works in the North-South corridor would not be completed until 2015.

Figure 9: Total cost of proposed ARTC enhancements by year of expenditure



Source: Authors estimates based on ARTC (2008).

Infrastructure Australia in its report to the Council of Australian Governments has listed these projects (Infrastructure Australia 2008, pp. 68-69), along with others for ‘further analysis’. The Australian Government also announced in December 2008 that it would provide an added A\$1.2 billion equity investment into the ARTC to help finance these projects (Australian Government 2008).

7.2. The Passenger Sector

Rail passenger travel has grown rapidly in recent years in most state capitals in response to recently increased petrol costs and growing road congestion. There has been large increase in patronage in Melbourne (10.0% in 2006/07

compared with 2005/06) and Brisbane (9.0%) and a more modest increase in Perth (5%). In Sydney, on the other hand, patronage growth has been constrained, apparently by capacity limitations, to an increase of only 2.8% for 2006/07.

Table 9: Travel by mode, 2003/04, passenger kilometres

Mode	Sydney	Melbourne	Brisbane	Adelaide	Perth
Passenger cars	47.83	46.53	19.11	13.34	16.73
Light commercial vehicles	2.37	1.73	1.17	0.52	1.04
Motor cycles	0.29	0.19	0.18	0.06	0.07
Rail	5.19	2.33	1.01	0.14	0.55
Light rail	0.02	0.75	n.a.	0.01	n.a.
Bus	2.38	1.12	0.83	0.62	0.84
Ferry	0.13	n.a.	0.01	n.a.	0.00
Total	58.20	52.65	22.31	14.70	19.24
Proportion by mode					
Car	82.2%	88.4%	85.6%	90.7%	86.9%
Rail/Light rail	8.9%	5.8%	4.5%	1.1%	2.9%
Total public transport	13.3%	8.0%	8.3%	5.3%	7.2%

Source: BITRE (2008b).

Most passenger travel in the State capitals however is undertaken by car. The proportion ranges from a high of 90.7% in Adelaide to a low of 82.2% in Sydney as shown in Table 9. The proportion of passenger kms by car in Melbourne is second only to Adelaide and almost as high in absolute terms to Sydney despite a somewhat smaller population. A significantly higher proportion of total passenger kms in Sydney are undertaken by train, 8.9 % in 2003/04 compared with only 4.4% and 4.5% respectively for Melbourne and Brisbane (BTRE 2008b).

The increase in projected patronage has resulted in state governments planning significant capacity increases, but implementation is often problematic. One example of planned increases in capacity is in Victoria. Following the recommendations of the East-West Link Needs Assessment (EWLNA), the Victorian Transport Plan¹ adopted a range of proposed initiatives to increase the capacity of the rail network, most notably a new 17km tunnel from Melbourne's west to south west estimated to cost more than A\$4.5 billion. Analysis provided by the EWLNA demonstrated that based on even quite modest patronage growth and after the maximum possible timetabling and operational efficiencies, capacity on two groups of lines to the north and south would be exceeded by 2013 and 2019 respectively (EWLNA 2008, p. 81). A new tunnel would represent a step change in Melbourne's rail track network which had not been substantially increased since the 1980s. Significantly the tunnel was justified on forecast patronage growth rates of between only 2.1% p.a. and 6.6% p.a., significantly below the actual rate experienced since 2004 of 7.6% p.a. The lower range projections would result in a modest modal shift to public transport from 8% to 9% (EWLNA 2008, p. 77). Thus achieving a significant modal shift consistent with reducing greenhouse gas emissions would require a major investment in increased capacity.

¹ See <http://www4.transport.vic.gov.au/vtp/>

Other States have undertaken passenger rail improvements or are planning to do so. Perth has recently opened network extensions including a 72km extension to Mandurah and introduced new rolling stock. Adelaide is planning to electrify its urban rail system. The NSW government committed to the extensive Clearways program, although progress has been slower than planned, but the Epping-Chatswood rail link has now opened. There are several rail projects occurring in South-East Queensland including rail networks extensions including the Gold Coast.

7.3. The Key Industry Players

Two national rail operators, Queensland Rail (QR) and Pacific National dominate rail freight. QR, while Queensland based, is becoming an integrated national carrier and has significant state government support. Pacific National, which is part of the Asciano Group, is a national train operator but is saddled with high debt levels following the split with Toll Holdings in 2007. SCT Logistics is a niche operator specialising in the Melbourne to Perth link. It has experienced very high rates of growth, over 20% per annum for the period 2002/03 to 2006/07.

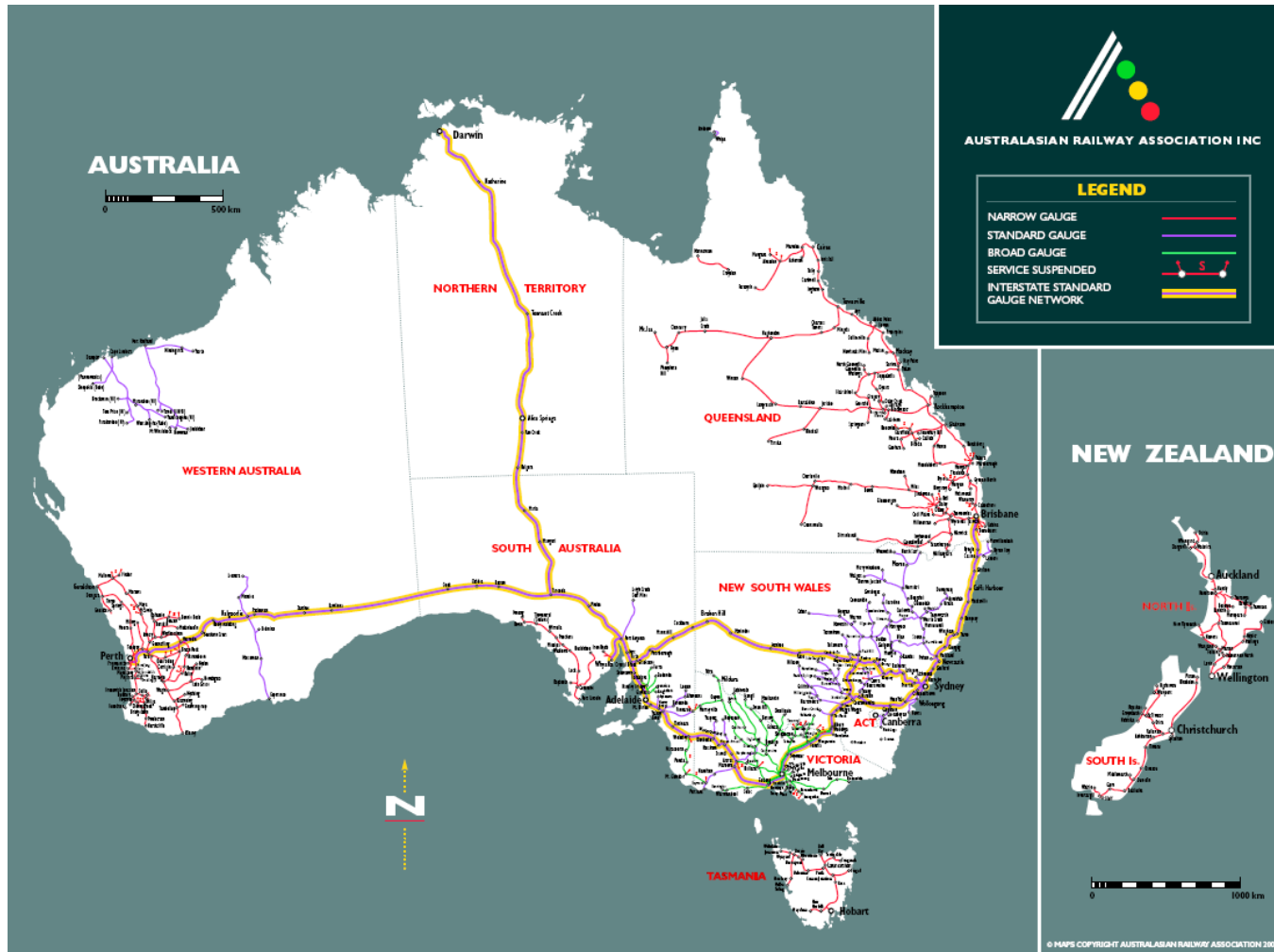
The other key participant is the Commonwealth owned, Australian Rail Track Corporation (ARTC). The Australian freight rail network is complex. It consists of an interstate standard gauge network and a number of independent state based regional networks each with different gauges as shown in Figure 10. The east coast regional links are each owned by their respective state authorities but a number of the others are privately owned.

The ARTC has integrated the key interstate rail links under its control and is now responsible for access and maintenance to the majority of the Defined Interstate Rail Network (DIRN) (the intercapital network) linking Brisbane to Perth.

However at a number of key locations access remains problematic for freight trains. Freight traffic passing through Sydney is accorded a lower priority than passenger traffic which can result in long delays. Also maintenance activity is sometimes poorly coordinated with train operators. Access to Brisbane along track owned by QR can also sometimes be subject to hold ups. QR is in the process of reorganising into separate companies for management of the network, operations and passenger rail which may help overcome these conflicts. However the east west link generally operates effectively with the added bonus that double stacking is possible from Adelaide to Perth

Other key rail participants are the rail track owners in Western Australia and in New South Wales. WestNet is the manager for the Western Australia network and is responsible for the Perth – Kalgoorlie section of the key Perth – Adelaide interstate route. This introduces another party with its own commercial, regulatory, planning and operating priorities, which means that total control and management of this key route is held by two parties.

Figure 10. Australian rail network



Source: Australasian Railway Association.

RailCorp, who own the network in Sydney, are primarily responsible for passenger train operations. This network is critically placed at the junction of key freight routes between Melbourne – Sydney, Sydney – Brisbane, Melbourne – Brisbane. Again, different priorities and procedures, political drivers and significant network congestion impact on the key interstate non-bulk freight routes and also impact on ARTC's ability to effectively manage the interstate corridors.

Toll Holdings is the largest road freight operator with about 6.8% of the market share. It has been growing rapidly (over 15% per annum). It is an acquisitive company and has been able to expand into China and Singapore through strategic purchases. It provides complex logistics solutions for some of Australia's largest companies as part of its freight services. Linfox, the next largest road freight operator, remains a private company and less is known of its operations. However it also provides supply chain management services for its major customers.

Each of the states has adopted different structures to deliver public transport. Victoria is the only state to have adopted a partly privatised model for rail passenger travel. Detailed data about rail passenger travel is difficult to obtain. However both Queensland and Victoria provide reasonably disaggregated information. In Queensland after a number of years of zero increase in subsidy levels, the Queensland government increased its subsidy by 16.9% in 2006/07. Together with the higher fare revenue this increased the segment result for QR passenger operations from A\$43.9 million in 2005/06 to A\$91.8 million in 2006/07. This trend continued in 2007/08, when the segment result for passenger climbed to A\$168.3 million, more than offsetting a loss of A\$8.2 million in the freight segment.

Victoria adopted franchise arrangements for rail and train transport in 1999 and achieved a significant improvement in reliability and punctuality of its services. However after the failure of one of the operators the arrangements were renegotiated with the remaining operators in 2004. This introduced many changes sought by the operators while retaining the performance targets previously achieved. While increasing congestion has meant that penalty payments have been levied because of performance failures, offsetting some of the fare revenue gains, total payments to the operators have increased by 13.6% per annum for Connex and 8.6% per annum for Yarra Trams for the period 2004/04 to 2007/08. As illustrated by the QR result, the shift to rail passenger transport has made operating such businesses at current subsidy levels a very profitable activity.

8. Achieving the Transformation of Transport in Australia

It has been demonstrated above that achieving a sharp modal shift to an enhanced, low pollution rail transport system is likely to generate substantial economic and social benefits, but will require not only a carbon price but also a wide range of complementary policies. These policies will address market failures in the transport system at key points directly related to the challenges that this industry faces in modernising and competing more effectively with other transport modes. Consistent with the previous argument, and with the more

detailed analyses provided in the supporting papers, policy initiatives are needed in the following areas.

Pricing. Where possible, an effective response to an externality is to introduce a price or a tax to internalise the costs and/or benefits involved, as is occurring with the internalisation of the social costs of greenhouse gas emissions through emissions trading. In freight transport the costs, both social and infrastructure, which are generated by large, long distance trucks are not passed through fully to the users of this form of transport. There is a widely recognised case for mass-distance-location charging to be introduced, as in other countries, to correct this market failure. Mass-distance-location charging also corrects some of the limitations of the existing road charging regime, including averaging of charges, whereby trucks which are more heavily used pay relatively lower charges, and the fact that the full social and environmental costs generated by large trucks are not fully passed on to users.

Infrastructure investment. Major rail infrastructure (such as rail track and associated works and equipment) suffers from all three forms of market failure highlight previously, as does road infrastructure. Constructing a new or enhanced railway involves a heavy sunk cost and provides benefits to many (including, for example, property and business owners) that cannot be fully appropriated by the owner of the infrastructure. The value of a railway system is also highly dependent on its coordination with other systems and facilities (e.g. rail or road connections) and coordination failures can greatly reduce its value. As argued above and in the detailed papers, major investment in the extension and upgrade of Australia's rail infrastructure is necessary, and there is a strong case for public support for this activity. Further steps towards standardisation of rail networks are also required, as these would generate many efficiency and capital cost benefits.

Standards for rolling stock. Uniform standards for rolling stock, perhaps in line with the US AAR (American Association of Railroads) standards, are highly desirable. These standards would require increasing the width and height of the rail corridor to accommodate larger rolling stock and increasing the strength of the rail track to accept heavier rolling stock. This would remove the current impediment of all new rolling stock having to be redesigned and specially built for the Australian market, which prevents the rail market from responding to market growth, increases equipment costs, reduces competitiveness with road, and delays the introduction of new technology. The current waiting time for a purchase of a new locomotive in the USA is 2 months, compared to 2 years in Australia for equipment based on an older design. Significant productivity and energy efficiency gains from carrying a greater mass per train would also be achieved.

Investment in systems, facilitation and coordination. Some similar considerations apply to investments in, for example, signalling and control systems, advanced modal interchanges and many aspects of intermodal and intramodal coordination. Large scale investments will be needed both to make rail transport more efficient and to facilitate the modal shift. Both private and public investment will be required, in many cases in joint projects to achieve simultaneously both public and private goals.

Investment in R&D, new technology and plant and equipment. To modernise Australia's rail system and to increase its scale of operations, massive investment will be necessary by operating companies, whether public or private, and by firms in supplier industries in these areas. The prospects for an adequate return on such investments would be greatly increased by the other investments outlined above (such as track extension and upgrading). But in view of the difficulties of appropriability and sunk costs, public initiatives in the form of R&D support programs and enhanced depreciation allowances for certain classes of expenditure are likely to be necessary.

Investment in electrification and renewable energy. Finally, investment in the electrification of large scale rail systems, such as those of the North-South corridor, and the linking of those systems to sources of renewable energy will involve massive sunk costs the returns on which will be difficult to capture fully and will be heavily influenced by the actions of others. Again this will in many cases require public leadership, when adequate long term social returns can be generated.

The massive modal shift to road transport described above, and illustrated in Figures 5 and 6, took place over 40 years or more, and the quality of much of Australia's rail network and rolling stock has also declined over a long period. Hence partially reversing that modal shift, and modernising the Australia rail industry, will also require long term, sustained action. But given vigorous action it is possible to consider that, within 20-30 years:

- the majority of Australia's non-bulk freight movements outside capital cities would occur in modern, highly efficient trains;
- a significant share (20-25%) of all passenger kilometres travelled in Australia would be by rail; and
- the overall rail system would be largely electrified and increasingly powered by renewable energy.

In the final sections of this report we provide a summary of modelling results on the economic, social and environmental benefits of moving towards these goals, and set these benefits in the context of the likely costs involved. We also explore how moving towards these goals can contribute to the stabilisation, and ultimately the reduction, in transport industry emissions.

9. Scenarios

9.1. Modelling Strategy

The actions that are required to achieve these goals are complex and diverse, as are the interactions between the different parts of the transport system. It is not possible to provide, at this stage, detailed costing of all of these elements, nor is it possible to construct a model that takes adequate account of all of the linkages within the transport system. Thus for the purposes of this report a different modelling strategy is adopted, one that focuses particularly on quantifying the benefits of particular steps towards these goals, and uses this quantification as a guide to the likely returns to

the investment required. The model that has been constructed to undertake this analysis is documented in Paper 10.

More specifically, the strategy adopted involves four main elements. First, three scenarios to 2020 are established, as specific defined steps towards achieving these goals. Secondly, using the model constructed for this purpose and consistent with the cost-benefit assessment guidelines of Infrastructure Australia, we estimate the economic, social and environmental benefits arising from each of these three scenarios. Thirdly, while detailed estimates of the required investment to achieve these scenario outcomes are not available, we can calculate, for a range of social rates of return, the level of investment expenditure that would earn a given rate of return in terms of these benefits. This 'permitted' level of investment can then be compared with what is known about the level of investment that is likely to be required. Fourthly, the implications of these scenarios for transport emissions are explored, including a simple extension of the model results to 2030.

9.2. The Three Scenarios

The first scenario, Scenario 1, involves a significant shift of long-haul freight to rail, and is broadly consistent with the ARTC's medium case scenario (ARTC 2008). Starting from the BITRE (2008c) projections, it assumes that after 2010 the volume of non-bulk freight carried by articulated trucks is fixed at its 2010 level (162.3 billion tkms), with the growth implied by the BITRE projections transferred to rail. It is also assumed that there is no change in any other freight allocations or variables, such as average loads. The increased rail task is split according to the split of the rail freight task in the base case.

The second scenario, Scenario 2, involves increased passenger movements by rail. The focus here is only on passenger movements, and freight movements have remained as they are in the base case. In this scenario a shift of motorists out of their cars and into public transport is assumed. Over 2010-20 the growth in passenger vehicle kilometres for cars is constrained to grow at 50% of the base case rate in the BITRE (2008c) projections, with the other half of the growth shifted to public transport, with an assumed split of 70% to trains and 30% to buses. Standard occupancy rates are used to convert these assumptions into vehicle movements.

The third scenario, Scenario 3, is one in which both the freight and passenger changes occur and in addition there is increased electrification and increased use of renewable energy to provide the electricity. To model this, two steps are undertaken. First the renewable energy component would lessen the impact of coal, so the greenhouse gas emission factor for electricity used in rail is reduced by 50%. Secondly, the increase in electrification sees urban passenger trains become totally electrified, and a significant portion of the freight network electrified resulting in a total of 60% of the total rail network being electrified (an increase from 38.5%).

Table 10: Summary of the rail tasks in the three scenarios

Year	Passenger			Freight			Total tkm
	Non-urban pkm	Urban (heavy rail) pkm	Urban (light rail) pkm	Hire & reward non-bulk tkm	Hire & reward bulk tkm	Ancillary tkm	
1990	2.35	7.18	0.48	19.49	35.36	33.06	87.91
1995	2.22	7.51	0.50	21.69	40.71	43.79	106.19
2000	2.38	8.34	0.56	27.39	57.17	49.00	133.56
2005	2.20	9.40	0.58	39.28	72.24	77.73	189.25
2010	2.39	10.56	0.64	48.92	82.63	114.49	246.04
<i>Growth rate 2000-2010</i>	<i>0.1%</i>	<i>2.4%</i>	<i>1.4%</i>	<i>6.0%</i>	<i>3.8%</i>	<i>8.9%</i>	<i>6.3%</i>
Base Case							
2020	2.75	12.61	0.79	61.66	106.74	169.62	338.02
<i>Growth rate 2010-2020</i>	<i>1.4%</i>	<i>1.8%</i>	<i>2.1%</i>	<i>2.3%</i>	<i>2.6%</i>	<i>4.0%</i>	<i>3.2%</i>
Scenario 1: Increased rail freight							
2020	2.75	12.61	0.79	75.41	130.55	207.46	413.42
<i>Growth rate 2010-2020</i>	<i>1.4%</i>	<i>1.8%</i>	<i>2.1%</i>	<i>4.4%</i>	<i>4.7%</i>	<i>6.1%</i>	<i>5.3%</i>
Scenario 2: Increased passenger traffic							
2020	4.62	21.17	1.32	61.66	106.74	169.62	338.02
<i>Growth rate 2015-2020</i>	<i>6.8%</i>	<i>7.2%</i>	<i>7.5%</i>	<i>2.3%</i>	<i>2.6%</i>	<i>4.0%</i>	<i>3.2%</i>
Scenario 3: Increased rail freight and passenger traffic with increased renewable electricity							
2020	4.62	21.17	1.32	75.41	130.55	207.46	413.42
<i>Growth rate 2015 - 2020</i>	<i>6.8%</i>	<i>7.2%</i>	<i>7.5%</i>	<i>4.4%</i>	<i>4.7%</i>	<i>6.1%</i>	<i>5.3%</i>

Source: Actual data and projections to 2010, BITRE (2008c); estimates of the authors.

The rail tasks implied by the three scenarios are summarised in Table 10. Over the decade to 2020 total passenger kilometres travelled by rail rise by 7.1% per annum, a substantial increase in the BITRE projection for the decade to 2010. But overall passenger traffic has been rising at close to this rate in recent years, in spite of capacity constraints in some cities, and it may be that the BITRE projections to 2010 underestimate this growth. Total freight traffic carried by rail is projected to grow by 5.3% per annum over 2010-20, which is actually lower than the estimated figure of 6.3% per annum over 2000-10. But the high growth in rail freight is heavily influenced by rapid growth in the bulk commodity trade (evident in the 8.9% growth in ancillary freight), and excluding that element the growth rate falls to less than 5%. Nevertheless both the passenger and freight scenarios have some grounding in the trends that have been underway in recent years, although massive investment will be needed to continue these growth rates to 2020.

10. Modelling Modal Change Scenarios

10.1. The Model

The modelling of the costs and benefits of different policies is a standard practice in the discipline of economics for project evaluation. This procedure allows for the efficiency, defined as net benefits per net cost, to be determined for a project allowing projects to be ranked in order of an efficiency criteria or rule. The model produced by CSES starts from the type of base model used by the BTRE model for reporting greenhouse gas emissions to the Department of Climate Change, and is consistent with the

cost-benefit guidelines issued by Infrastructure Australia. The reason why this model was chosen is based on the fact that it is a bottom up model which is transparent, with full details provided in reports from the department responsible for transport matters (BTRE 2002, 2006; BITRE 2008c).

In simple form the model derives activity in vehicle kilometres for different types of vehicle in different scenarios. These activity numbers are used to calculate estimates of operating costs and social costs, drawing on parameters estimates developed in Papers 2 and 5. Three types of social cost are included, for each vehicle type: accidents, noise and air pollution. As noted above, congestion costs are not included in this version of the model. In addition the emissions associated with a given scenario are calculated by applying fuel efficiency coefficients to estimates of the amount of fuel consumed, and then computing the greenhouse gas emissions by fuel using an emissions factor for that fuel.

10.2. The Estimated Benefits

Table 11 below provides a summary of the estimated overall annual benefit from the three scenarios by 2020, expressed in constant price dollars in that year. Overall the estimated benefits are very high, with a total annual benefit from all sources in Scenario 3 of about A\$10 billion in 2020. The benefits from lower operating costs and the social benefits are of comparable magnitudes, while the benefits from emissions savings are smaller (about A\$340 million by 2020).

Table 11: Summary of benefits: Annual benefits in 2015 and 2020 (\$A billion)

	Scenario 1	Scenario 2	Scenario 3
Total reduction in economic costs			
2015	0.94	1.34	2.28
2020	1.88	2.44	4.32
Total reduction in social costs (ex. climate change costs)			
2015	2.18	0.68	2.85
2020	4.06	1.23	5.30
Total reduction in climate change costs			
2015	0.08	0.05	0.14
2020	0.19	0.12	0.34
Total benefits			
2015	3.20	2.06	5.27
2020	6.14	3.79	9.96

The estimated benefits are expressed in net present value terms in 2008 in Table 12, using discount rates of 4%, 7% and 10% respectively. Again the numbers are very large, with Scenario 3 having gross benefits with an NPV in 2010 of A\$27.4 even at a discount rate of 10%. While it must be realised that there are large margins of error around these estimates, the basic finding of very large total benefits is beyond dispute. It should also be noted that the benefits included in the net present value calculations in Table 12 only extend to 2020, and these benefits will also accrue for many subsequent years.

Table 12: Net present value in 2010 of total benefits over 2010-20, relative to the base case (A\$ billion, constant prices)

Discount rate	Scenario 1	Scenario 2 (A\$ billion)	Scenario 3
4%	25.6	16.1	41.7
7%	20.6	13.0	33.7
10%	16.8	10.6	27.4

These figures again illustrate the magnitude of the economic and social costs being imposed on Australia by the transport patterns that have built up since the Second World War, and hence the benefits that can be gained by even partially reversing those trends.

10.3. Investment to Achieve the Benefits

The investments that need to be undertaken if these benefits are to be achieved are many and varied, covering both public and private participants in the industry and involving investment in track and equipment, in locomotives and many business service activities, and in rail electrification and perhaps in renewable energy generation. It has been not been possible in this study to quantify the costs of these investments, although some important components (the rail freight track component for the North-South corridor) have been costed by the ARTC at A\$4.9 billion. Overall it is likely that an investment of the order of A\$15-20 billion (in constant prices) over 2010-20 will be required to achieve the outcomes specified for Scenario 3.

Table 13: Annual justified investment to achieve total benefits, for different discount rates (A\$ billion per annum over 2010-20)

Rate	Scenario 1	Scenario 2	Scenario 3
4	2.9	1.8	4.8
7	2.7	1.8	4.5
10	2.6	1.8	4.2

As one way of approaching this matter, Table 13 reports calculations of the constant, real level of investment outlay per annum over the period 2010-20 that would be justified by these benefits, at different discount rates. Thus, for example, even at 10%, the justified annual level of investment is A\$4.2 billion, or an undiscounted total of A\$42 billion over the period. This is well above the actual level of investment that is likely to be necessary in practice to achieve the benefits.

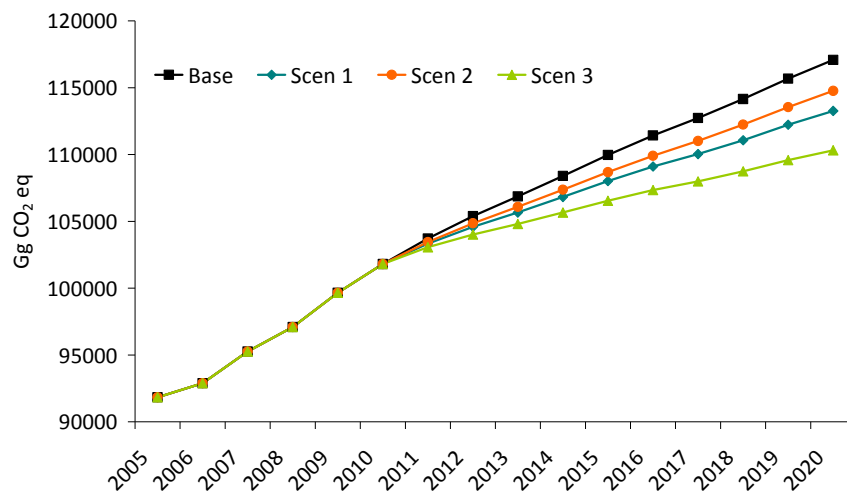
Another way of approaching these figures is to calculate the implied social rate of return in 2010 to an upper bound of the likely constant annual level of investment during the decade to achieve these benefits. Taking that upper bound as A\$20 billion, or A\$2 billion per annum, the implied social rate of return on this investment is 50%.

10.4. Impact on Transport Emissions

Finally, we report the model results for the impact of the three change scenarios on total transport emissions (further details are provided in Paper

10). These results are summarised in Figure 11, and show a reduction of about 7% in total transport emissions relative to the BITRE base case by 2020. Most of Australia’s transport emissions come from road transport, while emissions from air transport are a small but rapidly growing component. Road and air emissions are held at the base case in these simulations, except for the reduction in road emissions that take place as a result of the modal shift from road to rail. Having regard to this, and to the limited period (to 2020) covered, the emissions reductions shown in Figure 11 are quite significant.

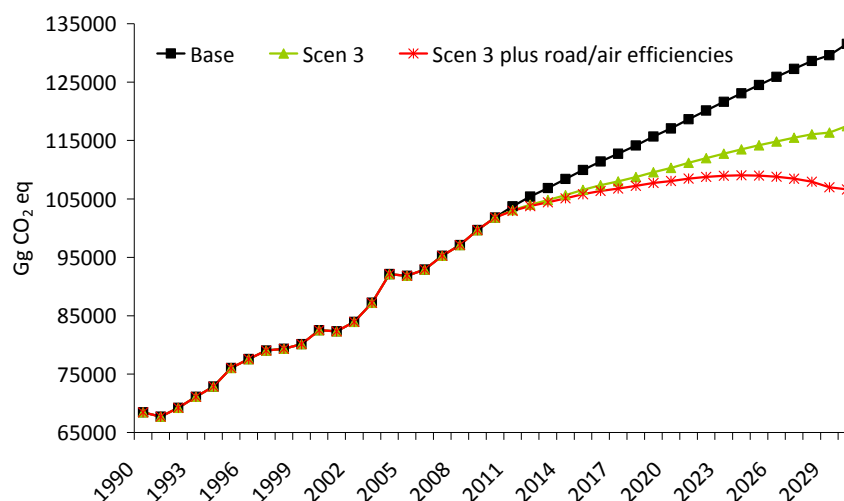
Figure 11: Total transport emissions to 2020, base case and three scenarios (Gg CO₂-e)



Source: Actual data and projections to 2010, BITRE (2008c); estimates of the authors.

In Section 1 of this paper we argued that, given a proper understanding of the climate change context in which Australia is placed, it will be necessary that transport emissions are declining in absolute terms before 2030. To examine the prospects for this outcome in the light of the scenarios discussed here, we have extended the model, in simple terms, to 2030 and also considered the implications of further improvements in the emissions intensity of road and air transport. The results are presented in Figure 12. The specific assumption used for the road and air sectors is that the emissions intensity per unit of activity in all components of these industries is 10% lower in 2030 than in the BITRE base case for that year, with the rate of reduction gathering pace over time.

Figure 12: Total transport emissions to 2030, base case, scenario 3 and increased fuel efficiency in road and air transport (Gg CO₂-e)



Source: Actual data and projections to 2010, BITRE (2008c); estimates of the authors.

Figure 12 shows that, taking account of the Scenario 3 effects only, total transport emissions are about 11% lower than in the base case by 2030. If account is also taken of further action to reduce emissions intensity levels in road and air transport, relative to the base case, by 10% by 2030, then total transport emissions are about 19% lower than the base case by 2030. Total transport emissions peak in 2024, and are less than 5% above their 2010 level in 2030.

Thus the actions discussed in this report not only generate large economic and social benefits, and high social returns to investment, but they also contribute significantly to reducing greenhouse gas emissions. If they are supplemented by further action to reduce the emissions intensity of road and air transport, total transport emissions can begin to decline after about 2025 and be brought close to their 2010 level by 2030. This would represent a major contribution to the achievement of Australia's broader climate change goals.

11. Conclusion

In this final section we provide a summary of the main argument and conclusions of this report.

Substantial reductions in transport emissions are required

The Australian Government's White Paper released on 15 December 2008 – *Australia's Low Pollution Future* – takes it for granted that Australia can achieve its climate change goals without any major change in the transport sector over the next two decades, and does so on the basis of modelling undertaken for the Garnaut Review and for the Australian Treasury. This presumption is almost certainly incorrect, for three reasons.

First, the Treasury modelling understates the task of achieving a given stabilisation level (e.g. 550 ppm CO₂-e) for atmospheric concentrations of greenhouse gases (GHGs). The best available estimate of total global GHG emissions in 2005 is 20-

25% higher than the starting point used in the modelling. As a result the modelling understates the cuts that all countries, including Australia, will need to achieve to reach a given stabilisation level.

Secondly, the modelling implies that 30-40% of the reduction in Australia's emissions allocations relative to business as usual will be achieved by purchasing permits overseas rather than by reducing emissions within Australia. In the modelling of the Government's CPRS-5 scenario (which implies an emissions allocation 25% lower than emissions in 2000 by 2030), actual emissions within Australia are still above 2000 levels in 2030, with all of the absolute reductions being from purchases emissions. This level of overseas purchases is unlikely to be either achievable or morally sustainable, especially given the first point above.

Thirdly, the generous free permit allocation provisions in the White Paper for energy intensive trade exposed industries (EITEs) mean that the allocations available for other industries are correspondingly reduced. For example, if Australia ultimately adopts a 15% reduction target and EITE industries grow by 3% per annum, then the available emissions allocation for other industries will fall by 43.5%, or over 5% per annum, over 2010-20.

Australia's target is for a 5% reduction in emissions by 2020 relative to 2000, the allocation for all other industries falls by 29.4% between 2010 and 2020, an annual reduction of 3.4% per annum. If the EITE growth rate is 5% per annum and the target is for a 15% reduction the fall in the allocation for all other industries is 57%, or 8% per annum over 2010-20, which is a seriously difficult challenge.

These three points imply that, if Australia is to participate in an international process to achieve even the modest stabilisation target of 550 ppm CO₂-e, a significant reduction in domestic emissions will be necessary, concentrated on non-EITE industries. Transport is responsible for about 27% of non-EITE industries emissions, but in the CPRS-5 modelling transport emissions are 40% higher in 2020 than in 2000. This cannot be permitted if substantial reductions in non-EITE emissions are to be achieved. Transport must be brought seriously into the emissions policy mix, with large scale reductions in emissions relative to business as usual over the next two decades.

This will involve reversing the long shift to road transport

Achieving a significant reduction in transport emissions, even relative to business as usual, will require steps to reduce the emissions intensity of all transport modes – road, rail and air – as well as a sharp modal shift from road to rail transport. However, this report is focused on rail, both in terms of increased efficiency within the sector, but most importantly in terms of a modal shift to an advanced, low pollution rail system.

The first four decades after the Second World War saw the rise of the car and the truck reshape Australia's transport patterns. Between 1945 and 1985 the rail share of both urban and non-urban passenger kilometres fell from over 50% to about 5%, and remained close to that level in 2005. Over the same period the rail share of non-bulk domestic freight traffic fell from 56% to 22%, and was at about that level in 2005. Only in the bulk freight area did the rail share rise (from 20% to nearly 50%), as new dedicated rail lines were built to take coal, iron ore and other commodities to port. This shift from road to rail has been supported by massive public investment in road networks over the postwar period, while rail systems were allowed to deteriorate over most of the country.

Recent years have seen some signs of renewal in the position of rail – passenger demand has risen strongly in some major cities; new rail investment has been undertaken in Queensland and Western Australia, and foreshadowed elsewhere; rail has captured a high share of non-bulk freight traffic on some long haul routes. But if transport is to contribute to meeting Australia’s emissions challenge much more will be required, involving a sharp reversal of the historical trend and a substantial modal shift to rail, in both passenger and freight.

There will be large scale benefits from a modal shift to rail

The mobility of people and goods is highly prized in modern societies, but the economic, social and environmental costs of current transport patterns are immense. Modernised and efficient rail can provide lower cost movement of freight between major urban centres than road transport, and move people in cities at a lower average cost per kilometre. The social costs incurred by current transport patterns have been widely studied and are very large, being estimated at about A\$52 billion or 5.6% of GDP in Australia in 2005. On average the social costs arising from rail transport per unit of activity are about 30% of those from road transport, so a modal shift should generate sharp reductions in social costs.

Rail efficiencies and electrification with renewable energy offers low emissions transport

Rail is typically a more energy efficient form of transport per unit than road, with lower energy use per passenger kilometre or per tonne kilometre. Rail’s energy intensity can be reduced further by a range of measures, from lighter and more advanced vehicles and improved vehicle/track interactions to more efficient engines, regenerative braking and the introduction of train protection and control systems. But one of the advantages of rail is that it offers the possibility of virtually zero emissions transport, when rail transport is fully electrified and powered by electricity generated from renewable sources.

Carbon prices are necessary but not sufficient; complementary policies are crucial and can support growth

The transport system is riddled with market failures, especially externalities, sunk costs and coordination failures. The presence of such pervasive market failures means that prices will have only a limited role in facilitating structural change and reduced emissions in transport. If such failures are not addressed the carbon price will be higher than necessary for a given reduction in emissions and that a less than optimal set of emissions reductions will be chosen by the market. By contrast, substantial programs to eliminate market failures will both reduce the carbon price required and generate a more efficient response. A carbon price is necessary but not sufficient to achieve an optimal outcome in the transport sector.

Introducing a carbon price will tend to reduce economic activity, as the existing low cost but polluting technologies are taxed and activity is shifted to higher cost but less polluting ones. But if complementary policies create new goods and industries through R&D, revitalised infrastructure and new investment, then action to reduce emissions may well be a source of growth. This point is particularly important in the context of the global financial crisis and its aftermath, especially the sharp recession in the USA and some parts of Europe, and the inevitable impact of that on Australia and other countries. Strong complementary policies would be growth enhancing, both by reducing the market-based carbon price and also by supporting investment in R&D, new infrastructure and plant and equipment. Thus many of the measures necessary to address key market failures would be strongly expansionary

and could be a central part of an appropriate fiscal response to the current slowdown.

The economic, social and environmental advantages of rail

There is substantial evidence that rail is, in many circumstances, the transport mode with the lowest full economic cost, as well as having much lower social and environmental costs.

Overall total social and environmental costs of transport in Australia are estimated at A\$52 billion or 5.6% of GDP in 2005, before including congestion costs. Of this only 9% is due to rail transport despite it providing a substantial proportion of the transport task.

A full costing of rail compared with road freight demonstrates that rail would become quite competitive commercially on the various North South routes, and unit costs might be expected to fall significantly if the market share of rail increased substantially and other operational efficiencies were made. Perhaps more importantly, the figures demonstrate that the total transport cost is significantly lower for efficient rail than road transport on all intercity corridors. However a considerable proportion of the benefits accrue to environment and the general community which are not realized financially by the commercial railways. Therefore there is a sound justification for governments to support railways so that the non-commercial benefits can be realized for the good of Australia as a whole.

Key challenges facing the rail industry

To achieve a modal shift to rail in the non bulk market many issues of cost, reliability, commercial certainty and service levels need to be addressed. In freight area increasing the efficiency of modal transfers through the establishment of specialist intermodal exchange terminals is important, and costs can also be reduced by double stacking, longer trains and better train management and communications systems. Freight train reliability is affected by unscheduled hold-ups and delays. While better train management systems also help to improve reliability, addressing this issue requires significant infrastructure investment, particularly for the North-South corridor linking Melbourne, Sydney and Brisbane, of the sort outlined in the ARTC submission to Infrastructure Australia (ARTC 2008). Improved infrastructure also provides a basis for investment in more advanced vehicles and systems.

Rail passenger travel has grown rapidly in recent years in most state capitals in response to recently increased petrol costs and growing road congestion. There has been large increase in patronage in Melbourne (10.0% in 2006/07 compared with 2005/06) and Brisbane (9.0%) and a more modest increase in Perth (5%). In Sydney, on the other hand, patronage growth has been constrained by capacity limitations to an increase of only 2.8% for 2006/07. Capacity constraints are now a key issue, and several state governments are planning significant capacity increases but these can carry substantial costs and implementation is typically problematic.

Policies for achieving a modal shift to advanced rail transport

Achieving the necessary sharp modal shift to an enhanced, low pollution rail transport system will require not only a carbon price but also a wide range of complementary policies. These policies will address market failures in the transport system at key points directly related to the challenges that this industry faces in modernising and competing more effectively with other transport modes. Policies in the following areas seem most important:

- In freight transport, the costs both social and infrastructural, which are generated by large long distance trucks, are not passed through fully to the users of this form of transport. There is a widely recognised case for *mass-distance-location charging* to be introduced, as in other countries, to correct this market failure.
- Invest in *major rail infrastructure* (such as rail track and associated works and equipment) which suffers from all three forms of market failure highlighted previously, as does road infrastructure. Large scale investment in the extension and upgrade of Australia's rail infrastructure is necessary, and there is a strong case for public support for this activity. Some similar considerations apply to investments in, for example, *signalling and control systems, advanced modal interchanges*, as well as many aspects of intermodal and intramodal coordination, where both private and public investment will be required, in many cases in joint projects to achieve simultaneously both public and private goals. Develop and implement *Standards for rolling stock and infrastructure* to improve asset utilisation, reduce purchase costs and maintenance costs, and improve transport system performance.
- To modernise Australia's rail system and to increase its scale of operations, massive investment will be necessary by operating companies, whether public or private, and by firms in supplier industries in these areas. In view of the difficulties of appropriability and sunk costs, *public initiatives in the form of R&D support programs and enhanced depreciation allowances* for certain classes of expenditure are likely to be necessary.
- Finally, *investment in the electrification of large scale rail systems*, such as those of the North-South corridor, and the linking of those systems to sources of renewable energy, will in many cases require public leadership, when adequate long term social returns can be generated.

The massive modal shift to road transport took place over 40 years or more, and the quality of much of Australia's rail network and rolling stock has also declined over a long period. Partially reversing that modal shift, and modernising the Australia rail industry, will also require long term, sustained action which could result in:

- the majority of Australia's non-bulk freight movements outside capital cities occurring in modern, highly efficient trains;
- a significant share (20-25%) of all passenger kilometres travelled in Australia being by rail; and
- the overall rail system being largely electrified and increasingly powered by renewable energy.

Three scenarios for modelling the benefits to 2020

The modelling strategy is based on the establishment of three scenarios to 2020 are established, as specific defined steps towards achieving the goal of a sustained modal shift to an enhanced rail system. The first scenario, Scenario 1, involves a significant shift of long-haul freight to rail, with no increase in the volume of freight carried on articulated trucks after 2010. The second scenario, Scenario 2, involves

increased passenger movements by rail, with half of the total increase in vehicle kilometres for cars over 2010-20 transferred to public transport, with an assumed split of 70% to trains and 30% to buses. The third scenario, Scenario 3, is one in which both the freight and passenger changes occur and in addition there is increased electrification and increased use of renewable energy.

High social returns from transforming rail

The central finding is that, as expected, the overall benefits produced by the three scenarios are very high, with a total annual benefit from all sources in Scenario 3 of about A\$10 billion per annum by 2020. The benefits from lower operating costs and the social benefits are of comparable magnitudes, while the benefits from emissions savings are smaller. The estimated benefits, expressed in net present value terms in 2008, were shown in Table 12, using discount rates of 4%, 7% and 10% respectively. Again the figures are very large, with the net present value in 2010 of the benefits from Scenario 3 being A\$27.4 billion even at a discount rate of 10%. While it must be realised that there are large margins of error around these estimates, the basic finding of very large total benefits is beyond dispute. It should also be noted that the benefits included in the net present value calculations in Table 12 only extend to 2020, and these benefits will also accrue for many subsequent years.

The figures in Table 12 again illustrate the magnitude of the economic and social costs being imposed on Australia by the transport patterns that have built up since the Second World War, and hence the benefits that can be gained by even partially reversing those trends.

The investments that need to be undertaken if these benefits are to be achieved are many and varied, covering both public and private participants in the industry and involving investment in track and equipment, in locomotives and many business service activities, and in rail electrification. It has been not been possible in this study to quantify the costs of these investments, although some important components (the rail freight track component for the North-South corridor) have been costed by the ARTC at A\$4.9 billion. Overall it is likely that an investment of the order of A\$15-20 billion (in constant prices) over 2010-20, or \$1.5-2.0 billion per annum, would be required to achieve the outcomes specified for Scenario 3.

Table 13 showed the constant, real level of investment outlay per annum over the period 2010-20 that would be justified by these benefits, at different discount rates. Thus, for example, even at 10%, the justified annual level of investment is A\$4.2 billion, or an undiscounted total of A\$42 billion over the period. This is well above the actual level of investment that is likely to be necessary in practice to achieve the benefits. Another way of approaching these figures is to calculate the implied social rate of return in 2010 to an upper bound estimate of the constant annual level of investment during the decade to achieve these benefits. Taking that upper bound as A\$2 billion per annum (at total of A\$20 billion) the implied social rate of return on this investment is 50%.

Transport emissions can be significantly reduced

Most of Australia's transport emissions come from road transport, while emissions from air transport are a small but rapidly growing component. Road and air emissions are held at the base case in the scenario simulations, except for the reduction in road emissions that take place as a result of the modal shift from road to rail. As was illustrated in Figure 12, taking account of the Scenario 3 effects total transport emissions are about 11% lower than in the base case by 2030. If account

is also taken of further action to reduce emissions intensity levels in road and air transport, relative to the base case, by 10% by 2030, then total transport emissions are about 19% lower than the base case by 2030. Total transport emissions peak in 2024, and are less than 5% above their 2010 level in 2030.

Thus the actions discussed in this report not only generate large economic and social benefits, and high social returns to investment, but also contribute significantly to reducing greenhouse gas emissions. If they are supplemented by further action to reduce the emissions intensity of road and air transport, total transport emissions can begin to decline after about 2025 and be brought close to their 2010 level by 2030. This would represent a major contribution to the achievement of Australia's broader climate change goals.

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Appendix: List of Supporting Papers

Paper 1: The Australian Transport Sector and Climate Change

Paper 2: Social, Economic and Environmental Impacts of Transport Modes

Paper 3: Emissions Trading and Transport

Paper 4: The Case for Complementary Policies with Emissions Trading Systems

Paper 5: The Transport Operators

Paper 6: Freight Infrastructure Issues

Paper 7: Operational and Transport Issues in Rail Passenger Transport

Paper 8: Powering Rail: Electrification and Emissions Intensity

Paper 9: Technology and Commercialisation Developments

Paper 10: Modelling of Modal Shifts in the Transport Sector