Garnaut
CLIMATE CHANGE
REVIEW

Issues Paper - Forum 5
Transport, Planning and the Built Environment

The issues discussed in this paper are based on topics raised at the Garnaut Climate Change Review Public Forum on 19 February 2007, other discussions with stakeholders and internal research.

The issues discussed in this paper do not represent the views of Professor Garnaut or the Review Secretariat, but instead seek to raise relevant questions and invite feedback from interested members of the community.

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1 Introduction

1.1 The Garnaut Climate Change Review

The Garnaut Climate Change Review (hereafter 'the Review') is an independent review by Professor Ross Garnaut, commissioned by Australia's Commonwealth, State and Territory Governments.

The Review will examine the impacts of climate change on the Australian economy and recommend medium to long-term policies and policy frameworks to improve the prospects for sustainable prosperity.

In carrying out this task the Review will undertake consultation to encourage open and informed debates on key climate change issues. For more information on how to participate in the Review please visit www.garnautreview.org.au

1.2 Purpose of this Issues Paper

On 19 February 2007, Professor Ross Garnaut hosted a public Forum on *Transport, Planning and the Built Environment* (hereafter 'the Forum'). The Forum sought to canvass the opinions of a wide range of experts on key climate change issues relating

to greenhouse gas mitigation in these sectors. Presentations for this Forum are available on the Review website http://www.garnautreview.org.au.

Drawing on the outcomes of the Forum, stakeholder discussions and internal analysis, this paper aims to raise and explore issues, and to seek input on the key issues related to mitigating greenhouse emissions in transport, land-use and buildings.

1.3 Submissions Process

All submissions in response to this Issues Paper should be received by 11 April 2008 either via email at contactus@garnautreview.org.au or sent to:

Garnaut Review Secretariat

Level 2, 1 Treasury Place

East Melbourne, Victoria 3002

Submissions will be made available on the Review website unless specifically requested to be confidential. If you have any queries, please contact the Secretariat via email at contactus@garnautreview.org.au.

2 Context

Transport, land-use and buildings are major contributors of greenhouse gas emissions. Cities are major centres for energy demand, requiring large quantities of energy in both construction and operation.

An emissions trading scheme (ETS) will address the primary market failure of uncapped greenhouse gas emissions and will encourage activities and investments to reduce emissions from transport and the built environment. However, other measures may be required to minimise the cost of abatement, primarily by addressing barriers to the adoption of low-cost abatement opportunities.

Issues related to the adoption of low-emission technologies and practices in transport, land-use and buildings are interlinked, but for the purposes of clarity this paper divides these issues into transport (Section 3) and buildings (Section 4). Land-use is discussed in both sections. Each section explores the emissions from the sector, technical options to reduce emissions, and potential barriers that may impede the adoption of cost-effective emission reduction strategies.

In doing so, the paper focuses on barriers to the adoption of existing low-emission technologies and practices. The paper does not discuss issues around ETS design or research and development. *Issues Paper 4: Research and Development* covers barriers to the development of new technologies. This is available on the Review website. The Review will shortly release an ETS discussion paper that will seek views on a broad range of ETS issues.

It should be noted that, like the Forum, this paper does not cover adaptation. Transport and buildings issues related to adaptation to climate change are significant issues on their own, and will be discussed in the Review's Draft Report.

3 Transport and planning

3.1 Transport and emissions

Mobility is a core feature of our economy. Transport services link manufacturers to markets and enable individuals to access employment, goods, services and social opportunities.

Fuel use in transport is a substantial source of greenhouse gas emissions, accounting for 14 per cent of Australia's emissions in 2005[1], and is growing rapidly with a projected increase of 67 per cent over 1990 levels by 2020.

There are various 'modes' of transport which are used in both passenger transport and freight. These include private cars, buses, trucks, trains and airplanes. There are two main sectors in transport:

- Passenger transport - the transport of people; and
- Freight - the transport of goods.

This paper discusses emission reduction options in transport according to sector, with the exception of aviation and shipping, which are discussed separately. Whilst the Review recognises that aviation and shipping are significant sources of emissions, the Forum focused mainly on land transport, and therefore this paper provides only limited discussion of these other modes.

3.1.1 Passenger transport emissions

A variety of modes are used in passenger transport, including private cars and motorbikes, public transport such as buses, trains, trams and taxis, and non-motorised modes like walking and cycling.

Passenger transport in Australia is dominated by private car use. Around 80 per cent of adults used a private car to commute to work in 2006 (Australian Bureau of Statistics (ABS) 2006). Emissions from cars account for 54 per cent of Australia's total domestic transport emissions, and are projected to increase by 40 per cent between 1990 and 2020.

Public transport accounts for a smaller proportion of Australia's passenger transport task. Across Australia, 14 per cent of adults used public transport to commute to work in 2006, although the rate of public transport usage varies between cities (ABS 2006).

Walking and cycling form an important component of passenger transport. Walking and cycling were the main form of transport to work for 6 per cent of Australian adults in 2006 (ABS 2006). These modes also facilitate many other forms of travel, including walking to public transport or car parking facilities.

3.1.2 Freight emissions

Several commentators raised concerns at the Forum in Perth that greenhouse gas emissions from freight have attracted relatively little attention, despite their rapid growth. Australia's total road freight is forecast to double between 2000 and 2020

[1] Figures on transport emissions come from Department of Climate Change projections for transport emissions (2007) and are at 2005 unless stated otherwise. These figures do not include the substantial emissions generated from the construction and maintenance of vehicles and transport infrastructure, nor emissions arising from electricity used in rail.

(Bureau of Transport and Regional Economics 2006). Trucks and light commercial vehicles account for 31 per cent of Australia's transport emissions, and emissions from these modes are projected to increase by 112 per cent between 1990 and 2020, outpacing the growth in emissions from passenger vehicles. Diesel rail is a smaller source of emissions than trucks.

3.1.3 Aviation and shipping

Aviation is a rapidly growing source of emissions in both freight and passenger transport. While domestic aviation only accounts for 6 per cent of Australia's transport emissions, domestic aviation emissions are projected to increase by 198 per cent between 1990 and 2020. Domestic shipping is predominantly used to carry bulk freight between Australian ports. Domestic shipping emissions have declined since 1990.

3.2 Lower emission opportunities in transport

There are a wide range of opportunities for reducing emissions from passenger transport and freight.

The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report lists a range of options for reducing emissions from road vehicles, without limiting vehicle usage, including:

- Reducing the weight of a vehicle;
- Improving the efficiency of the engine;
- Reducing pollutants in vehicle exhaust; and
- More efficient driver behaviour.

Similar technical options exist for improving the efficiency of other vehicles. The IPCC notes that that some modern civil aircraft are 70 per cent more efficient per passenger-km than models 40 years ago. Changing aviation practices, such as flight speed and air traffic control practices, can also deliver greenhouse gas reductions.

There may be some opportunities to reduce emissions from vehicles by using alternative fuels, such as liquefied petroleum gas and potentially biofuels. This issue has received extensive debate, particularly given rising fuel prices and potential constraints on future oil supplies.

Alternatively, emissions could be reduced by using different modes of transport. In passenger transport, switching from private cars to public transport and non-motorised modes may reduce emissions per kilometre of travel. Likewise, where possible moving freight from road to rail and shipping may reduce emissions per haulage unit.

Reducing travel distances and changing travel patterns can also reduce transport emissions. For example, households can reduce their emissions by visiting shops and services that are closer to their homes, or by taking a single journey to carry out several activities rather than making a separate journey for each activity. In some cases, the need for business-related travel can be reduced by using increasingly available technologies such as teleconferencing.

3.3 Barriers to lower emission passenger transport opportunities

There are a range of potential barriers that may impede the adoption of cost-effective, low emission options in passenger transport. These are discussed below in four sections:

- Price and information barriers;

- Barriers to the uptake of more efficient vehicles;
- Infrastructure and service barriers; and
- Urban form and land-use planning.

3.3.1 Price and information barriers

The Forum heard that there may be price factors that act as a barrier to more efficient passenger transport patterns. These include:

- The lack of a carbon price - if individuals do not pay for the full impact of their use of transport (including the impact on climate change), there may not be a sufficient incentive for them to reduce their transport-related emissions;
- The lack of a congestion price - when a car travels on a busy road it increases the delay for all users of the road, but the driver does not pay the extra 'cost' of the delay that their use of the road imposes on other road users. This may encourage individuals to drive more than they would otherwise. In addition, vehicles idling in traffic may have a higher emissions profile per kilometre travelled (Bureau of Transport Economics 2000); and
- Tax arrangements - some tax structures may reduce the cost of driving, reducing the incentive for individuals to reduce emissions (Ryan 2008).

These price issues may influence not only the total amount that people travel, but also the mode that they use to travel. When individuals decide to travel, they choose *between* different modes, so the cost and convenience of private car use relative to other modes, such as public transport, may also be important.

The Forum debated whether charging individuals for greenhouse gas emissions and congestion would significantly reduce transport emissions. If the costs are a relatively small component of the total costs faced, people's decisions may not be strongly influenced by what are considered relatively small changes in transport costs.

Information may also influence peoples' transport behaviour. Price signals may only be important if people know the relative costs of various transport options. In some cases, individuals may not even know some transport options exist. For example, an individual may be unaware that a bus runs from near their house to their workplace.

3.3.2 Barriers to the uptake of more efficient vehicles

The uptake of more efficient vehicles could potentially reduce emissions from passenger transport, as the vehicle fleet is replaced over a relatively short period compared to buildings and infrastructure. However, there may be barriers to the uptake of more efficient vehicles, including:

- The lack of a carbon price - this means that there is less incentive for people to buy more efficient vehicles;
- Information - some consumers may not be aware of the financial benefits of more fuel-efficient vehicles;
- Access to funding (capital) – an inability to fund vehicles with a higher upfront cost and higher efficiency may impact on the uptake of lower emission vehicles. However, conventional compact cars are generally both cheaper and have lower emissions than larger vehicles; and
- Consumer preferences – some consumers may want vehicles with greater size and power, for a range of reasons. The relatively low priority given to fuel

efficiency by some consumers is highlighted by the increase in the market share of sports utility vehicles in recent years[2], and some models of this type of vehicle have relatively low fuel efficiency (Department of Infrastructure, Transport, Regional Development and Local Government 2005).

3.3.3 Infrastructure and service barriers to mode choice

Surveys have indicated that one of the most substantial barriers to the use of public transport, walking and cycling is the lack of appropriate infrastructure and services (e.g. ABS 2006). The extent of infrastructure and services can influence the speed, convenience, safety and flexibility of these modes, which may influence individuals' mode choice.

Decisions about which infrastructure and services to provide, have a strong influence on transport patterns. These decisions are often made by governments, as the major provider of public transport and road infrastructure.

The different modes compete for funding and passengers. Modes can also conflict when sharing the same physical space. Several commentators at the Forum suggested that funding for transport in Australia has historically been weighted towards road infrastructure, with the majority of the $12.3 billion in AusLink funding in 2004-09 dedicated to road infrastructure (Department of Infrastructure, Transport, Regional Development and Local Government 2008).

Research indicates that provision of road infrastructure may induce growth in passenger car use, by reducing the competitive advantage of public transport and possibly inducing additional travel (Zeibots & Petocz 2005). Sharing the same space can lead to one mode negatively affecting another. For example, higher private car speeds can reduce the safety of other road users such as cyclists (Federal Office of Road Safety 1997). Similarly, level crossings can impede traffic flow on roads and limit the number of trains that can run on a rail line.

Additionally, variations in the provision of public transport in different regions may have equity implications. Research by Dodson and Sipe (2006) has indicated that some outer suburban regions with low levels of public transport services have high proportions of car-dependent low-income households, which expend a significant proportion of their income running two or more vehicles. Rising fuel prices may disproportionately impact on households in these suburbs. In contrast, households in those inner-urban areas that are well serviced by public transport and often have higher average incomes may be less vulnerable to rising fuel prices.

3.3.4 Urban form and land-use planning

Research indicates that urban form may influence transport emissions. Newman and Kenworthy (1999) suggest that there is a good correlation between urban density, mode choice and the energy used in transport. Lower-density cities in Australia and North America may have higher levels of car use and energy use per capita than higher-density cities in Western Europe and higher-income Asian countries.

This correlation may have arisen from urban form influencing the distances that people need to travel and their choice of mode. As noted, the purpose of transport is to link firms to their suppliers and markets, and individuals to employment, goods and services. Urban form determines how close firms and individuals are to each other, affecting the distance that people and goods need to travel. In addition, distance may

[2] Based on vehicle sales figures from the Federal Chamber of Automotive Industries website, available at URL: http://www.fcai.com.au/sales

act as a disincentive to walking and cycling (ABS 2006), and these modes facilitate the use of public transport.

Urban form may also influence the cost-effectiveness of public transport services. Public transport has economies of scale, with the cost and greenhouse emissions per passenger decreasing as the number of passengers increases (Mills and Hamilton 1994). Built environments that are either higher density or are oriented around public transport services may support higher levels of patronage and can lower the unit cost of providing good quality public transport services (Newman and Kenworthy 1999).

While more compact urban form may support lower-emission transport patterns, there may be a range of countervailing factors (Brueckner 2000). These include:

- Governments may effectively subsidise new housing developments on the urban fringe if they provide infrastructure and services;
- Extensive road infrastructure and the lack of congestion pricing may lower commuting costs; and
- Urban form can take a long time to evolve.

However, some researchers suggest that it may be possible for lower density areas to support lower emission transport patterns. Mees (2005) has suggested that some cities with similar densities have quite different transport patterns. These differences may be attributable to the relative quality of infrastructure and services for public transport, pedestrians and cyclists. Improving infrastructure and services for these modes could result in a reduction in emissions, even in low-density areas.

Questions for Consideration

What are the key barriers to the adoption of cost-effective and low-emissions mode use in the passenger transport sector? How might these be addressed effectively and efficiently by government policy?

What policies would be suitable to address barriers to the uptake of more fuel efficient passenger vehicles?

How can land-use planning and the built environment be managed more effectively to lower reliance on high emission patterns of transport behaviour?

3.4 Barriers to lower emission freight opportunities

Some of the barriers to lower emission freight outcomes are related to those identified in passenger transport, such as urban form and infrastructure. However, there are some key differences which are discussed below.

There may be fewer impediments in the uptake of efficient vehicles in the freight sector. Fuel costs are a significant component of freight costs and so strongly influence vehicle purchase.

The Forum heard that there may be price factors that act as barriers to more efficient road freight patterns and the transfer of freight from road to less emissions-intensive forms of transport such as rail and shipping. There has also been substantial debate as to the competitiveness of road and rail pricing (Productivity Commission 2006). However, pricing is only one of a range of considerations in selecting modes for freight, which include time, staffing, accessibility, flexibility, handling costs and the demands of producers.

Infrastructure may also be important in determining the choice of mode for freight. The lack of inter-modal terminals may be an important factor in preventing greater use of rail (Sinclair Knight Merz 2006). However, trucks may be the only viable option for freight transport in some situations.

Freight emissions need to be considered in the context of the whole production and distribution system. Lowering costs and emissions across an entire production and distribution system may still entail some high emission freight transport. Some researchers have suggested that the total emissions of producing some goods in one location and transporting them to another location may be lower than producing the goods in the destination location (e.g. Saunders et al 2006).

Questions for Consideration

What policies could support cost-effective emissions reductions in the freight sector?

3.5 Barriers to low emission opportunities in aviation and international transport

Aviation is likely to become more fuel-efficient, but this may be offset by increased flying. Fuel costs are a significant factor in airlines' costs and there are strong incentives for the uptake of more efficient airplanes and flight patterns. However, in terms of overall fuel use and emissions, this may be offset by consumers choosing to fly further or more often.

International shipping and aviation are very significant sources of greenhouse emissions, which are not currently included in countries' greenhouse accounts. Addressing these emissions has become a growing area of debate in Europe.

Questions for Consideration

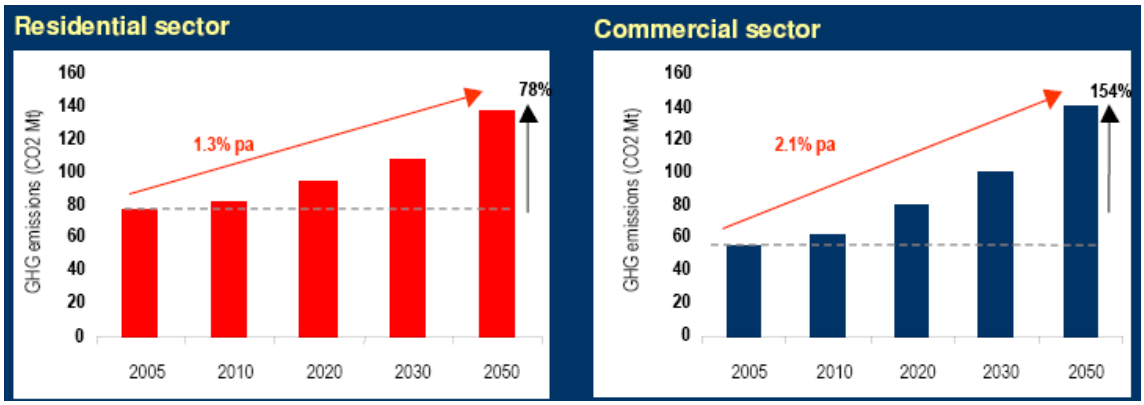
What policies could support cost-effective emissions reductions in aviation and shipping?

4 Buildings

4.1 The built environment and emissions

Residential and commercial buildings are responsible for a significant proportion of Australia's emissions, in both construction and use.

There are various estimates of the amount of greenhouse emissions that are attributable to energy use in buildings. The Centre for International Economics (2007) estimates that buildings are responsible for around 23 per cent of Australia's greenhouse gas emissions, although this figure excludes emissions from the construction, renovation and demolition of buildings, and non-CO_2 emissions such as refrigerants. The Centre for International Economics has also projected that emissions attributable to energy use in buildings will grow in both the residential and commercial sector.



Source: Centre for International Economics (2008)

The emissions generated in the construction and refurbishment of buildings and appliances is also significant. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) estimate that "The energy embodied in existing building stock in Australia is equivalent to ten years of the total energy consumption for the entire nation" (CSIRO 2008).

4.2 Lower emission opportunities in buildings

The IPCC lists a wide range of technical opportunities for reducing emissions from the building sector. These include:

- Improving the use of passive heating, cooling and lighting;
- Enhancing insulation;
- Installing more efficient appliances such as heating and cooling systems, water heaters, lighting and computers; and
- Integrating generation systems into buildings, such as gas-fired co-generation plants and photovoltaic panels.

Occupant behaviour can also strongly influence a building's energy efficiency.

Many authors have identified significant opportunities for mitigation in the building sector using current technologies which, based on engineering estimates, would appear to be cost-effective. A recent McKinsey report (2008) estimates that 60 Megatonnes of carbon dioxide emissions reduction opportunities could be found in buildings by 2030 at low or negative cost. The Centre for International Economics

estimated that the share of emissions from buildings could be reduced by 30-35 per cent by 2050 at low cost.

Many estimates of this kind do not account for the full range of transaction costs faced by firms and individuals before they take up these lower emission opportunities. However, even if these costs are considered there may still be significant opportunities for emission reductions that would quickly provide financial benefits for building occupants, partially protecting them against the effects of potential energy price rises.

4.3 Barriers to lower emission opportunities in buildings

As with transport, the lack of a price on greenhouse gas emissions may reduce the incentive for individuals and firms to reduce their building-related emissions. While an ETS would address the barrier of a lack of a price on carbon emissions, the Forum heard arguments that a number of other barriers to low emission opportunities in the building sector may need to be addressed.

Possible barriers in the building sector could include:

- Split incentives - these can arise when one individual makes decisions about building design and appliances, but another individual pays the ongoing cost of using the building. For example, landlords may choose which heating system to install in a building, and pay the upfront cost. However, tenants often pay the running costs of the heating system. This means that there may be insufficient incentive for the landlord to a install lower emission heating system, even if the total cost of the system is much lower over its lifetime;
- Informational barriers - if individuals and firms don't have information about the financial savings that would accrue to them from low emission options in buildings and appliances, they may choose options with lower up-front costs. The lack of readily available information for engineers, architects and builders could be an important barrier in the design and construction of lower emission buildings;
- Risk - builders may avoid adopting products based on new technology if they cannot assess their reliability. As a result they may use more familiar, older and less efficient products. This highlights that early adopters of new technology take some risks that may benefit the entire building sector, by trialling and proving new technologies;
- Local impacts - nearby buildings, infrastructure and land-use can impact on the ability to passively heat and cool a building, such as by blocking sunlight and breezes and generating heat. Builders generally do not have the ability to control the design of whole urban areas;
- Access to funding (capital) - individuals and firms, particularly low-income households, may not have access to the extra capital needed to pay the higher upfront costs of lower emission building and appliance options, even if these options are more cost-effective in the long-term; and
- Consumer preferences - as with passenger cars, consumers may have a range of preferences for buildings and appliances, such as location and size, which may affect their purchase decisions. As a result consumers may end up purchasing buildings and appliances that are less energy efficient.

The speed of change in emissions arising from energy used in buildings may be limited. The effective life of buildings and appliances varies, but some buildings are long-lived and changes to the whole building stock take place gradually.

This means that the emissions profile from buildings constructed today are 'locked-in' over a long period of time, and reducing emissions from buildings will require activities to address both new buildings and the retrofitting of older building stock. However, in considering the premature refurbishment of buildings, it is important to consider both cost and the additional emissions from construction and refurbishment.

Questions for Consideration

What are the key barriers to cost-effective low emission opportunities in the building sector?

What policies could be used to address the low uptake of energy efficiency opportunities, given that many of these opportunities already provide financial benefits for firms and households?

What policies would be appropriate to overcome barriers to low emission opportunities in the building sector, such as split incentives and information gaps?

Are additional policies necessary to address barriers to low emission opportunities in existing buildings?

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