Public transport’s role in reducing greenhouse emissions

July 2008
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# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commissioner's Foreword</td>
<td>3</td>
</tr>
<tr>
<td>Executive summary</td>
<td>5</td>
</tr>
<tr>
<td>Summary of recommendations</td>
<td>9</td>
</tr>
<tr>
<td>Purpose</td>
<td>10</td>
</tr>
<tr>
<td>Introduction</td>
<td>10</td>
</tr>
<tr>
<td>PART 1</td>
<td>13</td>
</tr>
<tr>
<td>Climate Change</td>
<td>13</td>
</tr>
<tr>
<td>Victoria's Greenhouse Emissions</td>
<td>14</td>
</tr>
<tr>
<td>Impacts of Climate Change in Victoria</td>
<td>16</td>
</tr>
<tr>
<td>Greenhouse emissions from different transport modes</td>
<td>17</td>
</tr>
<tr>
<td>Average Emissions Intensity</td>
<td>17</td>
</tr>
<tr>
<td>Incremental Emissions Intensity</td>
<td>17</td>
</tr>
<tr>
<td>Future reductions in car emissions</td>
<td>19</td>
</tr>
<tr>
<td>Biofuels</td>
<td>19</td>
</tr>
<tr>
<td>Congestion and induced demand</td>
<td>20</td>
</tr>
<tr>
<td>The role of land-use planning</td>
<td>21</td>
</tr>
<tr>
<td>Overview of the Victorian public transport system</td>
<td>23</td>
</tr>
<tr>
<td>The roles of public transport</td>
<td>23</td>
</tr>
<tr>
<td>The Victorian public transport system</td>
<td>23</td>
</tr>
<tr>
<td>Current Government Policy Settings</td>
<td>25</td>
</tr>
<tr>
<td>Greenhouse Emissions Reduction</td>
<td>25</td>
</tr>
<tr>
<td>Victorian public transport initiatives</td>
<td>25</td>
</tr>
<tr>
<td>Growing Victoria Together – “20/2020”</td>
<td>25</td>
</tr>
<tr>
<td>Melbourne 2030</td>
<td>28</td>
</tr>
<tr>
<td>Meeting Our Transport Challenges</td>
<td>29</td>
</tr>
<tr>
<td>Other Government Initiatives</td>
<td>29</td>
</tr>
<tr>
<td>Technical options for reducing greenhouse gas emissions from public transport</td>
<td>30</td>
</tr>
<tr>
<td>Context</td>
<td>30</td>
</tr>
<tr>
<td>Metropolitan Trains</td>
<td>30</td>
</tr>
<tr>
<td>Trams</td>
<td>31</td>
</tr>
<tr>
<td>Tram procurement programme</td>
<td>31</td>
</tr>
<tr>
<td>Use, re-use and storage of electrical energy</td>
<td>31</td>
</tr>
<tr>
<td>Rationalisation of tram stops</td>
<td>31</td>
</tr>
<tr>
<td>Increased road priority</td>
<td>32</td>
</tr>
<tr>
<td>Buses</td>
<td>32</td>
</tr>
<tr>
<td>Improvements in fuel efficiency</td>
<td>33</td>
</tr>
<tr>
<td>Bio-diesel</td>
<td>34</td>
</tr>
<tr>
<td>Driver training</td>
<td>34</td>
</tr>
<tr>
<td>Road priority and design</td>
<td>34</td>
</tr>
<tr>
<td>Improved coordination and service frequency</td>
<td>34</td>
</tr>
<tr>
<td>Wider policy options for reducing emissions from public transport</td>
<td>35</td>
</tr>
<tr>
<td>Make Public Transport Carbon-Neutral</td>
<td>35</td>
</tr>
<tr>
<td>GreenPower for all trains and trams</td>
<td>35</td>
</tr>
<tr>
<td>Offset diesel fuel usage</td>
<td>36</td>
</tr>
<tr>
<td>Cost comparison of options</td>
<td>37</td>
</tr>
<tr>
<td>Include environmental performance indicators in operator contracts</td>
<td>38</td>
</tr>
<tr>
<td>Extending provision of public transport</td>
<td>39</td>
</tr>
<tr>
<td>Part 2</td>
<td>41</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>----</td>
</tr>
<tr>
<td>Peak Oil</td>
<td>41</td>
</tr>
<tr>
<td>Introduction</td>
<td>41</td>
</tr>
<tr>
<td>Environmental impacts</td>
<td>41</td>
</tr>
<tr>
<td>Improving Vehicle Efficiency</td>
<td>43</td>
</tr>
<tr>
<td>Government support for local car manufacturing</td>
<td>44</td>
</tr>
<tr>
<td>Transport funding and taxation</td>
<td>45</td>
</tr>
<tr>
<td>Introduction</td>
<td>45</td>
</tr>
<tr>
<td>Federal funding of public transport</td>
<td>45</td>
</tr>
<tr>
<td>Funding policies that favour cars and roads</td>
<td>46</td>
</tr>
<tr>
<td>Tax concessions for private use of company cars</td>
<td>46</td>
</tr>
<tr>
<td>Road Pricing</td>
<td>47</td>
</tr>
<tr>
<td>Car registration and stamp duty</td>
<td>48</td>
</tr>
<tr>
<td>Costs of transport infrastructure</td>
<td>48</td>
</tr>
<tr>
<td>Institutional Arrangements</td>
<td>49</td>
</tr>
<tr>
<td>Reflection of public transport services in sustainable building design</td>
<td>52</td>
</tr>
<tr>
<td>Introduction</td>
<td>52</td>
</tr>
<tr>
<td>The extent to which public transport is included in current sustainability indices</td>
<td>52</td>
</tr>
<tr>
<td>The benefits of including public transport within building standards</td>
<td>53</td>
</tr>
<tr>
<td>The way forward</td>
<td>54</td>
</tr>
<tr>
<td>References</td>
<td>57</td>
</tr>
</tbody>
</table>
Once seen only as the province of peripheral environment agencies, climate change is now at the centre of Victorian and Commonwealth government, where policy is being developed. In fact, we are now in a state of flux, with a range of responses under consideration by governments at all levels. However, the urgency of the challenge demands that we don’t just plan, we act.

Commissioner’s Foreword

Climate change and the separate issue of oil availability and pricing are probably amongst the two most debated topics in governments these days. Again it is ironic that oil, the basis of much of our modern mobility and material goods, is one of the major contributors to the climate change phenomenon. These two issues also highlight the dilemma of policy making for developed countries across the world. The approach to oil pricing underlines the task of governments to handle immediate political issues, but in doing so, running the risk of exacerbating the problem of climate change and not responding in a way that enables longer-term economical, social and climatic resilience. This second issue is no longer an ethical task, that of maintaining living conditions for future generations, but one in real time, as the effects of climate change are beginning to drive migration in agriculture, expensive augmentation of urban water supplies, risk assessment of increasingly intense storm events and coastal erosion and coastal realignment from sea level rise.

This report asks what can be done to reduce emissions from the transport sector. While public transport is shown to perform more sustainably than private cars, electricity-driven rail and tram systems in the Melbourne metropolitan area are based on the same greenhouse gas intensive brown coal as the industrial and residential sector’s electricity use, while buses are powered by diesel.

Not only is the issue one of greenhouse gas emissions, but the steadily increasing international price of crude oil is also driving a resurgent policy interest in public transport. The Commonwealth Government has acknowledged oil affordability cost pressures and excluded petrol from the effects of the forthcoming Carbon Pollution Reduction Scheme until 2013 at least, by offsetting any price increase with a drop in excise. Yet a recent CSIRO forecast shows that the peaking of global oil supplies could drive petrol to $8 a litre by 2018 (about the time that Sir Rod Eddington’s road tunnel might be finished). A carbon price of $20-40 per tonne would add another 5-10 cents per litre to the price.

This move masks the connection between personal transport choices and emissions and allows another whole cycle of vehicle fleet replacement before fuel costs are effectively included in the scheme. It is ironic that public transport users will indirectly pay for their transport emissions but motor vehicle users will not. The offsetting of this increase also reduces the pot of money available to provide sustainable long-term solutions to oil affordability risks and rising transport emissions, such as investing in public transport. While I acknowledge fuel cost pressures and the need for a smooth economic transition, I strongly encourage the Commonwealth to consider some level of carbon price signal from 2010.

Metropolitan Melbourne in the post-war era has become a quintessential car based urban region. Relatively cheap personal and household mobility using the motor vehicle has created a middle and outer ring of suburbs poorly supplied with public transport. This in turn has created a set of vulnerabilities, particularly to oil prices, that was never considered a possibility during the bullish times of the 1960-1990 period, and which risks exposing families to a seriously reduced capacity to access their places of work, recreation, social obligations and schools.

Recently Sir Eddington released his East West Link Needs Assessment (EWLNA) report following a remit from the Victorian Government to study the need for improved transport connections between the eastern and western districts of Melbourne. Eddington has come up with an adventurous report given the narrow geographic frame of the study. Indeed most of his recommendations are in fact directed toward the improvement of public transport provision, and in their generality they have my support.

The Report also attempts to deal with the suburban road consequences around the Port of Melbourne from increased truck movements and for that its work must be acknowledged.
However, there are a number of concerns. Although reducing emissions was not an objective within the
terms of reference, the report acknowledges that the $18 billion package of recommendations would
have a ‘minimal impact’ on emissions. This is in part because the effects of induced traffic generated
by the new road are discounted and also because there is an inability or unwillingness to consider
a significant shift towards public transport, even in the longer term. With these issues in mind, the
benefits of a road tunnel, compared against other public transport service needs, are questioned.

I see the Eddington Report, although more wide ranging than expected, as perforce a confined
examination of the polarisation that has been allowed to evolve. Over a long period there has been an
under-investment in public transport while a demand driven reaction to increased, indeed insatiable,
road needs has directed public policy and capital investment into more and more road provision.

There are suggestions that a major new transport strategy addressing Melbourne’s longer-term needs
will emerge in November, as it becomes increasingly clear that Meeting Our Transport Challenges is
being left behind by growing patronage. I hope the new strategy will be accompanied by a clear and
timetabled plan of investment in public transport provision aimed not only at improving greenhouse gas
efficiency, but the social needs of improved access and mobility.

While new transport infrastructure is desperately needed, the real measure of success will be how
any further funding commitments serve as a foundation for a further significant expansion of public
transport options. Such an expansion would provide real alternatives to the dominance of private motor
vehicles and could lead to a dramatic shift people’s travel patterns.

The establishment of the Department of Transport and a strong coordination responsibility within it is
a strong sign that the new realities are being acknowledged. Road provision now has to take a place
alongside public transport in the debate on priorities.

In my State of the Environment Report and in my annual Strategic Audit Report on Government
environmental performance this year I will be emphasising the need for much broader environmental
assessment of proposed policies, strategies and programmes. Formal Environmental Effects Statements
do a useful job of informing the community and government of the immediate site and neighbourhood
impacts of a proposed development, but do little to identify the regional, State and national impacts.
One of the best outcomes of the Channel Deepening Project could be an improved rail freight network,
but if it is considered it would be outside of the scope of an EES. The land-side impacts of this project
are every bit as important as environmental risk management in Port Phillip Bay. I look to highlight the
major principles of the European Strategic Environmental Assessment approach into the Government’s
Environmental Sustainability Framework to create a working and practical tool for government to
understand and choose between the options examined through such a process.

The government now needs to consider the Eddington Report in the context of a broader, strategic,
long-term transport plan for metropolitan Melbourne and in turn for Victoria which acknowledges the
increasing evidence of climate change risks. Such a plan needs to have climate change, the need to
reduce transport emissions and the availability of affordable oil at its centre.

Another record-breaking investment strategy for Victoria’s transport may be announced later this year.
However, what is needed is a step change in the provision of public transport to offer real transport
alternatives and drive a reduction in greenhouse emissions. The Government to demonstrate a
commitment to reduced travel demand, an expansion of public transport, cycling and walking, and the
use of appropriate pricing mechanisms to drive a shift towards more sustainable transport modes.

Lastly, I would like to acknowledge the support received from the Department of Transport and the
Department of Sustainability and Environment in the development of this report.

Dr Ian McPhail
July 2008
Executive summary

In 2007 the Commissioner released a position paper "Creating a city that works – Opportunities and solutions for a more sustainable Melbourne." That paper looked at three challenges facing Melbourne – climate change, peak oil and the health impacts of car dependency. With scientific evidence of accelerating greenhouse emissions, petrol prices over $1.60 per litre, continuing concern about obesity, and increasing population growth, it is clear that these challenges have only got greater.

Increasing awareness of the urgency of climate change and the scale of the change required has yet to translate into an appropriate response. Much faith is being placed in the development of a Carbon Pollution Reduction Scheme following advice from the Garnaut Climate Change Review. The Federal Government has committed to implement an Australian emissions trading scheme by 2010.

Transport’s current contribution to climate change is already significant. In Victoria, emissions from transport are second only to stationary energy and continue to grow. Transport is part of the problem and must be part of the solution.

The legacy of past transport funding decisions that favoured road-building and encouraged car dependent urban sprawl increases the challenge for Melbourne. For decades, the highest priority has been given to the most carbon intensive transport mode. While a worthy long-term objective of the government’s Melbourne 2030 programme is to increase Melbourne’s population density, and thus reduce the demand for travel, action, not just plans, is required.

The Federal Government must play a stronger role in promoting sustainable transport. It is time that federal funding was made available for urban public transport infrastructure, and not just roads and rail freight. It is time that perverse taxation policies that favour motor vehicles, like the fringe benefits tax that actively encourages driving, are revised to favour sustainable transport modes. Road pricing could also be used more extensively to encourage better use of existing transport infrastructure.

Melbourne’s population continues to grow strongly. A new Urban Growth Zone has been created to provide affordable housing and accelerate the development of outer suburbs. Without the alternative of effective public transport services, these areas will be vulnerable to increasingly high petrol prices as oil affordability and carbon pricing begin to bite. Efficient public transport services must be provided early in the planning process.

There is an urgent need to shift passenger travel onto public transport which produces fewer greenhouse emissions, and to promote cycling and walking which produce none.

Public transport has been experiencing an unprecedented surge in patronage, driven in part by the rising population, increases in petrol prices and government initiatives such as the removal of Zone 3. Continued patronage growth cannot happen without a significant increase in capacity as there is already overcrowding on many services, some routes have reached capacity and the forecast is for continued population growth and public transport demand.

There is considerable scope for reducing the emissions for which public transport itself is responsible. Minor improvements are possible from technical changes such as expanding the role of regenerative braking in trams and trains to conserve energy. Significant gains are achievable through the purchase of renewable energy to power trains and trams. Combined with improving the efficiency of buses and diesel trains and offsetting the residual emissions, this would provide Victoria with a carbon-neutral public transport system. Such an initiative would demonstrate government leadership while providing Victoria’s citizens the opportunity to dramatically reduce their own emissions through a change in behaviour.

We can improve the emissions performance of all transport modes. Vehicle fuel efficiency standards, similar to those being introduced in Europe and other countries, would have significant benefits, but to date Australia lags behind in this simple action.
The Victorian Government has recently been handed the East West Link Needs Assessment report by Sir Rod Eddington and his team. The terms of reference for the study were geographically narrow – being an east-west corridor across the centre of the city – and there was no objective of reducing greenhouse emissions.

The report recommends a $18 billion package of recommendations, most of which relate to improving public transport. Others relate to roads, freight and cycling. The big-ticket items proposed are a $9 billion cross-city road tunnel, a $7 billion cross-city rail tunnel and a $1.5 billion new rail route to the west of the city.

However, it is disappointing that Eddington’s view is of a future that is fundamentally business as usual, with an approach that extrapolates past growth in demand for private travel and provides the necessary infrastructure with the car assumed to be the dominant travel mode. It is also disappointing that the net impact of the recommendations on greenhouse emissions is considered ‘minimal – but beneficial’ (the ‘benefit’ based on the assumption of more free-flowing traffic).

However, that conclusion is based on current transport mode shares being maintained, and the new road having no ‘induced demand’ effect on traffic. If one accepts, as most studies do, that the new road will lead to increased overall motor vehicle traffic levels, it follows that emissions will increase as a result.

It is also increasingly likely that rapidly increasing oil prices will drive further demand for public transport services. As a result of global demand and supply for oil, a recent CSIRO report forecasts a possible petrol price of $8 per litre by 2018 – the year before construction of Eddington’s proposed cross-city road tunnel is scheduled to finish.

While reducing greenhouse emissions was not part of Eddington’s brief, it is a critical policy objective of the Victorian Government which is also seeking to establish sustainable legislative objectives for the transport sector. The government has adopted a target of a 60% reduction in total emissions by 2050 against 2000 levels. Major policy and investment decisions in all sectors, including transport, should assist in meeting the target. The Government should consider its next transport strategy in the context of the need to increase community resilience to both climate change and oil price risks, and the need to meet a range of short and long-term social, economic and environmental objectives. Nothing short of this will be enough.
SUMMARY OF RECOMMENDATIONS

- Provide a step change level of public transport investment to actively drive a mode shift from private cars to public transport, by constructing new train lines, extending tram lines, and continuing to introduce additional bus services (page 40).

- The Eddington Report should be viewed as a major contribution to the development of a long-term strategy for metropolitan Melbourne that clearly demonstrates significant reductions in transport emissions (page 56).

- Make all public transport in Victoria carbon neutral by buying renewable energy for metropolitan trains and trams, improving efficiency and purchasing offsets for buses and regional trains (page 38).

- The Government should undertake an analysis of the likely effects on public transport demand of a significant rise in the price of oil. Strategies should be developed to feed into the development of the long-term transport strategy (page 42).

- Through COAG, the Government should continue to encourage the Federal Government to provide funding for public transport infrastructure, and to adopt more transparent processes for transport funding and to (page 46).

- The Government should incorporate strong environmental objectives, including the obligation to reduce greenhouse emissions, into revised transport legislation as part of the Transport Legislation Review (page 49).

- Through COAG, the Government should support the introduction of mandatory fuel efficiency targets for Australian passenger vehicles (page 44).

- Through COAG, the Government should encourage the Federal Government to abolish the current FBT concession for private use of company cars, and conduct a broader review of taxation policies with negative or perverse environmental impacts (page 47).

- The Government should introduce a road pricing scheme with funds raised directed at expanding public transport services, walking and cycling (page 48).

- The Government should incorporate the essential elements of broader environmental assessment as used overseas to support its existing ESF integration policy commitment (page 51).

- Include environmental performance indicators in future contracts with public transport service providers (page 39).

- The revised Precinct Structure Planning Guidelines should include effective minimum levels of public transport service provision, transparently described, for all new developments (page 22).

- The Government should ensure that future financial assistance provided to the automotive industry is tied to demonstrable improvements in vehicle fuel efficiency and should lobby for this measure through COAG (page 44).

- The Government should extend the current preferential treatment of registration fees for hybrid vehicles to a full system of annual vehicle registration charges based on vehicle emissions, and remove the stamp duty concession for cars costing between $35,000 and $57,009, as part of a broader investigation into incentives to encourage the purchase of more fuel-efficient vehicle (page 48).

- The Government should investigate policy options, such as HOV lanes, to encourage higher vehicle occupancy (page 19).

- The Government should expand the implementation and enforcement of priority measures for trams (pages 32).

- The Government should expand the implementation and enforcement of priority measures for buses (pages 34).

- The Government should investigate the potential energy and thus emissions savings available to the train network through better storage of energy regenerated through braking and incorporate energy-saving measures into the network. (page 30).

- The Government should investigate the potential energy and thus emissions savings available to the tram network through better storage of energy regenerated through braking and incorporate energy-saving measures into the network. (page 31).

- If no significant reliability or maintenance issues arise from the hybrid bus trial, all buses purchased from now on should be hybrids (page 33).

- Government and bus operators should work together to ensure that driver training programmes are encouraged and are evaluated appropriately (page 34).

- The Government should investigate the potential for public transport service provision to be included in indicators of building sustainability. (page 53).
PURPOSE

This report aims to assess the current and potential contribution of the Victorian public transport system to reducing greenhouse gas emissions, and to recommend proposals that will reduce emissions further from the broader transport sector.

INTRODUCTION

Transport is an integral and vital part of modern society. Efficient transport of goods and people is crucial to a healthy economy, enabling freight to reach markets and people to get to work. Transport also provides a fundamental social role, providing access to a wide range of activities and services.

However, the current transport system is also responsible for a wide range of negative environmental impacts. The most pressing and significant of these impacts is the emission of greenhouse gases which contribute to climate change, recognised as the greatest challenge of this generation.

All forms of powered transport in Victoria emit greenhouse gases, either directly or indirectly. Road vehicles are powered by fossil fuels, and each car, taxi, van, truck and bus emits a given mass of CO₂ into the atmosphere for each litre of petrol, LPG or diesel burned. While public transport is more efficient at moving people than private cars, it also produces greenhouse emissions. Regional trains and coaches and metropolitan buses are powered by diesel, while Melbourne’s metropolitan trains and trams are powered by electricity generated via the combustion of brown coal.

The concept of environmental sustainability incorporates not just the condition of the natural environment, but also social and equity issues. Many areas of Melbourne, and indeed wider Victoria, are not served by an effective, high speed public transport network. The population of these areas tends to be highly car-dependent while those without cars are effectively without any means of transport at all. Recent rises in the price of fuel have already increased the vulnerability to financial hardship and social exclusion of those without access to effective public transport. This vulnerability will only increase as fuel prices increase further, both in response to the pressures of rising global demand and falling supply (see section on ‘Peak Oil’) and as a result of the forthcoming emissions trading scheme if an excise offset is removed in future."

The first part of this report looks at climate change and the contribution of transport to the emission of greenhouse gases. It goes on to analyse the greenhouse impacts of different land-based passenger transport modes, and quantifies the benefits of encouraging people onto the less emissions-intensive modes. Recommendations are provided to government as to how emissions can be reduced.

The second part of the report begins with a discussion of peak oil and its potential environmental consequences. It then looks at some strategic issues and initiatives that are more within the sphere of influence than direct control of the Victorian Government, including improving vehicle fuel efficiency and the potential to influence federal funding and taxation policies. There follows a discussion of the institutional arrangements currently governing public transport, the potential for incorporating public transport more strongly within building sustainability indices and a discussion of the Eddington Review of the East-West Needs Assessment.
Part 1

CLIMATE CHANGE

The fundamental global challenge of our time is human-induced, or anthropogenic, climate change. Anthropogenic climate change is a result of the release by humans of greenhouse gases such as carbon dioxide, nitrous oxide and methane which trap the sun’s heat inside the earth’s atmosphere and cause global temperatures to rise – the enhanced ‘greenhouse’ effect. The increase in the concentration of these gases in the atmosphere corresponds closely with the beginning of the industrial revolution (as shown in Figure 1) and the subsequent release of increasing volumes of greenhouse gases, in particular from the burning of fossil fuels to provide electrical energy and transportation.

Figure 1. Atmospheric concentrations of carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) from Antarctic ice cores (blue) and Cape Grim atmospheric measurements (orange) over the last two millennia. (CSIRO Marine & Atmospheric Research and Cape Grim Baseline Air Pollution Station)

Impacts of climate change include increased global average temperatures, raised sea levels and flooding, loss of biodiversity and increased frequency of extreme weather events.

Both the United Nation’s Intergovernmental Panel on Climate Change (IPCC) and the Garnaut Review have highlighted the particular vulnerability of Australia’s environment and economy to climate change. Amongst other things, this is because of:

- Australia’s current climate which is already hot, dry and variable
- The importance of agriculture to the national economy
- The extent of coastal settlements and
- Australia’s proximity to developing countries which are also at risk.

Although climate change is often talked about as an ‘environmental’ concern, because of the obvious and increasing impacts it is having on the natural environment, climate change represents a fundamental challenge to all aspects of human society and our quality of life. Indeed, climate change has only been taken seriously by many parties once they have recognised and understood the challenge to their ongoing economic prosperity.

The debate around climate change continues to advance, as overwhelming evidence continues to support acceptance of the role of human activity in causing global warming. In November 2007, the IPCC advised that policy makers around the world had a seven-year window of opportunity to turn emissions around from the upward path that they have been on to a downward trend to avoid ‘dangerous’ levels of climate change and an increase of more than two degrees Celsius in average global temperatures.

It is widely recognised that the costs of adapting to climate change far outweigh the costs of mitigation. Despite that, the world has not yet responded at a scale appropriate to the threat. In fact, things have been moving in the wrong direction. In April 2008 Al Gore said that the situation had “gotten worse” since his influential 2006 film An Inconvenient Truth. In the same month, Sir Nicholas Stern said that he had underestimated the threat in his equally influential review, published in October 2006, which focussed on the economics of climate change.

Figure 2 – Actual temperatures compared to IPCC forecasts (DSE 2007)

Recent scientific observations suggest that we are tracking at the high end of previous forecasts. As successive reports are released, it appears that earlier estimates have underestimated the carbon-intensive growth of the global economy in the last decade, particularly from developing countries such as China and India. The significant loss of Arctic sea ice in the northern summer of 2007 and the partial loss of the Wilkins ice shelf in the Antarctic in early 2008 both surprised and alarmed scientific observers, many of whom had not predicted such events for many decades.

Attention has now turned to a combination of mitigation efforts and adaptation strategies, as while some impacts have already been felt, more are inevitable even if greenhouse emissions were to cease immediately, due to the long time lag involved between emissions and effects.

Australia is one of the top 25 greenhouse emitting countries in the world, which together account for 87% of global emissions. Of these 25 countries, Australia has the second highest per capita emissions, just below the USA, reflecting a combination of wealth and an energy-intensive economy.
Along with other developed nations, Australia has committed to reducing carbon emissions by recently ratifying the Kyoto protocol. Australia has committed to reducing emissions by 60% by 2050 against 2000 levels.

As developed countries such as Australia not only have greater financial capacity to reduce emissions but are also responsible for the vast majority of fossil fuels burned over the last century, many, including for example David Spratt and Philip Sutton⁸, and Bill Hare of the IPCC⁹, argue that they should go beyond the 50-60% overall global emissions reduction required and should aim for a much greater reduction in their own greenhouse emissions by 2050. The Garnaut Review has also acknowledged that a 60% reduction may not be enough.

Victoria has been at the forefront of the climate change debate in Australia, driving the introduction of an emissions trading system and encouraging emissions reduction through the Victorian Renewable Energy Target and a range of other initiatives. In March 2008 a Climate Summit was held as the first step towards a White Paper on Climate Change, to be released in 2009, and a Climate Change Bill. The Department of Premier and Cabinet has also initiated a whole-of-government review of current policies to assess their impact on climate change objectives.

VICTORIA’S GREENHOUSE EMISSIONS

About one fifth of Australia’s emissions are from Victoria. As shown in Figure 3 below, Victoria’s own greenhouse emissions have increased strongly since 1990, the base year for Kyoto protocol calculations.

Greenhouse gases are generally quantified in terms of "carbon dioxide equivalent" or "CO2e". This measure acknowledges that, while carbon dioxide is the most prevalent of the greenhouse gases, there are a number of other gases that have a greenhouse effect. These include methane, perfluorocarbons and nitrous oxide, and some of them have a greater impact on global warming per kilogram than carbon dioxide. CO2e expresses the amount of global warming of greenhouse gases in terms of the amount of carbon dioxide that would have the same warming potential.

The majority of net greenhouse emissions in Victoria – around 67%¹¹ – are from the stationary energy sector, from electricity generation and use from the combustion of brown coal. Because of Victoria’s abundant stocks of easily accessible brown coal, and significant past investment in centralised generation and distribution infrastructure, this is currently the cheapest method of producing electricity. However, it is also the most greenhouse-intensive method in Australia.

Transport’s share of greenhouse emissions is the second greatest after stationary energy, at around 17%¹². As a result in part of a growing and increasingly wealthy population, transport’s emissions are increasing, both in absolute terms and as a proportion of total emissions. There is an urgent need to pursue low-carbon transport alternatives to prevent further increases and to contribute to longer-term reduction commitments.

Because of the inefficiencies from burning brown coal and distributing the electricity, electricity accounts for only 19%¹³ of final energy consumption. The transport sector is the biggest consumer of energy in Victoria, consuming 37%¹⁴ of the total, almost entirely in the form of petroleum.

Figure 4 below shows how emissions from the transport sector have increased more quickly than overall emissions in Victoria between 1990 and 2005.

This has resulted from a growing population with more wealth and increasingly energy-intensive lifestyles. In 2005, Victoria generated over 120 million tonnes of greenhouse gases.
As shown in Figure 5 below, over 90% of emissions from the transport sector come from road transport. Each litre of fuel burned by a vehicle releases a given quantity of greenhouse gas into the atmosphere, regardless of either the fuel-efficiency of the engine or the efficiency of pollution control equipment. In fact, a greater mass of CO2 is produced than the mass of the fuel itself, due to the addition of oxygen from the atmosphere to the fuel during combustion.

A litre of -
- petrol releases 2.4 kg of CO2
- diesel releases 2.7 kg of CO2, and
- LPG releases 1.6 kg of CO2.

It should be noted that the energy content of the different fuels varies considerably. In particular, a litre of LPG contains much less energy than petrol or diesel, so more LPG is needed to travel the same distance.

Public transport is also responsible for greenhouse emissions as a result of the coal used to generate the electricity used to power trams and urban trains, and the diesel used to power buses and regional trains. However, as shall be discussed in more detail below, public transport generates fewer emissions than cars for each passenger kilometre travelled.

Future forecasts give little cause for optimism. The graph below from the Commonwealth Department of Climate Change shows the projected increase in overall emissions from transport in Australia until 2020. Under a ‘Business as Usual’ scenario, transport sector emissions are forecast to be 76% above 1990 levels by 2020. Under a ‘with measures’ scenario, the increase is still 67%.

The measures assumed to be in place include existing or proposed Federal and State Government policies and programmes, such as the voluntary new car emissions target and biofuels programmes, but do not include an emissions trading scheme.

Car 91.8%
Motorbike 0.4%
Public Transport 7.9%
Train 5.3%
Tram 1.3%
Bus 1.3%
Walking & Cycling 0%

Figure 5– Composition of 2005 Victorian transport emissions (Victorian Greenhouse Office 2007)

Future forecasts give little cause for optimism. The graph below from the Commonwealth Department of Climate Change shows the projected increase in overall emissions from transport in Australia until 2020. Under a ‘Business as Usual’ scenario, transport sector emissions are forecast to be 76% above 1990 levels by 2020. Under a ‘with measures’ scenario, the increase is still 67%.

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Figure 7- Transport GHG projections to 2020 (Department of Climate Change, 2008)

‘High’ and ‘low’ emission scenarios give some indication of how emissions may be affected by the uncertainty in forecasting key drivers such as economic growth, population, fuel efficiency improvements and fuel prices. The Federal Government forecasts continued steady growth in transport emissions in all scenarios except that of low emissions, in which emissions peak around 2015 and then decline slightly.
IMPACTS OF CLIMATE CHANGE IN VICTORIA

Victoria’s climate is changing. Analysis of historical data shows that both maximum and minimum average temperatures have increased by 0.8 degrees celsius since 1950\(^\text{19}\). Over the same period, Victoria has experienced a decline in total rainfall of 13% with an increase in the frequency of extreme droughts\(^\text{19}\).

CSIRO and the Bureau of Meteorology published new climate change projections for Australia in October 2007\(^\text{21}\), based on a range of emissions scenarios. Average temperatures in Victoria are forecast to increase by a further 0.9°C by 2030, with a range of 0.6-1.5°C. By 2070 this increase is projected to be as high as 3°C with a range of 2°C to 4°C\(^\text{22}\).

By 2030 annual rainfall is projected to decrease by around 4% relative to the climate of the past century and by 2070 the change is projected to be a decrease of around 6% under a low emission scenario, or around 11% under a high emission scenario. Extreme daily rainfall is less affected by the underlying drying tendency and may increase.

The 2007 CSIRO report “Infrastructure and Climate Change Risk Assessment for Victoria”\(^\text{23}\) examines the effects of climate change on the State’s infrastructure. The report found a wide range of negative impacts on transport infrastructure, including:

- Increased frequency and intensity of extreme rainfall events may cause significant flood damage to road, rail, bridge, airport, port and especially tunnel infrastructure.
- Rail, bridges, airports and ports are susceptible to extreme wind events; ports and coastal infrastructure are particularly at risk when storm surges combine with sea level rise.
- Accelerated degradation of materials, structures and foundations of transport infrastructure may occur through increased ground movement and changes in groundwater.
- Increased temperature and solar radiation could reduce the life of asphalt on road surfaces and airport tarmacs.
- Increased temperature stresses the steel in bridges and rail tracks through expansion and increased movement.
- Increased temperature causes expansion of concrete joints, protective cladding, coatings and sealants on bridges and airport infrastructure.

Because of the long life of transport infrastructure, these future impacts must now be considered in all investment decisions.

The Public Transport Division of DOT has conducted a more detailed risk assessment of public transport infrastructure. This identified a range of risks including buckled train and tram tracks as a result of an increased number of high-temperature days and found that infrastructure standards and maintenance procedures will need to be regularly reviewed and updated to match the changing future climate.
GREENHOUSE EMISSIONS FROM DIFFERENT TRANSPORT MODES

Public transport is generally believed to be a ‘good thing’ for the environment. While this is correct, it does have its own environmental impacts, including the emission of greenhouse gases. However, in the absence of public transport, many more journeys would be taken by private car. As demonstrated below, a trip taken on public transport creates fewer greenhouse emissions than the same trip undertaken by car. Therefore, on a relative basis, public transport can be said to be reducing emissions.

Trains and trams are powered by electricity that is generated primarily through the combustion of brown coal, the most emission-intensive method of electricity generation in Australia. Buses and regional trains are powered by diesel. Therefore all public transport modes contribute to greenhouse emissions either directly (from the vehicle) or indirectly (through electricity generated elsewhere).

This section examines the greenhouse emissions from different transport modes – both public and private – and assesses the potential reductions in emissions that could be achieved through a shift to less polluting methods.

The following analysis of emissions from different transport modes is based on ‘full fuel cycle’ calculations. Full fuel cycle analysis measures the tail-pipe emissions from the vehicle, and includes the energy expended in processing and transporting the fuel to the vehicle. It is not based on ‘life-cycle analysis’, which includes the energy embodied in vehicles, due to the lack of reliable data.

It is a systems analysis. That is, a change in one variable will lead to a change in another.

AVERAGE EMISSIONS INTENSITY

In order to compare the overall emission performance of different transport modes, total emissions is not the most useful indicator as it does not reflect the total ‘transport task’ being undertaken – that is, the total number of people travelling and the average distance each travels. A more useful indicator is emissions intensity, measured in kilograms of greenhouse gases emitted per person kilometre. This provides an indicator of the greenhouse efficiency with which different transport modes carry out their share of the transport task.

This section compares the emissions intensity of the main private and public transport modes. It should be noted that this methodology is specific to Melbourne under current operating conditions, with current energy sources and using current estimates of average occupancy rates. The analysis was undertaken by the Public Transport Division of the Victorian Department of Transport.

Figure 7 below shows the average greenhouse emissions intensity of a range of different transport modes. A distinction has been made between peak and off-peak times of day to include the effects of occupancy and also congestion.

The figure illustrates that, on average, public transport emits 149 grams of CO2e per person kilometre compared with 213 grams for private cars. That is, on average, public transport emits 30% fewer emissions than cars per person kilometre. In peak times the difference is much greater – 99 grams as opposed to 250 grams. This reflects lower car occupancy rates, as most vehicles are driver-only commuters, more road congestion and higher occupancy for public transport modes. In peak times, public transport emits 60% fewer emissions overall than cars per person kilometre.

In the off-peak, the situation is different. Cars have slightly higher occupancy rates and roads are less congested, while public transport occupancy rates are lower. In fact, on average the private car is slightly less emissions intensive, that is, it performs marginally better than public transport overall, during the off-peak (compare ‘a’ with ‘b’ in the figure above).

INCREMENTAL EMISSIONS INTENSITY

To reduce overall transport emissions, people need to shift to less emissions-intensive transport modes. To assess the value of such a change, one needs to measure the emissions saved by such a change in behaviour. It is not the average emissions intensity that determines the effect of such a change, but the incremental intensity, ie how much emissions an extra kilometre of travel produces.

Consider a person standing outside their house and deciding how to get to work. Let’s assume they can walk, cycle, drive a car as a sole occupant, get a lift in a friend’s car or catch public transport. What is the effect on overall emissions of that decision? The incremental emissions intensity is the change in total greenhouse emissions resulting from each additional kilometre of a particular transport mode.

A general assumption has been made here that in off-peak times there is some spare capacity in every train, tram and bus. Even in the off-peak, there is still a very small increase in emissions as a result of the additional energy needed to move the weight of the additional passenger. For example, in Figure 8 below, just 7 grams of CO2e are emitted as a result of an extra passenger travelling a kilometre in an off-peak train.

ATTACH Figure 7- Average greenhouse intensity of transport modes (DOT)
During peak times, it is assumed that trains, trams and buses are full, and that additional passengers can only be accommodated by adding additional services. The increase in public transport emissions are calculated assuming a proportional increase in service levels to meet demand. For example, in Figure 8 an additional 96 grams of CO2e are emitted per passenger as a result of an extra train service.

This is of course a broad assumption, and does not reflect the majority of public transport routes around the metropolitan area. While some train lines, especially, are at full capacity following recent growth, many still have some spare capacity and some off-peak services are almost empty. In addition, the majority of tram and bus lines have some spare capacity even at peak times. As such, this assumption leads to an underestimation of the benefits of encouraging people to switch to public transport. In practice, the incremental emissions from any public transport service in peak times that has any spare capacity will be equivalent to those shown as off-peak in the analysis.

On average (that is, the average of peak and off-peak) one additional driver-only car will emit 328 grams CO2e per kilometre, whereas one additional passenger on public transport will increase emissions by 51 grams CO2e per kilometre. Therefore, someone who normally drives a car on their own but switches to public transport will reduce their transport-related greenhouse emissions by around 85% (from 328 to 51 grams CO2e/km) on average.

In peak periods, the incremental emissions intensity of driver-only cars is slightly higher (365 grams CO2e/km in Figure 8) than the average emissions intensity (313 grams CO2e/km in Figure 7) because of the slight increase in congestion caused by one more vehicle on the road. The increased emissions from the congested traffic has been assigned pro rata to the additional car.

In the off-peak, it is assumed the roads are not congested, so the average intensity and the incremental intensity are the same (297 grams CO2e/km).

This extra traffic congestion slows both the car itself and all other users of the road, thereby reducing fuel efficiency and increasing emissions. While the extra congestion would, in reality, be negligible for just one additional car, the methodology is designed to estimate the impacts of broader shifts in travel behaviour.

Figure 9 below illustrates the greenhouse savings of people switching from private cars to public transport at average levels of occupancy.

As people are encouraged to shift from cars to public transport, it is likely that total car kilometres decrease more than public transport kilometres increase. This effect is known as ‘transit leverage’. Public transport generally travels more directly, with more walking at each end of the trip, and a proportion of people will give up a car altogether when public transport services are improved. This effect is not considered as part of the analysis here, but suggests the greenhouse emissions benefits of public transport are underestimated.

The analysis highlights the sensitivity of passenger occupancy levels, particularly for private cars. The average occupancy of private cars is estimated to be just 1.4 persons; it is 1.25 during peak periods and 1.55 journeys during the off-peak (VATS). The incremental emissions from an additional passenger in a car are only 21 or 22 grams CO2e/km, because the extra weight of the person makes very little difference to the overall weight of the vehicle. If people share trips there is generally a slight increase in kilometres driven, but the effect of the extra distance is not significant compared to the savings.

From a policy perspective, the analysis demonstrates the potential for reducing overall greenhouse emissions from transport by encouraging a shift from private cars to public transport and increasing car occupancy rates.

With current capacity constraints during the peak periods, there is greater potential for emissions reduction by encouraging public transport patronage in the off-peak. While there are more services and passenger movements per hour in peak periods, there are many more public transport services overall each week during the off-peak, and this is when there is spare capacity.
A number of initiatives have been introduced to encourage off-peak or shoulder-peak travel on public transport. These include the Sunday Saver and Weekend Saver tickets and the ‘Early Bird’ train tickets where travel is free on journeys completed by 7am.

High Occupancy Vehicle (HOV) lanes have been introduced with varying levels of success in Australia and overseas countries such as the USA and Canada. It is important that HOV lanes are long enough to provide sufficient incentive to use them, rather than only being provided in critical congestion hot-spots. Car pooling programmes have also been trialled in various countries, but it remains very difficult to persuade individuals to modify their travel behaviour without strong financial inducement. However, as both a low-cost method of reducing transport emissions and in preparation for much higher future petrol prices, which are likely to lead to greater demand for car-sharing and car-pooling, the provision of such initiatives should be encouraged.

**RECOMMENDATION 1**
The Government should investigate policy options, such as HOV lanes, to encourage higher vehicle occupancy.

**FUTURE REDUCTIONS IN CAR EMISSIONS**

Faced with the challenges of both climate change and higher oil prices, car manufacturers around the world are investing increasing amounts in technologies to reduce fuel consumption and thus emissions. These initiatives are encouraged by regulatory measures in countries such as Japan and the USA which have mandated fuel efficiency standards. The EU is also finalising stringent mandatory efficiency targets following the failure of most manufacturers to meet voluntary targets introduced some years ago.

In Australia, the Commonwealth Government reached agreement with the automotive industry in 2003 on a voluntary target of 6.8 litres per 100km for petrol passenger cars by 2010 – the National Average Fuel Consumption (NAFC) Target. *(The need to improve vehicle fuel efficiency is discussed further in Part II).* The target has now been replaced with a carbon emissions based target. Little actual progress has been made.

However, with petrol prices reaching record levels in recent months, there has been a noticeable increase in demand for smaller and more economical vehicles, resulting in an increased proportion of imported cars sold. This can only be expected to continue with further oil price rises anticipated over the long term.

While the shift to smaller, more economical cars is likely to continue, the introduction of new technology will make medium and large cars more fuel efficient. As worldwide production of cars with more efficient powertrains increases, such as common-rail diesel engines and hybrids, the price premium will fall so that they become relatively affordable.

In the longer term, plug-in hybrid technology, electric vehicles and, potentially, hydrogen-fuelled vehicles are expected to become widespread. However, electric and hydrogen-fuelled vehicles can only offer greenhouse emissions advantages if the electricity and hydrogen are produced by sustainable, low-carbon methods rather than from the combustion of brown coal.

**BIOFUELS**

Biofuels are also expected to play an increasing role in reducing transport emissions and oil dependency. Although biofuels are considered by some to be a ‘good thing for the environment’, the reality is far more complex.

The capacity of the current crop of biofuels to reduce carbon emissions on a life-cycle assessment is limited. The range of studies suggests that bioethanol produced from corn or wheat can have a slightly positive, neutral or even slightly negative effect on overall carbon emissions. This is because of the significant energy that goes into the planting, cultivating, harvesting, processing and transport of the fuel, even though the carbon in the fuel has been derived from the atmosphere by the growing plant. Particular concerns have been raised about the greenhouse emissions from nitrogen fertilisers used to accelerate growth in feedstocks.

There are also a variety of other environmental and social issues surrounding biofuels, such as water, fertiliser and pesticide use and land take. The most vocal opposition has been to the impact on food prices. Much corn and wheat production in the USA and Canada has been diverted from food to bio-ethanol production and prices have increased substantially as a result, with flow-on effects on a range of food products. This has led to much publicised pasta boycotts in Italy and ‘tortilla riots’ in Mexico.

In April 2008 the World Bank issued a statement calling for a massive increase in funding for the World Food Program®, following an 83% increase in global food prices over the previous three years. Many countries point the finger at biofuels production, particularly in the United States and Europe, as a key driver of higher prices.

Another environmental concern is the displacement of native vegetation to grow biofuels crops. In particular, the removal of rainforest in Indonesia to plant palm oil for the European biofuels market has attracted much criticism. Future European biofuels programmes are now scrutinising both the sustainability of the production processes and also the net greenhouse benefits of the biofuels.

For Australian biofuels especially, another key consideration is water use and the expected increase in water prices. With drought already widespread, and expected to increase in severity as a result of climate change, the environmental and economic sustainability of some biofuels crops may be compromised. The effects of climate change are also likely to reduce the viability of existing crop-producing land and this will put further pressure on food production.
Biodiesel made from waste oils or tallow offers significantly better whole-of-life emissions performance as the feedstock already exist in the economy, sometimes even as a waste, and the processing methods are less energy intensive. ‘Second generation’ biofuels, such as biofuels made from lignocellulosic (woody) wastes, promise to deliver much improved carbon emission performance and less competition with demand for food.

However, driven by increasing prices for oil and the urgency of tackling climate change, extensive research is continuing into so-called ‘next-generation’ biofuels. Future feedstock may deliver far more beneficial results, with processes that can turn sources of biomass into fuels, with net greenhouse savings and with less competition with sources of food. Sources include lignocellulosic (woody) wastes such as wood chips or corn stalks, and algae.

The Victorian Government has a target of 5% biofuels by 2010. It has also recently conducted an enquiry into the establishment of a mandatory ethanol and biofuels target. That enquiry recommended that no mandatory target be set.

An improvement in average fuel consumption across the passenger vehicle fleet is likely in coming years as consumers respond to rising fuel prices by purchasing more fuel efficient cars. This improvement may be accompanied by an increased take-up of biofuels with increasing greenhouse benefits, and potentially by an increase in car occupancy rates.

In the longer term there is likely to be a significant shift to renewable energy which will greatly improve the emissions intensity of trains and trams. In the shorter term, however, the combined effect of these changes could reduce the advantage in emissions intensity that public transport currently holds over private cars. If there is no improvement in the emissions intensity of public transport, cars could become the better performing transport mode.

CONGESTION AND INDUCED DEMAND

The most common justification of the need for new or improved roads in established areas is the need to tackle congestion. A common response in opposition to such proposals is that reductions in congestion are short-lived because the new road ‘induces’ more demand. That is, the savings in journey times encourage new traffic to use the road which did not use the previous road, and there is an increase in the overall number of trips. Ultimately, congestion on the new road may increase to reach the level previously experienced on the old road.

This may be because they would otherwise have taken a different route, used public transport, or not have taken the journey at all. New roads can also encourage road use by encouraging people to live further from their workplace. Of course, increased traffic is also a result of a growing population, in Melbourne’s case largely in the more car-dependent outer suburban areas.

The models used to estimate costs and benefits of new roads examine the time savings that result from higher speeds and freer flowing traffic. These benefits only last until congestion increases on the new road and slow traffic down again, yet this fact is often excluded from the modelling.

The Victorian Competition and Efficiency Council (VCEC) examined the concept of induced demand in its 2006 report "Making the Right Choices: Options for Managing Transport Congestion”. The VCEC report referred to a number of international studies that suggest that new roads lead to relatively small short-term increases in traffic, but more substantial long-term increases.

The VCEC report concluded that –

“It is important that induced demand effects be included in project appraisals. Failure to account for induced demand could lead to estimation errors in the benefits and costs of new road infrastructure”.

Increased or improved public transport services encourage a proportion of road users to shift to public transport. This frees up existing road capacity and will attract some new traffic that was previously deterred by the level of congestion. This new road traffic, some of which may be people shifting back from public transport and some of which may be new travel demand, will go some way towards replacing the traffic that the new public transport service took off the road.

For this reason, if overall greenhouse gas reduction is an objective of transport policy, then simply increasing the provision of public transport is not likely to be successful in a growing economy with a growing population, and where public transport itself produces emissions. To reduce emissions, the increase in public transport must be matched by a decrease in car usage. Measures need to be taken simultaneously to reduce road traffic – measures such as road pricing or supply constraints such as road narrowing or turning lanes into bus-only lanes or high occupancy lanes, introducing bike lanes, or traffic ‘calming’ measures.

As the Melbourne 2030 Audit Report (see page 38) stated –

“It is, however, important that responses to congestion encourage modal shift to public transport, walking or cycling and do not simply provide for more cars on the road.”

The ability of high-quality public transport services to reduce road congestion is often underestimated due to a lack of recognition of the amount of space that cars take up. The difference in road space taken up by the same number of people travelling by car, bus or bicycle is clearly demonstrated in Figure 10 below.
The comparison of cars with trams and trains is even more striking. The Melbourne 2030 Audit Report included some ‘key facts’ on Melbourne’s Transport System. These included:

- One commuter tram replaces about 100 cars – equivalent to a line of cars one kilometre long, and
- One commuter train replaces about 1,000 cars – equivalent to a line of cars 10 kilometres long.

**THE ROLE OF LAND-USE PLANNING**

One of the challenges in encouraging sustainable transport is designing cities that minimise the need to travel, and thus reduce overall environmental impacts from travel. One approach is referred to as Transit Oriented Design, and involves building densely populated residential areas close to centres of employment and around efficient public transport hubs, with good provision for local walking and cycling.

By contrast, the majority of Melbourne’s recent rapid growth has occurred in outer areas such as Melton and Casey which are not well served by public transport. This means people moving to such areas are highly dependent on cars, and many households have two or more. The term ‘forced car ownership’ has been coined to describe this effect and the associated financial impacts. Those without the financial means to afford a car are extremely isolated.

The vulnerability of outer suburbs to rising fuel prices and interest rates was demonstrated graphically by Neil Dodson and Jago Sipe in the ‘Vulnerability Assessment for Mortgage, Petrol and Inflation Risks and Expenditure’ (VAMPIRE) index shown in Figure 11 below. Statistics from early 2008 on mortgage stress and house repossessions confirm these forecasts, with impacts strongest in car-dependent outer suburbs.
The announcement of the new Urban Growth Zone for Melbourne provides an opportunity to encourage effective incorporation of public transport into developing areas through Precinct Structure Plans (PSPs). PSPs are the primary planning tool for the development of Melbourne’s growth areas, and provide the ‘big picture’ requirements for the design of new communities. Guidelines for the preparation of PSPs, covering critical elements of development including public transport, are currently being revised by the Growth Areas Authority.

While the requirement to provide adequate levels of public transport already exists within the guidelines, the ‘adequacy’ of the services is often debateable. In the revised guidelines, the Growth Areas Authority should be transparent about the minimum service levels that are required. There should also be clear explanations of any failures to meet the minimum standards in new developments.

It is especially important to integrate efficient public transport early in the development of new areas to avoid car purchase and use becoming entrenched.

**RECOMMENDATION 2**
The revised Precinct Structure Planning Guidelines should include effective minimum levels of public transport service provision, transparently described, for all new developments.

While the principles of transit oriented design should be adopted for new developments, the legacy of past planning decisions means that other approaches are also required to significantly reduce transport emissions. While there are efforts to increase population density in established residential areas, including initiatives within Melbourne 2030, such an approach cannot address more than a small part of the overall problem.

This is due to the lag times in infrastructure change and the limitations involved in significantly changing Melbourne’s existing built environment. One such limitation is local pressure (such as in Camberwell) against development that is felt would detract from an area’s character or its perceived aesthetic appeal.
OVERVIEW OF THE VICTORIAN PUBLIC TRANSPORT SYSTEM

THE ROLES OF PUBLIC TRANSPORT

Public transport can be considered to play two separate roles. One is ‘mass transit’, typically commuter services, where public transport generally provides the most efficient and cheapest travel option. Mass transit has an additional benefit of reducing road congestion for all road users, including trucks that have no alternative.

The other role is that of ‘social transit’ which is concerned with providing travel to people who do not have access to other options such as private cars. Public transport reduces levels of social exclusion caused by lack of access to jobs, recreational opportunities and social interaction. This is a more challenging task for public transport as the journeys are generally much more dispersed both geographically and temporally and more flexible responses are needed.

The recent liveability inquiry by the Victorian Competition and Efficiency Council were advised by the Department of Victorian Communities that –

“Lack of transport is consistently rated by rural, regional and metropolitan fringe communities as ‘one of the most significant barriers to accessing services employment and social networks’”

In terms of greenhouse gas emissions, it is more valuable to focus on the mass transit role. This is because it is responsible for the majority of emissions, and because provision of effective mass transit encourages people out of their cars and on to less emissions-intensive travel modes.

There is inevitably some overlap between the two roles described above. As the reduction of greenhouse gas emissions is so important, a third role for public transport, spanning both mass transit and social transit, could be to provide a more sustainable option.

THE VICTORIAN PUBLIC TRANSPORT SYSTEM

There are five main types of public transport in Victoria – regional trains and coaches, together with trains, trams and buses in the metropolitan area. In addition to Victoria’s metropolitan and inter-town passenger rail services, several inter-state rail services are also available. The main Melbourne–Sydney rail service is provided by the CountryLink XPT train. A Melbourne–Adelaide rail link is provided by The Overland train.

V/Line

V/Line is a State-owned statutory corporation that operates a network of regional rail and coach services throughout Victoria under a franchise agreement.

In 2007 the regional rail network was bought back from the private operator Pacific National. Under the terms of the agreement, V/Line now maintains and operates 4,100 kilometres of rail lines for both passenger and freight services. More than 1,400 train services and 600 coach services are operated every week across the State, serving 1.3 million people.

There has been unprecedented patronage growth on V/Line services in recent years. In 2006-07, patronage climbed to its highest level in 60 years, with around nine million passenger trips – an increase of 29% over 2005-06 (V/Line Annual Report 2006-07).

While it is very likely that higher oil prices contributed to this increase, a number of initiatives to increase patronage were also introduced during the period. The most significant change was the implementation of the Regional Fast Rail programme. A new timetable was also introduced during September and October 2006 and the Government reduced fares by 20% in March 2007. V/Line is working to achieve a further 20% increase in patronage over the next two years.

The growth in patronage has resulted in some overcrowding, particularly on the Melbourne commuter sectors of Geelong, Bacchus Marsh and Sunbury. Two new ‘V-Locity’ trains, delivered in late 2007, together with 14 new carriages to be delivered in mid-2008, are expected to help address the problem.

A challenge in further expansion of V/Line services will be to efficiently coordinate the V/Line services with Connex local train services in the metropolitan area where track is shared and where there is already track congestion especially at peak times.

Metropolitan trains

Metropolitan train services in the Melbourne area are currently operated by a private company, Connex, via a franchise arrangement with the Victorian Department of Infrastructure (DOT).

The trains themselves are owned by DOT, which leases them to Connex. The track is owned by Victrack and leased to the Director of Public Transport who on-leases them to Connex. Connex operate a fleet of 329 trains across 15 different lines, providing over 12,000 services each week.

Patronage on metropolitan trains grew by 12.2% during 2006/07 to 178.6 million boardings, and has risen by 23% over the past two years. Unprecedented growth in recent years, and the past two years in particular, has led to widely reported overcrowding in peak times, particularly on certain lines.
As with V/Line patronage growth, some of this is undoubtedly a result of higher petrol prices encouraging people to choose a cheaper travel mode. In addition, as with V/Line, DOT introduced a number of initiatives aimed at promoting growth. These include the introduction of ‘Sunday Saver’ in April 2005 and the abolition of the outer suburban ticketing area (Zone 3) in March 2007 in an attempt to boost under-utilised off-peak resources.

A range of new infrastructure projects and other initiatives are also underway (see Meeting our Transport Challenges on page 35).

Trams

Metropolitan trams are operated by a private company, Yarra Trams, via a franchise arrangement with DOT. As with trains, DOT owns the rolling stock and leases it to Yarra Trams. The track is owned by VicTrack and leased to the Director of Public Transport who on-leases it to Yarra Trams.

Yarra Trams has operated the entire Melbourne tram network since 2004, and operates a fleet of around 500 trams across 27 routes, the second largest tram network in the world.

In contrast to many new tram or light rail systems that have appeared in cities throughout the world in recent years, over 80% of Melbourne’s trams do not have their own right of way but operate in mixed traffic. This means that trams have to navigate frequent road intersections and are often blocked by traffic turning or are simply held up by road congestion. This, combined with the historical legacy of relatively small distances between stops, means average tram speeds are low by international standards.

Funds have been allocated to improving tram speeds through the ‘Think Tram’ programme, which has introduced priority measures for trams such as platform stops, traffic dividing strips and traffic turn bans.

Tram patronage has also increased in recent years, growing at 3.6% in 2006/07 to 154.9 million boardings.

Metropolitan buses

While the majority of Melbourne’s inner suburbs are well served by trains and trams, bus services are the dominant mode of public transport to most of the middle and outer suburbs.

Metropolitan bus services are operated by 25 private operators that between them hold 40 contracts with DOT. Bus operators own and operate their vehicles. There are more than 17,500 metropolitan bus services each weekday.

One of the biggest challenges to bus services is the limited frequency and operating hours. Many current services do not operate at weekends or after 5.00pm, and there is a lack of effective coordination with train and tram services.

However, patronage growth on buses has also been rising, with an unprecedented increase of 7.4% over 2006/07. This was driven in part by a range of service extensions introduced by Meeting Our Transport Challenges, including significant growth (up to 40%) in patronage on ‘SmartBus’ routes. SmartBus routes are higher-frequency orbital routes that are designed to provide effective cross-town public transport in contrast to the primarily radial nature of train and tram routes.

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<td>Trains</td>
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<td>Annual boardings (2006-2007)</td>
<td>9.4 million</td>
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<td>Annual patronage growth</td>
<td>29% (2005-06 to 2006-07)</td>
</tr>
</tbody>
</table>

Figure 12 - Summary of current public transport patronage levels
CURRENT GOVERNMENT POLICY SETTINGS

The Government has a range of measures in place aimed at addressing climate change and promoting more sustainable transport and urban design. However, it is not always clear what the primary drivers for transport policy are. Road congestion is generally held up as the rationale behind building more roads, and is also often cited as a reason for improving public transport.

Other reasons include responding to demand, improving economic efficiency, regional development and reducing social exclusion. Most, if not all, of the current government policy initiatives list environmental benefits as one of their objectives, but, although the balance is beginning to change, the environmental benefits have generally been seen as secondary. For example, despite the implicit environmental benefits of many aspects of the $10.5 billion Meeting Our Transport Challenges programme, there is virtually no mention of them in the policy statement.

One more promising development is the Transport Legislation Review, which commenced in October 2007 with a discussion paper titled "Towards an integrated and sustainable transport future". The initial objective of the review process is to develop a suite of overarching policy objectives which will apply to all government stakeholders in the transport policy area. The review is discussed more in Part 2.

GREENHOUSE EMISSIONS REDUCTION

The Victorian Government has been at the forefront of emissions reduction initiatives in Australia.

In 2002 the Government introduced the Victorian Greenhouse Strategy and commenced implementation of a three-year programme of actions. In April 2005 the Victorian Greenhouse Strategy Action Plan Update was released, and included funding for a regional TravelSmart program in Melbourne's northern suburbs, support for the establishment of car sharing programmes in metropolitan Melbourne and funding to the Transit Cities programme.

The Victorian Government’s current overarching policy document that outlines its approach to environmental sustainability is Our Environment, Our Future, the Government’s Environmental Sustainability Framework released in April 2005. This was followed by the first action plan, the ‘Sustainability Action Statement’ released in July 2006.

Our Environment, Our Future contains new investment of over $200 million and 150 initiatives, covering a wide range of sustainability issues including climate change, waste reduction, resource efficiency, and land, water and air quality. It introduced the Victorian Renewable Energy Target aimed at lifting Victoria’s level of renewable energy from 4% to 10% by 2016. It also contained measures to promote the use of biofuels and provided $500,000 funding to a hybrid bus trial in Melbourne.

In 2007, the Victorian Government also announced a commitment to reduce greenhouse emissions by 60% by 2050 against 2000 levels. While the Victorian Government has been committed to an emissions trading scheme as a key driver of greenhouse reductions, responsibility for the introduction of such a scheme is now with the federal government. The forthcoming Garnaut Review is expected to assist the federal government in the design of a national scheme.

In April 2008 the government held the Victorian Climate Change Summit as the first step in the process towards a Climate Change White Paper and a subsequent Climate Change Bill. Although the process has begun, and a range of programmes aimed at reducing emissions are in place, there is no evidence of a detailed strategy and actions in place for achievement of the 60% reduction target. For example, there appears to be no indication from the government as to whether all sectors of the economy are expected to contribute equally to the reduction target, or whether disproportional reductions are to be expected from, for example, the energy sector.

Similarly, there are yet to be any indications of how individual government departments are to internalise the target and factor significant carbon emissions reductions into their strategic and day-to-day decision making, nor has there been any guidance on how proposed projects and programmes should be assessed against their contribution to meeting the target. There is also no standardised carbon price adopted within decision-making processes.

VICTORIAN PUBLIC TRANSPORT INITIATIVES

The public transport and planning elements of Government policy have been contained in five key strategic initiatives in recent years –

- Growing Victoria Together (2002, 2005),
- Melbourne 2030 (2003),
- Linking Melbourne: Metropolitan Transport Plan (2004),
- A Fairer Victoria (2005) and

GROWING VICTORIA TOGETHER – “20/2020”

One key public transport objective, introduced in Growing Victoria Together in 2001 and discussed in more detail within Policy 8.1 of Melbourne 2030 two years later is that of increasing public transport’s share of motorised trips within Melbourne from 9% in 2002 to 20% by 2020. This has become known as the “20/2020” target. Programmes designed to “lay the foundations for progress towards this target” were contained in the Linking Melbourne: Metropolitan Transport Plan and included:

- initiatives to give priority to buses and trams to make more use of existing road infrastructure,
- improved interchanges and Park & Ride facilities, and
- support for better and safer access for pedestrians and cyclists.
As Figure 13 below illustrates, in the years directly after the target was announced, the proportion actually went down. From 2003-04 however, the proportion increased strongly for two years. In 2006-07, despite record public transport patronage, the proportion of public transport trips actually fell by 0.2%. While the number of public transport trips increased from 1.06 million trips per day in 2005-06 to 1.15 million trips per day in 2006-07, this was offset by an even greater increase in the number of car trips, from 11.05 million to 12.22 million trips per day. This reflects the growth in travel per capita, as well as strong population growth.

Figure 13 - Public transport use as a proportion of trips taken by motorised means in Melbourne (2008-09 Victorian Budget Papers)

However, data from VicRoads appears to be at odds with the Budget findings relating to the increase in the number of car trips. The VicRoads data suggests zero growth in vehicle kilometres travelled between 2005-06 and 2006-07. This suggests the Government needs a more robust methodology with which to track its progress towards this target. It is hoped that the forthcoming Victorian Integrated Survey of Travel and Activity will provide the needed improvements.

The lack of progress, as evident in the Budget papers, may also be due in part to the fact that certain elements of the public transport network are close to full capacity already. In particular, metropolitan trains on some lines are experiencing crowding during the peaks as a result of a lack of capacity on the rail network. While the need for rolling stock is being addressed through the purchase of new trains, the capacity of the rail network is more difficult and much more expensive to address.

Particular capacity constraints include the lines between North Melbourne and Southern Cross stations and the city loop. Capacity in the city loop is constrained by the interval required between trains for safety reasons and the length of the platforms which limits the number of train carriages. This makes a continuation of the current rate of patronage growth extremely unlikely without substantial further investment over and above that already planned.

Regardless of the accuracy of the Budget figures or VicRoads’ data, it is clear that immediate and significant further investment is required if the target is to be achieved.

As the Victorian Competition and Efficiency Commission reported in their recent draft inquiry into Victoria’s Liveability, “It seems unlikely that without a very substantial increase in public transport investment (and particularly bus services which do not have the same upfront fixed costs and can be more readily deployed in outer Melbourne and provincial centres) that public transport’s modal share of all motorised trips will increase in the foreseeable future.”

The new cross-town rail tunnel as proposed in the Eddington Report would effectively address these inner city constraints and allow for a significant expansion of services and increased reliability.

Patronage levels on buses and trams, although increasing, are generally lower than trains. Some tram routes are likely to reach capacity if trends continue, notably St Kilda Road and Swanston Street, but there are few current overcrowding issues on buses.

Reaching the 20% target represents more than a doubling of the present proportion of trips on public transport. This might suggest a doubling of the number of public transport trips, but given the strong growth in population that is forecast between now and 2020, the absolute increase required in the number of trips is substantially more.

Of course, reaching such a target could be achieved either through an increase in public transport trip numbers or a decrease in private trip numbers, or both. From a greenhouse emissions perspective, it is essential that the target is achieved in a way that reduces overall emissions.

This could mean increasing the provision of efficient, high-quality public transport services both within existing areas and into new outer-suburban areas. If new public transport services are of a quality and cost that compares favourably with private cars, then people will choose them and car use will decline.

Where public transport services cannot compete with private cars in terms of quality and efficiency, increasing the provision of public transport without corresponding disincentives to continued car usage is unlikely to encourage people to shift modes. Such disincentives could include employing road demand management programmes such as a congestion charge or other road pricing mechanisms that more accurately reflect the full costs of driving.

The legacy of road funding priority

The challenges of providing sustainable transport to Melbourne are largely a result of past planning and funding decisions and attitudes.

Melbourne’s rapid growth during the latter part of the nineteenth century was accompanied by the development of a highly efficient public transport system which supported a strong focus of employment in the centre of the city. From the middle of the twentieth century there has been strong growth in car ownership, a decentralisation of employment and a spread of the population. Public transport usage fell dramatically in this period, with the annual number of trips per head of population falling from around 370 in 1950 to around 100 by 1980.
The last thirty years has seen a succession of new roads and freeways to accommodate the increase in road transport, much of which has been funded by the Federal Government. The priority given to roads, and the neglect of public transport, has created a city and a State that is highly car-dependent.

This trend has occurred throughout Australia as the following graph demonstrates.

While Meeting Our Transport Challenges (see below) was a welcome start, a long-term shift in funding priorities away from road-building is required, at both federal and state levels. If road funding continues as it has in the past, providing new or widened roads that bring temporary relief to congestion, even more people will be encouraged to drive and the challenge of providing more sustainable transport options will be even greater.

**Recent increase in public transport patronage**

So what are the drivers of the recent strong growth in demand for public transport, and can we expect them to continue? It appears that there have been a number of different factors impacting on demand simultaneously, and it is difficult to isolate the influence of each element.

It is almost certain that oil price increases have had an effect. The price of a barrel of crude oil has increased by a factor of ten in the last ten years. Although fuel still represents less than 20% of the cost of running a typical new car, it is the highest and most visible marginal cost, and the higher petrol price has encouraged car drivers to switch to public transport to save money (see Figure 19 page 38).

The graph below shows the correlation between petrol price changes and subsequent changes in public transport usage.
There are strong indications that oil prices are only going to increase further, driven by rising global demand, particularly in China and India, supply infrastructure constraints and a lack of new discoveries. It is reasonable to expect that future oil price rises will therefore lead to significant further increases in demand for public transport.

**Interest rate rises** in recent years may have had a similar effect, decreasing levels of disposable income.

Over 1200 people are moving to Melbourne each week and this **population growth**, together with sustained **economic growth**, has led to an increase in the demand for transport overall. However, as much of the growth is in outer-suburban areas which are not well served by public transport and are relatively car-dependent, not all growth is likely to have contributed to public transport’s increased share. However, there has also been a significant growth in inner Melbourne and CBD residential accommodation, and also in CBD travel.

There have also been **government policies** and programmes to encourage greater public transport patronage. The removal of Zone 3 and the introduction of Sunday Saver tickets have increased demand. Environmental concerns, aided by environmentally focussed marketing of public transport services, may also have had a positive effect. The improvements to the regional rail system which have greatly increased patronage have also had flow-on effects on public transport patronage in Melbourne.

**Increased car parking charges** through the Central Area Car Parking Levy have also widened the gap in price between private car transport and public transport.

**MELBOURNE 2030**

*Melbourne 2030 – Planning for Sustainable Growth* was released in 2002 and is the Government’s strategic plan to manage growth and change across the metropolitan area in a sustainable manner. Its aim was to provide a long-term framework to reduce urban sprawl through:

- the establishment of an urban growth boundary (UGB),
- encouragement of urban consolidation,
- development of activity centres with mixed land use and higher densities of development, and
- development of the Principal Public Transport Network (train, tram and SmartBus) to connect these activity centres and improve the range of services and facilities accessible by public transport.

An audit of the first five years of Melbourne 2030 has recently been completed. The audit found that the underlying principles behind Melbourne 2030 were sound and that there is even greater urgency to implement many of the initiatives within the strategy. This is because of the increasing challenge of climate change, faster than expected population growth, growing congestion, rising petrol prices and the fact that urban sprawl has not been effectively constrained so far.

There has been more development on greenfields sites on the city fringes than the Government had hoped for, with less consolidation of established areas. Much of the new growth has been in outer areas such as Melton and Casey which have relatively poor public transport, exacerbating car dependency.

The creation of the Urban Growth Zone in March 2008 was designed to speed up the development of new areas inside the UGB by simplifying assessment processes for developers as long as proposals are consistent with Precinct Structure Plans. However, there is as yet no explicit requirement that the provision of appropriate public transport services is a part of Precinct Structure Plans.

The Government’s emphasis on housing affordability needs to be focussed on longer term factors as well as simply house prices. With the urgent need to cut greenhouse emissions from transport, and the vulnerability of outer areas to further oil price increases, it is essential that Precinct Structure Plans include sustainable transport options.

As the Melbourne 2030 Audit Report stated –

“...When the full costs of housing, transportation and new services are considered, **new homes on the urban fringe are not ‘affordable housing’**, either to households or to agencies providing infrastructure or services... Close location to shops and jobs means that walking, cycling and public transport reduces the need for several cars.”

This view was reinforced by submissions to the Liveability Inquiry undertaken by the Victorian Competition and Efficiency Commission. The Municipal Association of Victoria argued that “in outer metropolitan growth areas like Casey, Cardinia, Hume and Melton, families need to rely on two cars to be able to function properly and that in Caroline Springs around 35% of the dwellings are not serviced by any form of public transport.”

While the audit report acknowledged the significant initiatives contained within *Meeting Our Transport Challenges* (see below), it was critical of the lack of public transport provided to outer areas. It found that Melbourne 2030 had under-performed in several key areas, including –

**Insufficient provision or commitment to crucial public transport investments**, such as fixed rail to the Whittlesea growth area and expanding the capacity of the city loop.

One of the recommendations of the report is that the Government “actively integrates transport planning with land use development” by “prioritising actions to support a rapid modal shift over the next five years from car to public transport – tram, train and/or bus – and walking and cycling.”

The Government has published its response to the audit, *Planning for All of Melbourne* which addresses many of the issues raised.
MEETING OUR TRANSPORT CHALLENGES

The Government released Meeting Our Transport Challenges (MOTC) in May 2006. MOTC represented a significant shift in funding priorities at the State level and contained $10.5 billion in transport funding over the following ten years, with around 60% devoted to public transport and the rest to road improvements.

MOTC highlights included:
- $1.4 billion towards new cross-town SmartBus routes and local bus services,
- $2 billion towards boosting the capacity of the rail network (although no new rail lines),
- $1.8 billion to new trains and trams and improved services,
- $510 million towards regional bus and taxi services,
- $2 billion towards arterial roads, and
- $740 million to increase capacity on the Monash-West Gate road corridor.

Despite the extent of the MOTC commitments, recent public transport patronage growth has been far stronger than predicted. As a result, there is an urgent need for a new transport strategy that better reflects this reality and the revised forecasts for future trends.

The Government recently announced, within its response to the Melbourne 2030 Audit, a commitment to develop an –

"Integrated longer-term vision for Melbourne's transport system beyond 2035 that helps Victoria meet its greenhouse gas reduction target and builds on the Government’s response to the East West Link Needs Assessment, due later in 2008."

This announcement is welcomed. It is hoped that the new vision includes short-term strategies that reflect not only recent patronage forecasts but continued increases in the price of oil, and are clearly linked to greenhouse reduction targets within the transport sector.

OTHER GOVERNMENT INITIATIVES

The Government, through the Department of Infrastructure, become a pledge signatory to the International Association of Public Transport’s (UITP) Charter on Sustainable Development in 2007. This means Victoria is required to set in place systems for reporting on the environmental and social aspects of transport in Victoria, and determine those actions required to move to being a full signatory. These include putting in place rigorous reporting procedures and ensuring the principals of sustainability are formally recognised as a strategic directive within the organisation.

Also during 2007, the Walking and Cycling Branch was established within DOT, as was the Transport Energy Branch. These areas demonstrate a new interest in sustainable transport modes and the significance of greenhouse emissions from transport.

In April 2008 the government announced the creation of the Department of Transport with Jim Betts, previously Director of Public Transport, as the new Secretary. This is a welcome development and with the previous Minister for Public Transport as the lead minister, promises greater priority for public transport and stronger integration of transport modes. However, the Minister for Roads remains the lead Minister for the response to the Eddington Report.

As discussed in part two of this report, there is also cause for optimism in the current review of transport legislation. A key aspect of the review is the establishment of overarching objectives within revised legislation that decision-makers will have to consider in future. It is hoped that the environmental objectives are significantly stronger than those included as possible examples in the initial discussion paper.

Although not the focus of this report, much attention has been paid in recent times to the predicted growth in road freight traffic. The total freight task is expected to double over the next 30 years, and the government has set an ambitious target of increasing the proportion of port-related freight carried by rail from 10% in 1999 to 30% in 2010. Despite some recent initiatives, including $43 million announced in April 2008 to upgrade freight rail lines, it is not anticipated that the target will be met. This is also a conclusion of the Eddington Report which recommended that the Victorian Government abandon the target and develop more realistic short-term objectives.

The desire to increase the proportion of freight carried by rail is driven primarily by efficiency and the desire to keep trucks out of residential areas for environmental, safety and amenity reasons and to reduce overall traffic congestion, but it also has environmental benefits as trains are significantly less emissions-intensive than trucks.

Current initiatives include re-establishing rail links to the Port of Melbourne such as linking West Swanson Dock to the Victorian and interstate rail network, improving rail access through the Dynon Port Rail Link and improving rail links to the Port of Geelong.

Initial results are not encouraging. The proportion has actually decreased in recent years, although this is partly a result of the drop in grain exports brought on by the drought. Export grain volumes through the Port of Melbourne in 2005-06 were less than half that of 2004-05.

There have been several Federal and State inquiries into biofuels in recent years. The discussion surrounding biofuels is often framed by environmental considerations, and the potential for greenhouse reduction. However, other objectives include ‘energy security’ (reducing reliance on increasingly expensive imported oil) and the potential for regional development and associated economic benefits.

In 2007, the Victorian Government’s Economic Development and Infrastructure Committee conducted an enquiry into the benefits of a mandated biofuels target for road-based transport, with a stated aim of reporting on “how to maximise the regional economic development benefits of a mandatory biofuels target including jobs growth and investment potential”. The conclusion of the enquiry was that a mandated target was not recommended, partly because of a lack of feedstock availability and the potential of a target to put pressure on feedstock and food prices.
TECHNICAL OPTIONS FOR REDUCING GREENHOUSE GAS EMISSIONS FROM PUBLIC TRANSPORT

CONTEXT

As demonstrated above, public transport performs better than cars in terms of greenhouse emissions. However, there are still opportunities to reduce these emissions further. Further reductions are desirable both in their own right and for public transport to continue to perform with lower average emissions-intensity than private cars and to thus offer the public a more sustainable means of transport.

As part of this analysis, a series of workshops were held in late 2007 with the operators of Melbourne’s three key public transport modes to investigate ways of improving environmental performance, in particular reducing greenhouse emissions. One workshop was held with Connex, one with Yarra Trams, and one with Bus Association Victoria and a selection of the private bus operators that Bus Victoria represents. Suggestions arising from the workshops are discussed below.

At both the train and the bus workshops, it was suggested that improved coordination and timetable synchronisation of the different public transport modes would attract new customers, increasing patronage levels and reducing overall emissions. Efforts are being made to better integrate train and bus timetables, especially on the new Smart Bus routes, but it remains a challenge.

The public transport operators have an in-built incentive to coordinate services and maximise patronage on the whole public transport network because fare revenue is allocated on the basis of fixed shares. Connex and Yarra Trams each receive 40% of the total fare revenue and bus operators together receive 20%. To provide further incentive to increase patronage, forthcoming bus contracts are likely to include specific provisions to reward operators for future patronage improvement.

Efforts are also being made to spread demand for public transport at peak times. For example, ‘Earlybird’ services have been introduced, offering free tickets for travel on metropolitan train services scheduled to arrive in the CBD before 7am. This initiative is designed to encourage commuters on the congested peak services to move to less congested earlier services.

The ‘Flex in the City’ initiative is another attempt to spread the load around the peak period (‘peak spreading’). Major employers are being encouraged to allow staff to vary their starting times to ease congestion on the public transport services that cater for the traditional nine to five working day.

METROPOLITAN TRAINS

Melbourne’s metropolitan train system is powered by electricity. Annual consumption of high voltage, traction electricity is approximately 320 Gwh. As that electricity is generated by the combustion of brown coal, the train system is responsible for significant greenhouse gas emissions. Initiatives that reduce electricity usage also reduce emissions.

The energy efficiency of newer trains is marginally better than that of older trains but this saving is offset by increased electricity use for air-conditioning and other ancillary equipment.

Regenerative braking systems have the ability to take the energy used in slowing a vehicle down and transform it back into electricity that can be used again for powering the vehicle. Conventional braking systems apply friction to the wheel to slow it down, and the energy is lost as heat. This is the primary reason that hybrid petrol-electric cars use less fuel than conventional cars. The saving is maximised in urban driving with repeated braking and accelerating.

About one third of the current Connex train fleet has the potential to redirect electrical energy from braking back into the overhead cabling system. This energy cannot be stored (as it can in a hybrid car) but can be used by another train that is within a two kilometre radius and is accelerating and thus drawing power from the system.

While this saves electrical energy, and thus reduces emissions, there is potential for the savings to be increased. The regeneration process is only occurring at low voltages. Higher voltages would provide greater energy savings but produces stray currents which can cause electrolysis and corrosion in infrastructure such as underground pipes. To allow for regeneration at the highest voltage across the network, investment in new infrastructure in the order of $5-10 million dollars would be required.

It is estimated that full re-use of regenerative braking energy by the entire fleet could reduce electricity usage by 20-30%. While the investment would be viable in the longer-term, it would not make a return within the time remaining on Connex’s lease. The Government is investigating options to improve energy savings from regenerative braking systems.

RECOMMENDATION 3

The Government should investigate the potential energy and thus emissions savings available to the train network through better storage of energy regenerated through braking and incorporate energy-saving measures into the network.
TRAMS

Melbourne’s tram system, like its train system, is powered by electricity that is generated by combustion of brown coal. Therefore, as with trains, efforts to reduce greenhouse emissions are focussed on reducing electricity usage.

TRAM PROCUREMENT PROGRAMME

Yarra Trams operate around 500 trams in metropolitan Melbourne. The last batch of trams was bought between 2000 and 2002 and replacement of the fleet will begin in 2011/12 at a rate of 20-30 per year.

The procurement of new trams should be seen as an opportunity for Government to negotiate with suppliers towards improved efficiencies. However, reductions in energy use from newer trams joining the fleet are unlikely to be significant. Newer trams are only marginally more energy efficient, and overall energy use is unlikely to fall significantly as an increasing proportion of the tram fleet will have air-conditioning.

USE, RE-USE AND STORAGE OF ELECTRICAL ENERGY

Trams, like trains, can redirect electrical energy from braking into the overhead cables. This energy can be used by another tram in close proximity that is accelerating and drawing current from the cables. Between 20% and 40% of regenerated power is consumed, depending upon how many trams are nearby. If there is no tram nearby, the surplus energy is wasted and is released as heat.

CSIRO is carrying out research into the use of a new type of supercapacitor that could store and release electrical energy far more effectively than a standard battery. Such technology could also reduce the need for overhead cabling (i.e., over distances up to about 1 km, trams could be powered by the capacitor, allowing cabling to be removed from sensitive locations). There is also the potential to mount supercapacitors in substations. Lithium-ion batteries are also emerging as cost-effective electrical storage devices. Such technology could assist with reducing electricity demand in future.

Tram designs that use flywheels for energy storage, that are gaining some popularity overseas, are not considered sustainable in Melbourne. Trams are limited in their capacity to be fitted with new technology by the space available and also by the weight limits of current track, including bridges and other infrastructure. Also, adding weight to rolling stock increases energy consumption, so there is some energy trade-off.

Heating and cooling use up to 20% of the electrical energy. Older trams are more inefficient in this regard as all the doors open at stops, letting the outside air in and increasing the need for heating and air-conditioning. The push-button door mechanisms on newer trams reduce heating and air-conditioning energy consumption.

Tram lighting uses about 2 MWh/year of electricity. Solid state inverters can save energy and will become more economically viable as electricity prices increase. It would cost between $2.5 million and $3 million to modify the entire fleet. Solar powered lighting is already used at some tram stops.

RECOMMENDATION 4

The Government should investigate the potential energy and thus emissions savings available to the tram network through better storage of energy regenerated through braking and incorporate energy-saving measures into the network.

RATIONALISATION OF TRAM STOPS

One of the characteristics of Melbourne’s tram system is the short distance between tram stops compared with other tram systems around the world. The average distance between stops is 250 metres but in some areas the distance is less than 150 metres. The European standard for tram stop spacing is one per 400 metres. So compared to Europe, Melbourne’s trams have to stop an additional 15 times per 10 kilometres of route. This means that Melbourne’s trams expend more energy stopping and starting and are relatively slow.

More stops mean that average walking distances at the beginning and end of journeys are reduced, but the journeys themselves take longer. Some rationalisation of tram stops has already been introduced as part of Think Tram initiatives, but more could be done.

Improved environmental performance and service delivery could be achieved by further reductions in the number of tram stops. This would allow trams to reach higher average speeds and would reduce the extra energy required for acceleration from rest. RMIT has undertaken an analysis of the extra energy used in stopping and starting and found significant savings could be made.
While undoubtedly unpopular with some passengers, patronage levels could be increased by the reduced journey times as the improved tram speeds would be closer to the average speed of private cars, particularly on commuter routes with tram priority.

Considerable energy is expended in heating and cooling the interior of trams, and much of this is lost when a tram stops and the doors open. Reducing the number of stops would lower the heating and air-conditioning requirements by keeping the outside air out for longer.

Reducing the number of stops would improve the traffic flow for all road users. This would reduce emissions by avoiding repeated braking and acceleration of vehicles and would also reduce journey times.

A reduction in the number of tram stops could also lower operating costs, as fewer trams and drivers would be needed to maintain frequency levels, assuming there is some spare passenger capacity. Alternatively, service levels could be increased and operating costs kept constant.

However, there is generally strong resistance at the local level to the removal of tram stops – from shopkeepers, some councils and communities. Public education of the benefits of such a programme, with support from Government, would probably be necessary.

INCREASED ROAD PRIORITY

As discussed above, the performance of Melbourne’s tram system is severely limited by the lack of a separate right of way for most trams. Less than a fifth of the network operates in its own right of way. This means that trams are obstructed by other road traffic, particularly vehicles turning right, and are subject to frequent road intersection signal disruptions. This, combined with the short distances between stops, has resulted in average tram speeds across the network of approximately 15 kilometres per hour.

The term ‘tram priority’ is used to describe traffic signalling that gives preference to trams over other road users by, for example, allowing trams to move away first from green lights. From a perspective of numbers of passengers being transported, however, the approach could be seen as simply decreasing the inherent disadvantage of 80 people in a tram being held up behind one or two people in a car.

“A balanced multi-modal approach to transport in Melbourne requires that road users cede space to mass transit in the interests of overall transport efficiency.”

Significant funds have been allocated to improving tram priority through the $30m Think Tram programme. Think Tram commenced in 2004, and was given additional funding through MOTC. Works undertaken as part of Think Tram include:

- dividing strips and other measures to provide physical separation of trams from other road traffic,
- remodelling of traffic signals to give greater priority to trams,
- traffic turn bans, and
- construction of platform stops which allow passengers to get in and out more safely and easily, reducing boarding times by 45%.

Further improvements are possible as a result of the Government’s Keeping Melbourne Moving programme, which includes an extension of the hours of operation and enforcement of clearways.

DOT has an objective of increasing average tram speeds by 25%. So far, improvement has been modest although there was a slight increase in speed from 2005 to 2006. Average speed would have increased further had it not been for the strong growth in patronage which means more time is spent at each tram stop.

However, it is clear that without a much more substantial shift towards tram priority across the network, including consideration of initiatives that may disadvantage other road users or have negative impacts on adjoining land users, the 25% target will be very difficult to achieve and overall tram performance will remain compromised.

The EWLNA recommends that the Victorian Government be “much more proactive in using its powers to enforce public transport priority” where there is opposition from local councils or traders to the loss of on-street parking.

RECOMMENDATION 5

The Government should expand the implementation and enforcement of priority measures for trams.

BUSES

Although metropolitan bus services are provided by a group of private operators, the buses themselves are funded by the Department of Infrastructure. The operators are responsible for selecting the preferred model, subject to compliance with a range of standards. While the operators own the buses, the Government pays the capital costs back over a 15 year period.

The need for better priority for public transport was a recommendation of Sir Rod Eddington’s East West Link Needs Assessment (EWLNA): His report states –
IMPROVEMENTS IN FUEL EFFICIENCY

There have been improvements in the fuel efficiency of bus diesel engines in recent years. However, these have been offset by a combination of more stringent air pollution and noise emissions controls, the recently mandated requirement for air-conditioning, and increased weight as a result of more stringent safety requirements, all of which increase fuel consumption.

Significant improvements in bus fuel efficiency in future are likely to come from adoption of new technologies such as hybrids or, in the longer term, fuel cells.

Hybrids

Hybrid bus technology operates in a similar way to that of hybrid cars. A normal combustion engine is combined with an electric motor powered by a battery. The battery is charged either from the combustion engine or from regenerative brakes that convert the kinetic energy into electrical energy that can be stored to be reused. Hybrid-powered vehicles use less fuel than conventional vehicles and the savings are maximised in stop-start urban driving conditions in which regenerative braking systems are most effective.

Hybrid buses are significantly more expensive than conventional buses but, as with hybrid cars, increased demand will bring prices down over time. Hybrid buses are already being produced by several different manufacturers and have been introduced into a number of bus fleets in cities around the world.

A hybrid bus trial for Melbourne has received $500,000 in funding from DSE and the Federal Department of Climate Change. Two hybrid bus technologies will be trialled in Melbourne’s Public transport network – a “series” hybrid with Ventura Bus Lines and a “parallel” hybrid with Grenda Transit Management.

A hybrid bus currently costs about $250,000 (or 50%) more than a conventional bus. Exact fuel savings will be assessed as part of the trial, but a payback period of around 15 years is anticipated at current fuel prices based on experience in other cities.

The trial is not focused purely on assessing the potential for fuel savings. Other aspects of the new technology, such as reliability and the capacity to deal with Melbourne’s climate will also be assessed. However, as the current average life of an Australian urban bus is around 15 years, this suggests hybrid buses are financially viable already. In the absence of any significant reliability or maintenance issues, all buses purchased from now on should be hybrids. A financial arrangement will need to be negotiated between bus operators and the Government to address the higher capital costs.

The payback period will of course come down should fuel prices increase further – either as a result of global demand continuing to outstrip supply or through the introduction of a carbon price through a greenhouse emissions trading scheme.

This will be complemented by the reduction in the expected purchase price for a hybrid bus as new technologies mature and are manufactured with greater economies of scale. By way of example, lithium-ion battery technology has begun to emerge and is expected to be the dominant battery technology for the next generation of hybrid vehicles due to its superior performance characteristics and ultimately cost. Hybrid buses that use supercapacitors as well as batteries are also being considered.

RECOMMENDATION 6

If no significant reliability or maintenance issues arise from the hybrid bus trial, all buses purchased from now on should be hybrids.

Hydrogen Fuel Cells

A trial of a bus powered by a hydrogen fuel cell ran in Perth between September 2004 and September 2007 as part of an international investigation into the new technology which many believe represents the long-term future of powered transport.

Fuel cells are electrochemical energy conversion devices, which convert chemical energy in the form of hydrogen and oxygen into an electric current with the by-product of pure water and heat (H2 + 1/2 O2 => H2O). Fuel cells were invented in the nineteenth century and the technology was later developed to provide electrical power for the NASA Apollo space missions of the 1960s and 1970s.

However, while fuel cells are highly efficient at converting hydrogen into energy, significant energy is required to produce the hydrogen. Hydrogen is sometimes referred to as an energy medium as opposed to an energy source. If fossil fuels such as coal are burned to provide the electricity to produce the hydrogen, there may not be any overall reduction in greenhouse emissions.

The energy used in creating the hydrogen must be considered when assessing any net greenhouse benefits from the technology. In the case of the Perth trial, the hydrogen was ‘waste’ from the BP oil refinery at Kwinana that would otherwise have been disposed of by being burned.

The Perth trial successfully demonstrated that hydrogen fuel cells are technically viable. However, the trial also highlighted the significant challenges in developing hydrogen as a transport fuel. Firstly, with fuel cell technology currently adding around $3 million to the price of a bus, it is a long way from being economically viable. A further significant barrier is the lack of any suitable refuelling infrastructure. A final challenge is the ability to produce and distribute sufficient quantities of hydrogen from renewable sources.

There are no plans at present to introduce fuel cell buses to Melbourne.
BIO-DIESEL

A cost-benefit analysis of the use of biofuels within the public bus fleet is currently being conducted by DOT in association with Bus Victoria.

Bio-diesel produced from canola, tallow or other feedstock is capable of replacing conventional diesel fuel in buses. The Croydon Bus Service initiated a trial of biodiesel in its bus fleet but the trial was not completed because the supply of canola oil ended because of the drought.

The bus industry is opposed to the removal of the current 18 cents per litre tax benefit for biofuels in 2012. However, if transport fuels are incorporated into an emissions trading scheme by then, the 18 cents ‘subsidy’ may be replaced by a lowered price as a result of lower overall greenhouse emissions.

DRIVER TRAINING

At the workshop it was suggested that significant fuel savings are achievable from improved driver training. One bus operator, Grenda’s, reported a trial that showed a difference in fuel consumption of more than 20% between the most and least fuel-efficient drivers over the same route. It is estimated to translate to a 5-10% average saving across all drivers, which would more than offset any costs associated with the training programme.

RECOMMENDATION 7

Government and bus operators should work together to ensure that driver training programmes are encouraged and are evaluated appropriately.

ROAD PRIORITY AND DESIGN

The efficient operation of bus services is dependent on roads that are appropriately designed. Some new suburbs have narrow roads and small roundabouts that buses cannot negotiate. The proliferation of roundabouts and also speed bumps in metropolitan Melbourne was cited in the workshop as slowing bus travel times and making them less efficient and less attractive. Councils also on occasion narrow existing residential streets with little consultation and this can hinder bus progress, especially where car parking further reduces road width.

The bus industry believes that Government should also take a firm policy decision to provide greater bus priority at junctions and more dedicated bus lanes. Bus lanes have the potential to greatly reduce travel times, particularly on congested commuter routes where buses in dedicated lanes can offer significantly shorter journey times than private cars.

This recommendation is supported by Sir Rod Eddington’s EWLN report (see comments above regarding tram priority).

RECOMMENDATION 8

The Government should expand the implementation and enforcement of priority measures for buses.

IMPROVED COORDINATION AND SERVICE FREQUENCY

Better synchronisation of train and bus timetables is needed and would increase patronage and reduce overall emissions by encouraging people to shift from private cars to public transport. Many critics of Melbourne’s public transport system point to the lack of alignment between timetables. Efficient coordination between modes is essential if public transport journey times are to compete with the private car.

However, coordination would be improved even further if the frequency of bus services could be increased to the point that timetables became redundant. The bus industry believes there is a ‘tipping point’ of bus frequency of between 10 and 15 minutes when the attractiveness of bus services increases significantly and demand would increase strongly. For example, a doubling of bus frequency on route 508 led to a doubling of patronage within three months.

Improved ‘feeder’ bus services around train stations would encourage public transport usage and would reduce the need to construct expensive car parks at stations. While providing car parking is important to attract train passengers, bringing passengers to a station by bus is cheaper overall and less polluting.

Despite the 7% annual growth in patronage across the bus network in the past year, the bus industry feels that there still needs to be further increases in bus service provision – beyond what is currently within MTOC. MTOC was conceived without the current level of regard to greenhouse emissions, and buses are well-placed to deliver additional public transport services within short timeframes on existing infrastructure at relatively low cost.
WIDER POLICY OPTIONS FOR REDUCING EMISSIONS FROM PUBLIC TRANSPORT

MAKE PUBLIC TRANSPORT CARBON-NEUTRAL

One initiative that had support from all the workshops with the public transport operators was making metropolitan public transport carbon neutral. This could be achieved through a combination of adopting all feasible energy-saving initiatives for all public transport modes, buying renewable GreenPower electricity for trains and trams, and offsetting the emissions from buses and regional trains by buying carbon offsets.

In March 2008 Yarra Trams launched its “Wind-Powered Tram” along Route 96 in Melbourne. While laudable as an initiative, and useful for education purposes, the renewable energy purchased to power just one tram represents a small proportion of the total electricity demand.

Figure 17 – The launch of Melbourne’s ‘Wind-powered tram’

GREENPOWER FOR ALL TRAINS AND TRAMS

GreenPower is the federal government’s programme of accredited renewable energy providers, which means the energy comes from new sources that cannot be depleted or can be replaced. Most importantly, the generation of renewable energy does not add to the total emission of greenhouse gases. Sources of GreenPower include the sun, wind, water and biomass. Currently, the largest proportion of commercialised renewable energy in Victoria, and in Australia as a whole, is wind power.

DOT’s analysis of emissions intensity (see above) shows that car users can significantly lower their emissions by switching to public transport. In off peak periods, where there is spare capacity on the public transport network, emissions can be reduced by 95%. In peak periods, where spare public transport capacity is not available and new services would need to be provided, the savings made by car users switching to public transport are equivalent to a 60% reduction in emissions.

On average, however, public transport currently carries passengers only 30% less emissions-intensively than private cars. The main reason public transport’s advantage is relatively small is that trains and trams are powered by the combustion of brown coal, and this is combined with low occupancy rates across the system in off-peak periods.

This advantage is likely to diminish as car efficiency increases over time. Fuel efficiency, and thus emissions efficiency, of car engines is increasing rapidly. Cars are already available in Australia that use less than half the fuel of the average car in the vehicle fleet. As petrol prices increase, along with environmental awareness, the shift in the new car market to more fuel efficient models is likely to continue.

Furthermore, efforts may also be made to increase car occupancy levels. If such efforts are successful, then the combination of increased car fuel efficiency and increased car occupancy could lead to trains and trams losing their greenhouse emissions advantage if trains and trams continue to be powered by brown coal.

Benefits of Running Trains and Trams on GreenPower

Although public transport is already more efficient than cars, there is considerable scope to improve its performance. More than 80% of the greenhouse emissions from metropolitan public transport come from the generation of electricity to power trains and trams. Therefore, buying renewable energy would have the greatest impact of any emissions reduction strategy for public transport.

As renewable energy does not contribute to greenhouse gas emissions, a shift from conventional brown coal-generated electricity to renewable energy for trains and trams would lead to a significant drop in greenhouse emissions from transport in Victoria and from government activities in particular.

The reduction in greenhouse gases is of course independent of the final use of the electricity, and therefore it does not matter whether the GreenPower is purchased to power trains, trams or office photocopiers. Indeed, such an initiative could be compared with other initiatives in other sectors of the economy. However, there are several advantages in tying the purchase of GreenPower specifically to trains and trams.
A critical advantage is that by providing carbon neutral public transport, members of the public would be provided with the opportunity to significantly reduce their own carbon footprint by shifting from cars to trains, trams or buses. In most cases this would also involve a significant personal cost saving, as public transport is so much cheaper than private car travel.

Provision of renewable electricity to power trains and trams would represent the biggest potential contract on behalf of the Government, other than the proposed desalination plant, and would give a significant boost to the renewable energy sector.

Such an initiative would be very attractive from a marketing perspective, with people able to see that making a journey by train or tram was carbon neutral, whereas a journey by private car caused emissions. Trains and trams are already seen as environmentally-friendly or ‘green’ travel options, and carbon neutral travel would only enhance that public opinion.

In a recent market research exercise conducted on behalf of Metlink, designed to assess the public perception of the “greenness” of public transport, there was surprise amongst respondents that public transport was only 30% better in terms of greenhouse emissions. The environmental benefit was felt by some to be too small to warrant the loss of the convenience of the car.

Buying GreenPower would send a strong message that the Victorian government is leading the way in terms of tackling climate change and focussing on transport as an essential element of its approach.

Alignment with other government targets and programmes

The Victorian Government has committed to a target of a 60% reduction in greenhouse emissions by 2050, based on 2000 levels. While there are no specific targets for different industry sectors, it is reasonable to assume that all sectors, including transport, will play their part.

With the overwhelming current reliance on brown coal to produce Victoria’s electricity, the most greenhouse-intensive method of electricity generation in Australia, it would appear that a shift towards renewable energy would have to be one of the main aspects of such a strategy. As such, the transfer of large Government electricity contracts to GreenPower would contribute significantly to the meeting of this objective.

One of the critical issues discussed in the recent five-year Melbourne 2030 audit is the urgent need to reduce greenhouse emissions through improved public transport services and better land-use planning. The Government recognised the challenge of reducing transport emissions when it published its response to the audit, Planning for all of Melbourne. In that document it says that the Government will –

“Develop a Victorian transport energy strategy to complement the Victorian Government’s Green Paper/White Paper on Climate Change from 2009-10 onwards”

and

“Consider bio-fuels and electricity from renewable sources for the transport sector where this will reduce greenhouse gas emissions”

These commitments are welcomed. While there is debate as to the net greenhouse emissions impact of some forms of bio-fuels (see above), there is no doubt that electricity from renewable sources will reduce emissions. It is to be hoped that the Government will not only ‘consider’ renewable energy for trains and trams, but commit to it as soon as possible.

Another of the Victorian Government’s current strategies to reduce emissions is the Victorian Renewable Energy Target (VRET). The VRET scheme commenced operating on 1 January 2007. The Victorian Renewable Energy Act 2006 (the Act) established the VRET scheme which mandates Victoria’s consumption of electricity generated from renewable sources be increased to 10% by 2016. The aim of the VRET scheme is to encourage additional generation of electricity from renewable sources. Under the scheme, all electricity retailers and wholesale purchasers of electricity in Victoria will have a legal liability to contribute towards the generation of additional renewable energy by acquiring Victorian renewable energy certificates (VRECs).

Purchases of GreenPower are independent of, and additional to, electricity retailers’ obligations to purchase renewable energy under the VRET scheme.

OFFSET DIESEL FUEL USAGE

The other elements of the public transport system – buses, coaches and regional trains – are powered by diesel fuel. In the longer term, emissions from these modes may be able to be reduced through the use of new technologies, such as hybrid buses and through the use of second-generation biofuels. In the short term, these emissions cannot be reduced significantly and making these services carbon neutral would require the purchase of offsets. Offsets involve the funding of another activity that reduces carbon emissions to balance emissions that cannot be avoided. The most common offset programmes involve energy efficiency and renewable energy projects.
The Victorian Government currently offsets the emissions from the entire inner-government passenger vehicle fleet. A similar rationale could be equally well applied to the diesel-powered elements of the public transport vehicle fleet, while efforts to reduce diesel usage and explore alternative fuels and technologies continue.

If 100% of train and tram electricity were to be purchased as GreenPower, offsets could be provided for bus, coach and regional train emissions so that the whole public transport system could be carbon neutral and one public transport mode was not seen to be less ‘green’ than another.

It is estimated that the cost of offsets to balance emissions from metropolitan buses, regional trains, coaches and buses would be $3-4 million.

**COST COMPARISON OF OPTIONS**

DOT has analysed the cost-effectiveness of these and other initiatives solely on the basis of their capacity to reduce greenhouse emissions from public transport. These are compared in the figure below. Of course, in reality additional public transport services provide a wide range of economic, social and other environmental benefits beyond reducing emissions and may generate significant positive returns on investment. Furthermore, it should also be noted that public transport services are generally cheaper to provide than additional roads, and public transport is cheaper to society overall than car transport. This is discussed further in the next section.

![Costs of emissions reduction initiatives](image_url)

**Figure 18 - Comparison of emissions reductions from public transport initiatives emissions, in dollars invested per tonne CO₂e abated (DOT 2007)**

**The operation of trains and trams consumes approximately 420 Gwh of electricity per annum**, at a cost of around $40 million. Initial analysis suggests that it would cost an additional $15-20 million per annum to buy 100% GreenPower. This represents a small proportion of public transport’s total budget (around 5 cents per train and tram boarding) and would not impact significantly upon DOT’s capacity to expand public transport services.

Sustainability Victoria advise that there is already sufficient renewable energy capacity to purchase 100% of the needs of trains and trams. However, to avoid a spike in the price of renewable energy, an alternative approach would be to buy an increasing proportion of GreenPower from one year to the next. For example, 25% GreenPower could be purchased immediately, rising to 50% in the second year and so on.

Another approach that should be considered would be for government to investigate the possibility of a capital investment in renewable energy, such as a wind farm. There are a number of ways of involving the private sector in such an investment, such as a Public Private Partnership or BOOT scheme. Initial calculations suggest a wind farm of 130 turbines could provide sufficient power, at a cost of around $100 million.

Long-term contracts with renewable energy suppliers could bring many of the benefits of capital investment, such as reliability of supply and long-term price security, while still allowing for periodic revision and improvement to reflect new technologies or lower costs.

There is still no price signal attached to the emission of greenhouse gas, although plans for such a scheme have been progressing for several years at both the State and federal levels. The Carbon Pollution Reduction Scheme Green Paper, released by the Federal Government in July 2008, proposes the introduction of an Emissions Trading Scheme by 2010.

When the trading scheme is introduced, the price of energy from carbon intensive sources such as electricity from brown coal is likely to rise. As the carbon price rises, renewable energy will become relatively cheaper. As such, the additional cost of buying GreenPower will decline over time. However, because brown coal produces electricity so cheaply, even with a price on carbon it may be years before the price of carbon rises sufficiently to make renewable energy competitive financially. Until then, Government policies such as VRET are needed to provide incentives to cleaner energy to reduce emissions with the urgency required to avoid the worst consequences of climate change.

The proposed scheme contrasts markedly in several key areas with the recommendations of the Garnaut Climate Change Review’s Draft Report, also released in July 2008. To ensure the broadest coverage of an emissions trading scheme, Professor Garnaut strongly recommended that petrol be included. Without petrol, a major source of emissions is excluded, putting additional pressure and costs on other sectors such as electricity generation and use.
Public transport’s role in reducing greenhouse emissions

The Government’s Green Paper has recommended that petrol be included, but that the increased price of transport fuel is offset by a corresponding reduction in the fuel excise for the at least the first three years of the scheme. **This delay is disappointing** as:

- It effectively removes any additional incentive to change transport behaviours before 2013, be it purchasing more fuel efficient vehicles or shifting to public transport, walking and cycling. For fleet managers and many private consumers, the delay allows an entire further vehicle replacement cycle to be completed before the additional incentive is included;
- It fails to establish the link between people’s transport choices and greenhouse emissions, and
- It reduces the revenue available to invest in long-term solutions to rising transport emissions, such as public transport infrastructure.

If transport fuels were included within the scheme, one would expect the demand for public transport to increase as fuel price increases have a greater impact on private motoring costs than the costs of public transport. However, the additional cost of petrol is unlikely to be enough on its own to drive a significant reduction in demand, at least initially. As Garnaut stated in his draft report, demand for private transport has a low price elasticity where there are limited substitutes. As petrol prices rise, responses will be determined by the proximity of public transport services. For example, at a carbon price of $25 per tonne, the extra cost of petrol or diesel would only be around six cents per litre. The graph below demonstrates the minimal impact of a carbon price of $25 per tonne on the total weekly running costs of a selection of cars.

![Figure 19 - weekly running costs of passenger vehicles, 2007](image)

**Figure 19** – weekly running costs of passenger vehicles, 2007

If transport fuels were included in emissions trading, public transport would become even cheaper in comparison as fuel is a smaller proportion of the operating costs of public transport than cars.

Petrol price rises of greater magnitude in recent years have not led to a decrease in overall demand, but do appear to have contributed to an increase in demand for public transport. Because of the much higher numbers of trips taken by car than by public transport, a small percentage of car drivers shifting to public transport has a disproportionately high impact on public transport patronage levels.

The Government should buy GreenPower at least until the time that an emissions trading scheme is operating effectively and the price of carbon is high enough to drive significant changes in transport behaviour. This will encourage the development of the renewable energy industry, demonstrate Government leadership and commitment to a low-carbon transport system and provide early and immediate additional greenhouse emissions abatement.

The purchase of GreenPower could be viewed as a distortion of the efficient working of the emissions trading market. **However, the Victorian Government has already committed to GreenPower for the desalination plant at Wonthaggi (which will use about twice as much energy as all of Melbourne’s trains and trams combined)** and has set a target to increase Government’s own use of GreenPower to 25% by 2010."

It appears from the Commonwealth Government’s Green Paper that petrol will not be effectively included in the forthcoming emissions trading scheme for the first three years at least. If it is not included, the purchase of GreenPower could continue as a complementary measure, further reducing emissions and recognising the importance of public transport as a ‘public good’. If transport is included in the scheme, the benefits of continuing to purchase GreenPower should be reviewed subject to the scope and adequacy of the scheme as it relates to transport emissions.

**RECOMMENDATION 9**

Make all public transport in Victoria carbon neutral by buying renewable energy for metropolitan trains and trams, improving efficiency and purchasing offsets for buses and regional trains, subject to review following the introduction of an emissions trading scheme.

**INCLUDE ENVIRONMENTAL PERFORMANCE INDICATORS IN OPERATOR CONTRACTS**

Current contracts with public transport operators do not include any strong incentives to improving environmental performance. This means that responsibility for new environmental initiatives rests with DOT. Including explicit requirements for improving environmental performance both within the tendering process and the subsequent franchise agreements would ensure that the operators are also focussed on exploring and developing new initiatives to reduce greenhouse emissions and improve overall efficiency.
Such requirements could be related to:

- Fuel efficiency of buses
- Driver training for environmental objectives
- Reduced electricity use for train and tram operations
- Reduced electricity use for additional train and tram infrastructure such as stations and stops
- Stronger incentives to increase patronage.

**RECOMMENDATION 10**

Include environmental performance indicators in future contracts with public transport service providers.

**EXTENDING PROVISION OF PUBLIC TRANSPORT**

As discussed above, there are a range of reasons that drive the provision of public transport, and a corresponding range of objectives that effective public transport is designed to meet. Environmental improvements, such as emissions reduction, have until now been incidental benefits rather than fundamental drivers of new service provision.

As shown in Figure 15 above, DOT's analysis suggests that, for each kilogram of emissions reduced, buying GreenPower or purchasing offsets is considerably cheaper than providing new services. Whereas buying GreenPower costs between $10 and $40 per tonne of emissions abated, and carbon offsets can be purchased for between $15 and $25 per tonne, the provision of additional services costs around $40,000 dollars per tonne. This calculation was based on the provision of the new SmartBus services, with an assumption that half of the new passengers switched from single occupancy vehicles, while the other half either switched from walking or cycling, or would not have made the journey at all without the new service.

This comparison of costs should not be taken as evidence that extending the provision of public transport services is not a critical part of reducing transport emissions. As discussed earlier in this report, the primary functions of public transport are mass transit and social transit, both of which have profound benefits to the economy and to the quality of life of Victorians. The analysis merely highlights the relative costs of possible actions that could be taken to improve the environmental performance of the system.

As mentioned on page 21, there is also the 'transit leverage' effect. Where public transport services are of a high enough quality, there can be significant declines in car use. As such, greenhouse emissions savings can be greater per dollar than in the comparison here. To drive a reduction in overall transport emissions, new public transport services need to be introduced that compare favourably with private cars. Public transport is already far cheaper to consumers than private cars, but also needs to be at least as attractive in terms of frequency, speed, comfort and safety.

As public transport is not only less emissions-intensive, but cheaper to provide and operate than private cars, a transport system with extensive, efficient public transport will cost less to society as a whole than one which is more car-dependent. Studies have indeed found that the inhabitants of cities with more efficient public transport systems spend less overall on transport than those with less efficient public transport systems. Therefore, although such a shift may require redistribution of funding, and significant behaviour change, it cannot be said that society 'cannot afford' to invest in public transport.

The potential for public transport to make a significant contribution to greenhouse emissions is increasingly recognised at the international level. In the 2007 Synthesis Report, the final part of the IPCC's Fourth Assessment Report, the 'Summary for Policymakers' provides examples of climate change mitigation technologies, policies and measures. For the transport sector, one of the recommended mitigation practices is "modal shifts from road transport to rail and public transport" and one of the policies shown to be environmentally effective is "investment in attractive public transport facilities and non-motorised forms of transport".

Where public transport currently performs best in comparison with cars is in mass-transit, notably peak-hour commuting. Trains to the CBD are generally faster than cars, whereas buses and trams are generally slower except for those with priority lanes.

For a given cost, many more bus services can be introduced than train services. For outer suburbs, travel times by bus are unlikely to compare favourably with cars unless the bus service is rapid and with few stops. Bus lanes, especially on congested roads such as the Eastern Freeway, can offer journey times significantly lower than private cars.

However, new train lines should be planned for areas which are too far from the CBD for buses to provide an effective mass transit option. In particular, new train lines or other efficient public transport services should be provided in new suburbs and developed areas before people move to them, to prevent car dependency. Once new residents have bought cars and have become accustomed to driving, it is harder to change their behaviour.

Extensions of rail lines from Epping to South Morang and Mernda, from Huntingdale to Monash University and Rowville, and from Cranbourne to Cranbourne East are all recognised as examples of areas with opportunities for further public transport service provision.

As mentioned above, increases in public transport patronage resulting from car drivers switching modes lowers road congestion and thus induces some (though less than 100% of the reduction) new road traffic demand. Therefore to encourage a shift to public transport that will lead to an overall reduction in emissions, provision of new services needs to be accompanied by increased disincentive to car driving.
Such a disincentive may come about with the onset of higher oil prices via a carbon price set through an emissions trading scheme or, at some point in the future, through a stronger increase in global demand relative to supply (see ‘Peak Oil’ in part two). However, private motorists have remained resilient to recent oil prices and there is no indication yet of when sharp future increases will happen.

However, looking ahead to a time when carbon is priced through a trading scheme at a state or national level, adding a cost to the price of oil, potentially in combination with a rise in oil prices as a result of peak oil, there will be significant extra demand for public transport services.

Once a trading scheme is in place and functioning as it is intended, i.e., actually driving emissions reduction through a strong carbon price signal and decreasing annual carbon caps, governments will need to focus more on complementary measures that facilitate changes in public behaviour, such as moving to more sustainable travel modes. One of the most important of these will be to provide infrastructure. Because of the long lead times in providing public transport – even buses, but far longer for trams or trains – there is a need to start now.

Much is being done through MOTC and more recent fast-tracking of MOTC commitments to help meet the recent unexpected patronage growth. In addition, eight additional trains have been ordered as a result of the unexpected 2007 budget surplus. Other projects that go further than MOTC are also being delivered. However, supply of public transport is still responding to increases in demand. Victoria is still a long way from providing new public transport services as an inducement to more sustainable transport. **A step change in the provision of public transport services is required to actively drive a mode shift away from private cars.**

As well as addressing overcrowding on existing public transport routes, government should be continuing to extend the network into new areas, particularly along growth corridors. Criteria for public transport provision should be incorporated into Precinct Structure Plans within the new Urban Growth Zone. Without effective public transport, car ownership becomes entrenched and communities are vulnerable to increasing oil prices and future oil availability constraints.

**RECOMMENDATION 11**

Provide a step change level of public transport investment to actively drive a mode shift from private cars to public transport by constructing new train lines, extending tram lines and continuing to introduce addition bus services.
Part 2

PEAK OIL

INTRODUCTION

‘Peak oil’ refers to the point at which global oil production reaches its highest level. The concept is generally attributed to M.K. Hubbert who in the 1950s accurately predicted the peaking of US oil production in the 1970s. While ‘peak’ may suggest a point in time, the effect of peak oil is ongoing and indefinite increases in the price of oil.

When oil is first extracted from a newly discovered field, the production capacity increases as more wells are dug and the extent of the field is clearly identified. At some point, however, production levels reach a maximum (peak) before they decline as the remaining oil becomes harder to extract. Eventually the oil is exhausted. A bell-shaped graph could be drawn of production from the oil field. Such a bell-shaped graph can be drawn for one oil field, a country’s oil fields or, by extrapolation, from the whole world’s oil reserves.

Although some new oil reserves continue to be found and known reserves continue to be exploited with improved technology, not enough new oil is being produced to keep up with long-term demand. After the peak, the drop in supply combines with continuing or increasing demand to cause the price to rise steeply. Such an increase has the potential for severe social and economic impacts for oil-dependent societies.

Peak oil is not in itself an environmental issue, but there may be significant environmental impacts associated with our responses to it which need to be considered. Given the transport system’s overwhelming reliance on oil, peak oil is an essential part of the context of any discussion of future transport policy and planning.

While oil supply may be about to decline, there is currently rapidly growing global demand for oil, in particular from developing countries such as China and India.

There is much debate surrounding the actual date at which this peaking of oil production will occur, and the steepness of the resulting price rise. Some observers claim that the peak has already occurred, and that current oil prices around $145 US per barrel are an indication that the inevitable price rise has begun.

Many others predict a peak between 2010 and 2020. A few observers predict no peak at all, but a rapid improvement in oil extraction technology, an increase in the efficiency of oil usage and the development of alternative fuels as a response to increasing oil prices. As such, they do not foresee significant and sudden impacts.

Recently, a number of more conservative commentators have agreed that a peak may be approaching in the short to medium term. For example, in 2005 Shell was predicting a date of 2025 or later, but in January of this year Jerome van der Veer, CEO of Shell, said in a discussion of future energy scenarios that:

"After 2015, easily accessible supplies of oil and gas probably will no longer keep up with demand".

In March 2008 the managing director of Caltex suggested Australian petrol prices could double to more than three dollars per litre within the next decade.

Amidst protests by trucking companies at the price of fuel, in May 2008 the British Prime Minister, Gordon Brown, said that the world is facing a "great oil shock" that could only be addressed by a coordinated international response. This warning came a day after the French President, Nicolas Sarkozy, called for a Europe-wide cut in fuel tax.

In July 2008 the CSIRO released Fuel for Thought, a report by the Future Fuels Forum into the future of oil and other transport fuels. The report forecast a petrol price of $8 per litre by 2018 in a modelled scenario in which the international oil supplies decline abruptly and fuel and vehicle manufacturers are unable to introduce alternative technologies quickly [include endnote – CSIRO (2008), Fuel for thought – the future of transport fuels: challenges and opportunities http://www.csiro.au/resources/FuelForThoughtReport.html]. Such a price would add $220 to the weekly costs of running an average car.

The report suggests that because of the uncertainty involved, individuals and businesses are unlikely to prepare effectively for such change and demonstrates a strong role for government to alleviate the significant negative social and economic impacts forecast.

ENVIRONMENTAL IMPACTS

It is the social and economic impacts which generally receive most attention in the peak oil debate. As oil prices rise, the costs of goods and services that are highly dependent on oil-based transport, such as food, rise accordingly. Such impacts are felt disproportionately by the less wealthy. Individual mobility is also constrained for those who can no longer comfortably afford petrol, particularly in regional areas and in outer suburbs with limited access to public transport (as are common in Melbourne). Some observers predict significant economic impacts on a national scale as a result. The responses to peak oil may also have significant negative
Public transport’s role in reducing greenhouse emissions

While peak oil and climate change are separate issues, there is much overlap in effective policy responses. Initiatives that reduce our dependence on oil can reduce greenhouse emissions while also preparing us for the effects of higher oil prices. Mitigation reduces the cost of adaptation.

Policy Responses

While peak oil and climate change are separate issues, there is much overlap in effective policy responses. Initiatives that reduce our dependence on oil can reduce greenhouse emissions while also preparing us for the effects of higher oil prices. Mitigation reduces the cost of adaptation.

For example, extending public transport services and extending provision for cycling and walking reduces emissions by encouraging people out of their cars onto less emissions-intensive transport modes, and provides mobility to those who do not have cars or will not be able to afford cars in future. Because of the very long lead times involved in providing additional public transport infrastructure, it is essential that the likely increase in demand for public transport is factored in to transport planning decisions today.

Public transport patronage growth in recent years is attributable in part to petrol price increases. More significant future petrol price increases will lead to stronger calls to improve public transport services, especially in outer-suburban and regional areas where few public transport options currently exist. If petrol prices rise to the point where many people cannot afford to drive, there will be severe social and economic impacts if they cannot remain mobile through an effective public transport network.

Other government initiatives may be focussed on travel demand management, including transit oriented development, or encouraging increased vehicle fuel efficiency, supporting the development of sustainable alternative fuels such as second or third generation biofuels, or expanding provision for walking and cycling.

In February 2007, the Australian Government Senate Rural and Regional Affairs and Transport Committee published a report into “Australia’s future oil supply and alternative transport fuels”. The committee considered at great length the issues surrounding the concept of peak oil and concluded that much needed to be done to better understand and prepare for the inherent risks.

The first recommendation of the committee was –

“The committee recommends that Geoscience Australia, ABARE and Treasury reassess both the official estimates of future oil supply and the ‘early peak’ arguments and report to the Government on the probabilities and risks involved, comparing early mitigation scenarios with business as usual.”

The Committee did not propose a precise date for peak oil. It reviewed various forecasts and commented –

“The committee cannot take sides with any particular suggested date for peak oil. However in the committee’s view the possibility of a peak of conventional oil production before 2030 should be a matter of concern. Exactly when it occurs (which is very uncertain) is not the important point. In view of the enormous changes that will be needed to move to a less oil dependent future, Australia should be planning for it now.”

Recommendation 12

The Government should undertake an analysis of the likely effects on public transport demand of a significant rise in the price of oil. Strategies should be developed to feed into the development of the long-term transport strategy.
IMPROVING VEHICLE EFFICIENCY

While it is important to encourage people to shift to less intensive transport modes such as public transport, cycling and walking, it must also be recognised that demand for private car travel remains strong—as evidenced by increasing levels of road congestion. Therefore improving the fuel efficiency of vehicles can play a significant role in reducing greenhouse emissions.

For the first time, over a million cars were sold in Australia in 2007 despite rising petrol prices and increased awareness of climate change. While sales of smaller and more fuel-efficient cars have increased, the overall fuel efficiency of the fleet has changed little in recent years. In Victoria, the average rate of fuel consumption of passenger vehicles was 11.53 litres per 100 km in 2004/05, compared with 12.33 litres per 100 km in 1984/85 (Apelbaum28).

While engine efficiency has increased, there are a number of reasons for the lack of progress in fuel economy. These include—

- Tougher safety standards which tend to make vehicles heavier,
- Tougher air pollution emission requirements which reduce engine fuel efficiency,
- Local car manufacturers’ and consumers’ continued preference for larger, six-cylinder models,
- The increased popularity of larger, four-wheel drive vehicles,
- Petrol that is cheap by worldwide standards, and
- Higher standards of living.

There is a lengthy time-lag between any reduction in average new car fuel efficiency and the average efficiency of the vehicle fleet because of the time that cars stay on the roads. The average age of the passenger vehicle fleet in Victoria is 10.1 years (ABS, 200729).

Although petrol prices have increased dramatically, they only account for about 20% or less of the total running costs of an average new car, according to the RACV30. Once the substantial investment in a new vehicle has been made the highest cost is depreciation. Other fixed charges such as insurance and registration are also significant (although in the UK, there is a growing market for pay-as-you-drive car insurance to reward those who drive less). Once a new car has been purchased, and the fixed costs are made, even the current level of petrol prices appears to offer little disincentive to driving.

An increasing number of overseas countries have introduced, or are considering, mandatory fuel efficiency standards to force manufacturers to reduce the fuel consumption of vehicles and so reduce overall greenhouse emissions from transport. This drives investment in new fuel efficiency technologies and forces the companies to promote their smaller, more fuel efficient models. Rather than financially disadvantaging those who have no alternative to the private car, as would a carbon tax on fuel for example, such a directive can save people money by encouraging the development of more fuel efficient models. Such benefits will become increasingly valuable as the oil price rises further in future.

The European Union released proposed legislation in December 2007 that would bring down the average CO₂ emissions from passenger cars from its current level of about 160 grams per kilometre to 130 grams per kilometre by 2012, with a further 10 grams per kilometre to be saved through complementary measures including improved tyre and air-conditioner technologies and potential use of biofuels. 120 grams per kilometre equates to about 5 litres per 100 km for a petrol car, or about 4.4 litres per 100km for a diesel. Included in the draft proposals are heavy fines for companies that fail to meet the targets. The mandatory approach within the European legislation reflected the failure of manufacturers to achieve previously agreed voluntary targets.

The US Senate has also recently passed an Energy Bill that includes tough new Corporate Average Fuel Economy targets. Canada has also announced it has begun consultations with a view to introducing fuel consumption regulations for motor vehicles.

The establishment of average fuel-efficiency targets mean that manufacturers with a broad range of models have to sell more of their small, fuel-efficient models to balance sales of larger and more powerful models. Manufacturers may choose to cross-subsidise the prices of the vehicles in their ranges, adding to the costs of the larger cars and reducing the costs of the more fuel-efficient models, to help meet the targets.

In Australia the Federal Government reached agreement with the automotive industry in 2003 on a voluntary target of 6.8l/100km for petrol passenger cars by 2010. In 2005 the target was changed to one based on greenhouse emissions, better reflecting the objective and different fuel types. The target is now 222 grams CO₂/km, which is equivalent to 9.3/100km for petrol-engine vehicles. As the 2007 figure is reported as 226 grams CO₂/km, it appears likely that the industry will reach the new target. While clearly a much less ambitious target than the original, it is also much less stringent than those of other countries such as Europe and is still voluntary. The target does not appear to be driving industry beyond a ‘business-as-usual’ approach.

While lagging behind Europe, tougher Australian Design Rules (ADRs) have been introduced in recent years to force manufacturers to reduce the amount of various types of air pollution from new vehicles. However these standards, such as Euro 3 and now Euro 4, do not cover the emission of greenhouse gases.
The Australian Government Senate Rural and Regional Affairs and Transport Committee’s report into “Australia’s future oil supply and alternative transport fuels” is, released in February 2007, recommended that –

“The Government, in consultation with the car industry, investigate and report on trends in the fuel efficiency of the light vehicle fleet and progress towards the 2010 target for the fuel efficiency of new passenger cars. If progress under the present voluntary code seems unlikely to meet the target, other measures should be considered, including incentives to favour more fuel efficient cars; or a mandatory code.”

A recent ‘wedge’ analysis on behalf of the Victorian Office of Climate Change included an assessment of the potential for emissions reduction of four different transport initiatives. Although a significant shift from cars to public transport appeared beyond the scope of the analysis, the study concluded that “improving fuel efficiency is easily the most effective way to reduce emissions from transport; overcoming cultural barriers, however, is difficult”. Recognising that further intervention is required to encourage the take up of more efficient vehicles, the report suggests investment in education and marketing, “potentially along with increasing use of vehicle fuel efficiency standards.”

A similar view was reached by the UK’s Commission for Integrated Transport in its report “Transport and Climate Change”. The report recommended the introduction of a stronger mandatory European Union CO2 emissions target than that already proposed, complemented by taxation and education strategies. Complementary strategies are needed to ensure that the introduction of more fuel efficient vehicles does not create an incentive to drive more by lowering the cost of motoring. The extra distance driven would cancel out much of the emissions saved by the increased fuel-efficiency. This is known as the ‘rebound effect’.

**RECOMMENDATION 3**
Through COAG, the Government should support the introduction of mandatory fuel efficiency targets for Australian passenger vehicles.

**GOVERNMENT SUPPORT FOR LOCAL CAR MANUFACTURING**

Successive federal governments have given massive subsidies over many years to local car manufacturers, yet they have continued to produce large, primarily six-cylinder vehicles. The industry has not adapted to shifting consumer preferences and the increased demand for smaller, more fuel-efficient models which has been driven by recent rises in petrol prices. As a result, the market share of local manufacturers has fallen dramatically.

The Rudd government has commissioned former Victorian Premier Steve Bracks to undertake a review of the Australian automotive industry and government assistance. This represents an opportunity for future assistance to be tied to improvements in environmental performance of the vehicles produced. Such a programme of assistance could be coordinated with Recommendation 9 above and Recommendation 14 below (relating to emissions-based registration charges) to ensure a more effective transition to a focus on improved environmental performance.

To support the local economy, the Victorian Government’s vehicle fleet purchasing policy strongly favours local manufacturers, although this is in conflict with environmental and financial objectives. Larger cars not only use more fuel but cost more to buy and run. The availability of more efficient locally produced cars would help ensure that the government purchasing could continue to support the local manufacturers while helping reduce emissions from the Government’s own operations.

**RECOMMENDATION 14**
The government should ensure that future financial assistance provided to the automotive industry is tied to demonstrable improvements in vehicle fuel efficiency and should lobby for this measure through COAG.
TRANSPORT FUNDING AND TAXATION

INTRODUCTION

Given the growing awareness of the increasing contribution of transport to greenhouse emissions, and the environmental benefits of public transport, there are strong arguments for changes to funding arrangements. Several opportunities exist to change the priorities currently given to different modes, as reflected in federal and State budgets, to increase support for more sustainable transport modes.

FEDERAL FUNDING OF PUBLIC TRANSPORT

The State Government’s 2006 Meeting Our Transport Challenges programme represented a significant shift in funding priority from roads to public transport at the state level. However, the federal government’s programme of transport funding, included in both AusLink and AusLink 2, continues to overwhelmingly favour new road infrastructure, with only a small proportion directed at rail freight. No federal funding is currently available to public transport.

This contrasts markedly with the funding position in other developed economies. In most OECD countries, public transport is funded at least in part by the national governments. In the USA there is significant federal funding of public transport infrastructure, particularly rail. 15.5% of petrol taxes go to a ‘Mass Transit Account’ which is then directed at public transport. In total, around $9 billion has been allocated to public transport during 2008. In Italy and Spain, federal governments pay for 100% of public transport capital funding.

In Canada, which has a similar constitution to Australia, recent changes to federal policies have resulted in significant federal investment in urban public transport. There are a range of initiatives, including the ‘Gas Tax Fund’, which together are providing around $12 billion over six years to sustainable infrastructure including public transport,

In the lead-up to the 2007 Australian federal election, several groups urged the different parties to consider federal funding of public transport to reduce greenhouse emissions and other environmental impacts of road transport, reduce traffic congestion, reduce health costs and provide greater mobility for all sectors of the population. The response from both parties was pledges of further road-funding, often reported as being in marginal electorates.

The federal government had been presented with similar advice in 2005 in the “Sustainable Cities” report°° from its own House of Representatives Standing Committee on Environment and Heritage. The Committee examined the dominance of roads in current transport funding and the increasing levels of car dependency. It looked at the need to include assessments of sustainability, including greenhouse emissions impacts, within transport funding decision-making. It also considered the efficiency and cost-effectiveness of different transport modes. The report recommended that –

“The Australian Government significantly boost its funding commitment for public transport systems, particularly light and heavy rail, in the major cities.”

The Committee paid particular attention to the provision of public transport in urban fringes, especially in new developments. It noted that “developments on the fringe of cities generally lack public transport infrastructure and there is no option other than car use” and that this has a disproportionate financial impact on the lower-income groups who tend to live in such areas.

The report made another recommendation that –

“The provision of Australian Government transport infrastructure funds include provision of funding specifically for sustainable public transport infrastructure for suburbs and developments on the outer fringes of our cities.”

An efficient transport system is of national importance from an economic perspective, and this is recognised by the current federal AusLink funding programme. From an environmental perspective, it is equally important that investment is made in more sustainable transport modes.

The election of the Rudd Government and the establishment of a new body – Infrastructure Australia – provide an opportunity to change the way federal funding is allocated to transport. There have been suggestions that funding will indeed be made available to public transport, including assurances from individual MPs, but no clear policy statement. Federal funding should be diverted from predominantly road-building and road-widening schemes towards sustainable options such as public transport infrastructure.

There needs to be greater transparency in the process of deciding transport priorities, with a clear focus on the potential for emissions reduction of alternative proposals. There is also a need for stronger collaboration between different levels of government.

Effective public transport services can address road congestion by taking cars off the road, freeing up roads for other users such as freight transport, with significant reductions in greenhouse emissions. A significant shift in priorities is needed in order to make emissions reductions of the scale that are urgently required.
RECOMMENDATION 15
Through COAG, the government should continue to encourage the Federal Government to provide funding for public transport infrastructure, and to adopt more transparent processes for transport funding.

FUNDING POLICIES THAT FAVOUR CARS AND ROADS
There has been much debate regarding the extent to which road users contribute to the costs of building and maintaining roads. Various studies have attempted to estimate the value of subsidies to road users and have come up with quite different results due to differences in methodologies and accounting techniques. These include different approaches to accounting for -

- the value of land used for roads or rail,
- costs of road accidents,
- costs of health impacts of vehicle emissions,
- related costs such as the policing of roads and the registration of vehicles and drivers
- congestions costs, and
- greenhouse emissions.

The 2007 Institute of Sustainable Futures report “Energy and transport Subsidies in Australia” estimated that there was a ‘road user deficit’, or government subsidy of road users, of $4.7 billion per annum. Dr Philip Laird of the University of Wollongong estimated the deficit at about $13 billion per year in his November 2007 submission to the NSW Independent Pricing and Regulatory Tribunal on the Review of State Taxation.

Regardless of the extent of the overall subsidy towards road use, several Commonwealth taxation schemes have significant negative environmental impacts. These include the Fuel Tax Credits Scheme, reduced excise for aviation fuels and the exemption from petroleum excise for condensate.

TAX CONCESSIONS FOR PRIVATE USE OF COMPANY CARS
Another such scheme is the preferential taxation treatment offered to people with cars provided by their employers who are allowed to drive them for private use. The lease and operating costs of such cars are generally paid for through a salary sacrifice scheme using pre-tax dollars. A fringe benefit tax is payable by the employer for the proportion of the kilometres related to private use.

Two methods are available to determine the proportion of kilometres attributable to private use and thus subject to fringe benefits tax. One method involves keeping a log of kilometres driven for business and private use. The other involves a more simple calculation that assumes the further the car is driven, the higher the proportion of business use. Therefore, the further the car is driven, the less tax is payable. In practice, of course, high kilometres may reflect long-distance commuting or holiday driving. According to the ATO in 2006, this method accounted for 93% of employee contributions associated with motor vehicle fringe benefits in 2004-05.

The following table is used to determine the percentage of tax payable.

<table>
<thead>
<tr>
<th>Number of kilometres per FBT year (12 months to March 31st)</th>
<th>Statutory %</th>
</tr>
</thead>
<tbody>
<tr>
<td>From: 0 to 14,999</td>
<td>26%</td>
</tr>
<tr>
<td>15,000 to 24,999</td>
<td>20%</td>
</tr>
<tr>
<td>25,000 to 40,000</td>
<td>11%</td>
</tr>
<tr>
<td>40,000 and above</td>
<td>7%</td>
</tr>
</tbody>
</table>

Unlike income tax rates, the percentages are not marginal rates; they are applied to the total costs. There is therefore a strong financial incentive to make extra trips to reach the next threshold and pay less tax. There is even a phenomenon known as the “March Rally” when company car drivers take long road trips to reach the next bracket before the end of the FBT year.

The statutory formula method was introduced in 1986 to minimise compliance costs and to support the Australian car industry, which then provided nearly 85% of car sales. As a way of assisting the local industry, it is now much less effective as only about 20% of cars currently sold in Australia are manufactured here. There are other ways to ensure compliance costs are minimised that do not offer such financial rewards for unsustainable behaviour.

Not only does this scheme act as an incentive for car ownership and use, it is a perverse subsidy that encourages people to drive further as the tax benefits are often greater than the cost of driving the additional distance. Driving more, and thereby emitting more greenhouse gas, actually saves money. No similar benefits are available for the use of more sustainable transport alternatives such as public transport, creating a significant incentive towards car use.

The extra traffic generated by the taxation scheme also contributes to congestion. The marginal costs of car usage are already low compared with fixed costs such as insurance, registration and depreciation. The scheme provides an extra inducement to commute by car. One submission to the federal government’s “Sustainable Cities” Committee estimated that around 50% of car use during peak hour in Sydney was a result of the tax concession.
The Committee recommended that –

“the Australian Government review the current FBT concessions for car use with a view to removing incentives for greater car use and extending incentives to other modes of transport.”

Another Federal Government committee made a similar recommendation in February 2007. The Senate Rural and Regional Affairs and Transport Committee, in their report into ‘Australia’s future oil supply and alternative transport fuels’, suggested that to help “level the playing field” between private car use and public transport use –

“The Committee recommends that the government review the statutory formula in relation to fringe benefits taxation of employer-provided cars to address perverse incentives for more car use.”

Various other organisations have supported the abolition of the FBT concession. For example, the National Transport Commission in its National Transport Plan of March 2008 recommended that the concession be “completely phased out within three years”™ primarily as a way of alleviating urban congestion.

In the 2006 tax Expenditures Statement, the Federal Government estimated the value of the concession as about $1.1 billion per annum. However, recent estimates from the Federal Treasury predict the cost rising to just over $2 billion by 2009-10. The increase is largely due to changes to the methodology used to calculate the amount of revenue foregone.

The 2008 Federal Budget tightened salary packaging requirements for laptop computers to ensure that tax benefits would only be available to those who could verify that the laptop is for work purposes. Yet it made no changes to the rules on company cars.

The Commonwealth has signalled its intention to undertake a fundamental review of taxation arrangements, and has indicated its intention to examine environmental factors. This provides a useful forum within which the perverse environmental impacts of the current FBT policy can be addressed.

RECOMMENDATION 16

Through COAG, the Victorian Government should encourage the Federal Government to abolish the current FBT concession for private use of company cars, and conduct a broader review of taxation policies with negative or perverse environmental impacts.

ROAD PRICING

Road pricing can be seen as both a demand management strategy, by making roads less attractive, and a source of revenue that can be directed at more sustainable transport modes. Road pricing can be achieved through a variety of means such as congestion charges, tolls, parking fees and levies and, in future, full electronic pricing.

A number of recent reports have called on the Government to consider road pricing. However the current Government remains staunchly opposed to road use charging other than as a way of contributing to funding to allow the construction of new roads.

As a means of reducing road congestion, the 2006 VCEC report “Making the right choices: Options for Managing Transport Congestion”™ recommended that the Victorian Government conduct a feasibility study into road use charging in Melbourne. The Eddington Report also called on the Government to “re-evaluate its current road tolling policy”™.

The introduction of ‘rational pricing’ for roads – where users pay the full financial, social and environmental costs - was a key recommendation of the Commissioner for Environmental Sustainability’s 2007 position paper Creating a city that works – opportunities and solutions for a more sustainable Melbourne™.

The Business Council of Australia also called for the introduction of congestion charging in Australia’s major cities in its “Infrastructure: Roadmap for Reform” report released in September 2007™, which suggested infrastructure strategies designed to improve long-term economic performance. The report also called for further investment in urban public transport.

The London congestion charge, introduced in 2003, has proven successful despite initial public concern. Public support for the scheme is seen as being dependent upon awareness that revenue from the scheme is used to fund improved public transport, particularly buses, and improving facilities for walkers and cyclists. It is also dependent on the existence of extensive, efficient public transport services as an alternative to car use.

The Senate Rural and Regional Affairs and Transport Committee report into “Australia’s future oil supply and alternative transport fuels” made a similar recommendation –

“The Committee recommends that Australian governments investigate the advantages and disadvantages of congestion charges, noting that the idea may be more politically acceptable if revenue is hypothecated to public transport improvements (as has been done in London, for example).”

Many other cities around the world are currently considering introducing some kind of congestion or road pricing scheme.

Providing priority to trams, buses or high-occupancy vehicles can also be seen as a way of pricing road use. Using existing road space to provide new tramways, bus lanes or high-occupancy vehicle lanes adds to congestion initially and increases the time taken for journeys on the remaining road space. This extra time can be seen as an additional cost. If the tram or bus is now faster than a single-occupancy car on the increasingly congested road, more people will be encouraged to move to the more efficient public transport mode. As trams and buses can carry passengers more efficiently than cars, particularly at current low car occupancy rates, overall passenger flows can increase beyond the original level.
RECOMMENDATION 17
The government should introduce a road pricing scheme with funds raised directed at expanding public transport services, walking and cycling.

CAR REGISTRATION AND STAMP DUTY
An increasing number of overseas countries have annual vehicle registration fees based on greenhouse emissions or fuel efficiency. For example, in the UK there are seven price bands corresponding to different ranges of CO2 emissions. Annual charges range from zero, for cars producing less than 100 g/km CO2, to £300 for cars producing more than 225 g/km CO2. Such schemes are an incentive to consumers to buy smaller, more greenhouse-efficient models.

In 2007 Victoria introduced a hybrid vehicle registration discount. Hybrid vehicles, both passenger and commercial, are eligible for a $50 discount on annual registration fees. Apart the hybrid discount, annual registration costs in Victoria are unrelated to the environmental performance of the vehicle. While a $50 registration discount is unlikely to influence buying decisions, it demonstrates that the registration system can differentiate between models. The Government should introduce a scheme of registration charges that provides genuine incentives to purchase more fuel efficient vehicles.

In 2007 the Victorian Government also reduced the stamp duty payable on the purchase of a new car costing between $35,000 and $57,009. The intention as stated by then treasurer John Brumby was "about cutting costs for families, encouraging the use of more environmentally friendly and safer vehicles".

However, this price range corresponds closely to the current range of Australian-made vehicles. The change in stamp duty represents an incentive to buy locally produced models, but they are all medium or large cars and all except one, the Toyota Camry, have six or eight-cylinder engines. This change in stamp duty should be reversed, to remove the incentive to purchase relatively large and inefficient vehicles. If there is to be any differential in stamp duty it should be to discourage the take-up of more fuel-efficient vehicles.

RECOMMENDATION 18
The Victorian Government should extend the current preferential treatment of registration fees for hybrid vehicles to a full system of annual vehicle registration charges based on vehicle emissions, and remove the stamp duty concession for cars costing between $35,000 and $57,009, as part of a broader investigation into incentives to encourage the purchase of more fuel-efficient vehicles.

COSTS OF TRANSPORT INFRASTRUCTURE
One of the aspects of the funding debate that is often overlooked is that public transport is more efficient and, assuming good levels of patronage, is cheaper overall than the costs of building roads and buying and operating cars. Therefore society as whole is economically better off with effective and well-patronised public transport services, with more wealth available for other activities.

This was highlighted in the 2005 study for the Metropolitan Transport Forum, "Most liveable and best connected? The economic benefits of investing in public transport in Melbourne." Figure 19 below shows the proportion of wealth spent on private and public transport for 14 of the world's most 'liveable' cities. Those with the most effective reliance on public transport, and which spend the highest proportion of funds on public transport, spend the least on transport overall.

Although there would be up-front costs for a city such as Melbourne in establishing more extensive public transport infrastructure, if people shift from car use to public transport it will save the economy money in the longer term. On top of this saving in transport costs can be added savings in related expenditure such as health costs, costs of accidents and the costs of congestion. As petrol prices increase due to both the dynamics of global demand and supply, and as a result of a price on carbon emissions through an emissions trading system, the relative price advantage of public transport will only increase as fuel costs are a smaller proportion of overall public transport costs than the costs of running a car.
INSTITUTIONAL ARRANGEMENTS

As discussed already, the main drivers of new transport infrastructure in Victoria have been population growth and the resulting increase in congestion, both on roads and on the public transport system. However, with increasing environmental pressures, particularly climate change and the urgent need to reduce greenhouse emissions, it is essential that broader environmental objectives are considered in the decision-making process. Major transport infrastructure proposals and planning decisions in Victoria need to be assessed against their capacity to contribute to environmental objectives such as greenhouse reduction targets.

Road-building proposals may, in the short-term, reduce congestion and improve traffic flows, thereby improving vehicle fuel efficiency, but they generate more traffic. Over time, fuel savings due to reduced congestion are outweighed by increased traffic and overall transport emissions are increased as a result of the project. While the short-term objective may have been met, a more important longer-term objective may be compromised by induced demand.

The desire for more holistic analysis of transport options, with a better balance between road building and more sustainable alternatives, has led many observers to call for the establishment of an independent transport planning and management authority. Such an authority, it is argued, could operate at arm’s length from the political establishment of the day. Major funding decisions would still require approval from Cabinet, but more environmentally appropriate proposals might be put forward for approval if the new authority had clearly established environmental objectives.

As noted in the 2007 position paper “Creating a city that works”, the establishment of the Office of the Coordinator General of Infrastructure within DOT was aimed at improving whole-of-government coordination of transport and land use planning. A more recent and more encouraging change is the creation of the Department of Transport from the previous Department of Infrastructure. The stated objective of the new Department is to:

“Deliver a stronger focus on the delivery of public transport improvements, as new projects come on line to increase network capacity and meet record growth in patronage.”

The previous Coordinator General of Infrastructure has been appointed to the new position of Executive Director, Integrated Transport Planning. Although this new position will deliver the Government’s response to the Eddington Report, the lead Minister for the response remains the Minister for Roads.

Another encouraging development is the current Transport Legislation Review which aims to modernise and better integrate Victoria’s transport legislation. An initial aspect of the process is the development of a set of overarching objectives which would be incorporated in the revised legislation, and which would apply to all the major transport decision-makers in Government. The establishment of strong environmental objectives, including the need to reduce transport-related greenhouse emissions, has the potential to guide decision-making towards more sustainable transport outcomes. For example, where increased road congestion leads to road-based responses being assessed against public transport-based responses, a legal requirement to consider the long-term impacts on overall greenhouse emissions would be likely to favour public transport and lead to more sustainable outcomes.

While the process itself is supported, it was disappointing to see the draft environmental objectives defined so weakly in the October 2007 Discussion Paper. Phrases such as “an environmentally sensitive system” and “the design and operation of the system should not unnecessarily contribute to the creation of pollutants and wastes” suggest that environmental objectives may remain a peripheral concern rather than a core driver of decision-making. It is hoped that the objectives, when finalised, better reflect the importance of environmental considerations and this opportunity to more effectively embed over-arching environmental objectives, including the reduction of greenhouse emissions, within transport legislation is not lost.

RECOMMENDATION 19

The Government should incorporate strong environmental objectives, including the obligation to reduce greenhouse emissions, into revised transport legislation as part of the Transport Legislation Review.

One approach that has proved successful in effectively assessing proposals against high-level environmental objectives is Strategic Environmental Assessment (SEA). An increasing number of countries around the world are adopting SEA, including Canada, New Zealand and, following the European SEA Directive which came into effect in 2004, member countries of the European Union.

SEA has been defined as “the formalised, systematic and comprehensive process of evaluating the environmental impacts of a policy, plan or programme and its alternatives, including the preparation of a written report on the findings of that evaluation and using the findings in publicly accountable decision-making.”

The purpose of SEA is to consider and incorporate environmental aspects at decision-making levels, rather than allowing an individual project proposal to drive the consideration of higher-level, strategic issues through the standard, project-specific Environmental Impact Assessment (EIA). This ensures a higher quality of policy, programmes and plans in terms of environmental sustainability.
SEA contains some or all of the following elements:

- The definition of the environmental protection and sustainability objectives of a policy, programme or plan,
- the gathering and organisation of relevant environmental data in conjunction with other data collection processes,
- the assessment of the baseline environment and its likely change or evolution as a result of the various options,
- public participation,
- identification and assessment of alternatives,
- identification of the likely specific effects to the natural system,
- determination of measures to prevent, reduce and/or offset any significant adverse effects on the environment with clear monitoring systems designed for the policy’s lifetime, and
- the decision on the best alternative.

EIA as one observer has described “starts too late, ends too soon, and is too site-specific”. It is often applied after a decision has been taken in favour of a proposal, and the EIA serves as a process to clean up the operational detail and minimise any environmental impacts. In particular, EIA does not canvass the high level strategic alternatives that might have been possible nor estimate the cumulative impacts or the intended and unintended feedbacks that might eventuate.

The potential benefits of SEA include:

- the systematic consideration of the environment at higher tiers of decision-making,
- a wider consideration of cumulative impacts,
- upfront assessment of overall impacts and pressures,
- the strengthening and streamlining of downstream EIAs, and
- systematic consultation and public participation leading to greater accountability and transparency.

The impact assessment on the Port Philip Channel Deepening is a recent example of the current statutory assessment process in Victoria. While the focus of attention has been on the local environmental effects of the dredging, such as the impacts on marine ecosystems, there has been little consideration of the impacts of the increased container traffic within the EIA. The Department of Transport has estimated a five-fold increase in international container trade by 2035. The larger ships allowed by the dredging will contribute to this increase.

The Government has a target of 30% of port freight being carried by rail by 2010, compared to just 10% in 1999. Even if the government is successful in shifting freight onto the rail network, the increase in overall freight traffic will inevitably lead to a significant increase in truck movements. At the local level, this will lead to increased road congestion, amenity issues, noise and air pollution. At a broader level, it will lead to increased greenhouse emissions and will make the government’s objective of a 60% decrease in emissions by 2050 yet more challenging.

It is acknowledged that that a broader assessment approach was used in the draft Port of Hastings Land Use and Transport Strategy (PLUTS). The PLUTS recognised the limitations of the EES process and sought to develop a framework within which an SEA-style approach could be implemented. However, the introduction of a broader environmental assessment process does not necessarily ensure that broader environmental impacts are sufficiently taken into account in any final decision as they are able to be traded off against traditional economic factors within evaluation processes.”

The Government is currently assessing the recommendations of Sir Rod Eddington’s report into the need for a new east-west transport link in Melbourne. The recommendations include a new east-west road tunnel from the Eastern Freeway to the western suburbs, and a rail tunnel linking the western and south-eastern suburbs and providing additional capacity in the central metropolitan area (the study is discussed in more detail below).

Assessment of proposals such as these through the SEA process would force an evaluation of the contribution that the proposals, together with a range of alternatives, would make towards the meeting of emissions reduction and other long-term environmental objectives.

SEA can equip Cabinets and decision-making bodies with a full analysis, options and alternatives and do it in such a way that there is measured and understood consultative processes within and outside government. In theory it is possible for the public discussion to take place within a statutory process and allow government to observe the whole range of argument. Similarly a report that provides options rather than a single conclusion allows government to select the ‘best’ for the circumstances and where detailed public works follow it allows the traditional EIA to be focused on the immediate impacts – not to be the vehicle forced to carry the full policy debate. The introduction of SEA into the policy appraisal process would place Victoria at the forefront of environmental appraisal and assessment in Australia.
It is acknowledged that the Government’s existing Environmental Sustainability Framework (ESF) has many of the characteristics of SEA and has the potential, if effectively implemented, to deliver many of the benefits of SEA. The ESF was released in April 2005 and “aims to make environmental sustainability a consideration in everything we do by taking a long-term perspective and a holistic approach to improving the environment”. It provides the Government’s key strategic directions and objectives for reducing Victoria’s environmental impacts. The ESF is aimed at all sectors of the Victorian economy – government, industry, community and individuals – but commits government to taking the lead.

However, as discussed in the CES’s “Strategic Audit of Victorian Government Agencies’ Environmental Management Systems” released earlier this year, the consideration of environmental sustainability into decision-making, particularly policy development, is not yet effectively integrated into Government operations and processes. For example, the ESF could have been used as a mechanism for introducing a carbon price into government planning decisions.

DSE is currently developing a five-year implementation strategy for the Government’s ESF policy commitment which will give agencies more support and greater clarity regarding their responsibilities. However, it is not yet known what expectations will be set for agencies in terms of the methodological processes required to be undertaken. Explicit and sophisticated consideration of all environmental impacts is required to be addressed to support better decision-making.

The Victorian Competition and Efficiency Council recently considered the effectiveness of institutional arrangements in their enquiry into Victoria’s Liveability. In their draft report, they found that –

“Environmental concerns need to be brought more fully into the policy making process to ensure that the natural environment, and therefore Victoria’s liveability, are sustained into the future.”

**RECOMMENDATION 20**

The Government should incorporate the essential elements of broader environmental assessment as used overseas to support its existing ESF integration policy commitment.
REFLECTION OF PUBLIC TRANSPORT SERVICES IN SUSTAINABLE BUILDING DESIGN

INTRODUCTION

As discussed on page 28, it is essential that effective public transport is provided to new housing developments to reduce car dependency and provide more sustainable transport options. At the individual building level, there are a number of building sustainability indices in operation, both nationally and internationally, designed to provide an objective and consistent assessment of the environmental impact of buildings. The schemes generally focus on energy efficiency and water usage and provide an indication both of environmental sustainability and the financial impacts of current and future energy and water prices.

Some schemes include proximity to public transport as another indicator of sustainability. However, this is generally a low priority, and is restricted largely to new office buildings.

The current focus of building indices on water and energy use is important as energy use is currently Victoria’s largest source of greenhouse gas emissions, and water availability is expected to diminish even further in future due to climate change. However, with future oil prices set to rise and increasing awareness of transport’s impact on greenhouse emissions, better reflection of accessibility by sustainable transport within building indices could more accurately reflect the real long-term sustainability of buildings and encourage support for better integration of public transport into new developments and extension of public transport services in established areas.

THE EXTENT TO WHICH PUBLIC TRANSPORT IS INCLUDED IN CURRENT SUSTAINABILITY INDICES

The Victorian Government has a mandatory 5-star building standard for new and modified homes which is aimed at reducing energy consumption and thus greenhouse emissions. However, there are no requirements relating to transport sustainability.

While the Victorian Government should be applauded for establishing the 5-star standard and its recent extension to cover renovations, there have been calls to go even further to a 6-star standard with even more stringent environmental performance standards.

It is also ironic that the energy savings of a 5-star property are often offset by energy-intensive motor vehicle access, particularly for outer suburban residential growth areas. As VCEC found, outer suburban housing is not affordable housing. It is neither affordable nor environmentally friendly, if it is solely reliant on the motor car for transport needs.

The leading sustainable building index in Australia is the Green Building Council of Australia’s ‘Green Star’ rating system. Commercial buildings are given a rating of up to six stars based on allocation of points in different categories of environmental performance. Whereas the 5-star standard is a Victorian regulatory tool that mandates that residential properties achieve a level of environmental performance, the Green Star rating is a voluntary system used by building developers.

The Green Star rating reflects the proximity of a building to public transport services, and also rewards those buildings that include provision for cycling. From a total of 134 available points, the following points are available for transport-related features -

- five points for local public transport services,
- three points for provision for cyclists, and
- three points for car parking provision, both minimising overall numbers and giving priority to smaller, more fuel efficient cars.

The points awarded for public transport services are assessed using an on-line calculator and reflect the frequency and type of public transport, and the walking distance from the building.

While the Green Star rating system is currently focussed on new commercial buildings, or those in the design phase, the Green Building Council has recently launched a pilot for an extension of the scheme to cover new and refurbished multi-unit residential facilities.

The US Green Building Council’s “Leadership in Energy and Environmental Design” (LEED) green building rating system is a similar assessment tool. Out of a total of 85 points, one point is available for each of the following:

- a high density location,
- proximity to public transport,
- bicycle facilities,
- provision for alternative fuel vehicles and hybrids, and
- car pooling and telecommuting programmes.

The LEED assessment is not independent of the building design and depends on the actions of the building managers, such as allocation of car parking for low-emission cars and provision of shuttle bus to public transport.

Other Australian rating systems such as the National Australian Built Environment Rating System (NABERS) and Moreland City Council’s Sustainable Tools for Environmental Performance Strategy (STEPS) focus on existing residential, as well as office, buildings but the ratings are based on energy and water use without reference to public transport.
THE BENEFITS OF INCLUDING PUBLIC TRANSPORT WITHIN BUILDING STANDARDS

Transport is a key component of current and future sustainability considerations in both urban and regional areas. Greenhouse emissions from transport are increasing rapidly and, as has been shown, public transport is more greenhouse efficient than private cars. As such, building sustainability indicators should better reflect the importance of local public transport services. There is limited merit in encouraging new buildings that use less energy if they can only be accessed by high-energy means of transport.

There is concern that the Government’s announcement of the Urban Growth Zone will encourage housing development in areas without effective public transport. Provision of effective public transport services needs to be incorporated into Precinct Structure Plans within the new areas.

The gap between the costs of public transport and the costs of running a private car will increase as and when transport is included within an emissions trading scheme. The approach of peak oil will cause the price of petrol to increase even further.

Stronger reflection of public transport services within building sustainability indices would link property values more explicitly to local public transport services. This would give property owners and developers a vested interest in preserving and improving public transport provision, even if they do not use public transport themselves, and would put additional pressure on governments to deliver effective public transport services to developing suburbs before people move in.

Such a measure would also reinforce the public understanding of the importance of greenhouse emissions from transport and the need for sustainable transport to be part of a sustainable future.

Many elements of such a scheme would need to be researched further and negotiated with building agencies and environmental organisations. In particular, there would need to be agreement on the weighting within a rating scheme given to of different types of public transport service. The existing Green Building Council calculator could be used or adjusted to suit residential property too, along with commercial buildings, industrial facilities and educational establishments. Ratings would also need to be reviewed regularly to keep up-to-date with any changes to local public transport services.

RECOMMENDATION 21

The government should investigate the potential for public transport service provision to be included in indicators of building sustainability.
The growing contribution of the transport sector to greenhouse emissions demonstrates the need for Victoria to develop an overarching, holistic, long-term transport strategy that appropriately prioritises sustainable modes and reflects the reality of future oil prices.

Transport emissions need to be decoupled from economic and population growth by lowering the emissions intensity of the transport system. This involves reducing transport demand, in the longer term through increasing population density, shifting travel to less emissions-intensive modes, and lowering the emissions intensity of all modes, not just motor vehicles. In addition, total transport emissions, not just transport emissions intensity, must be reduced.

Given the existing emissions benefits from public transport as outlined in this report, and the potential for trains and trams to be run on renewable energy, it must be given greater priority than it has so far received.

Increases in public transport patronage in recent years are encouraging, yet the provision of new services continues to play catch-up to growing demand. What is necessary over a longer timeframe is for government policy to actually drive a greater shift to public transport – creating the capacity and then encouraging further demand with a mix of strategies.

The release of this report coincides with the Victorian Government’s consideration of Sir Rod Eddington’s review of the need for new east-west transport routes through Melbourne – the East West Link Needs Assessment (EWLNA).

Twenty recommendations are contained in the report, at a total cost of around $18 billion, most of which relate to improving public transport. The three main proposals are:

- a new road tunnel from the Eastern Freeway to the western suburbs
- a new train tunnel from Caulfield to Footscray via the city centre; and
- a new train line from Werribee to Sunshine (the Tarneit link).

The other recommendations include to a range of other public transport, freight and cycling initiatives.

While the road tunnel is the most expensive single proposal, the report clearly advises against the construction of off-ramps into the city centre for private vehicles, to prevent increased congestion. However, if the Government wishes to attract private investment to help fund the proposal, there may be significant pressure to include such off-ramps to maximise revenue. Other measures are proposed to manage road demand, including the recommendation that the Government considers road pricing for Melbourne.

The overall impact on greenhouse emissions from the recommendations is claimed to be “minimal but beneficial”. A small reduction in emissions is claimed due to the freer flowing traffic resulting from the new road tunnel.

While this aspect of the report has received much criticism, the terms of reference for the study team were focussed on addressing present and future transport capacity needs across a narrow geographical area. The EWLNA terms of reference included reporting on the impacts of current government policies, and consideration of government targets for increased public transport patronage and rail freight. However, despite the growing awareness of the importance of climate change, there was no objective of reducing greenhouse emissions.

The assertion within the EWLNA that greenhouse emissions will be reduced by the recommendations needs to be questioned. Appendix E of the report discusses the concept of ‘induced travel’ and concludes that new roads do not create any new travel demand, but merely provide for journeys that would otherwise have been taken on other roads. The report maintains that observed long-term increases in overall traffic levels are the result not of the road, but of population growth and economic development. The implication is that the proposed road tunnel will not increase kilometres travelled overall.

The causality of new roads and development is debateable. Is a new road responsible for the development of an area? Or is the development going to happen anyway and the road will be needed?

Despite that, the EWLNA’s conclusions are questionable on two grounds. Firstly, a lack of induced travel appears inconsistent with the stated objectives of improving the road network, such as:

- Significantly improving relative accessibility and density, boosting the west’s capacity to attract and retain businesses, jobs and households
- Reducing social disadvantage by improving access to the central city – for work, education and other purposes
- Opening up new business opportunities and employment growth, and
- Providing the efficient transport connections needed to sustain residential and industrial/commercial growth in the west and in Geelong.

It would seem difficult to deliver these benefits without increasing overall traffic levels.

Secondly, it is at odds with other studies of induced demand. Most studies have identified short-term effects and more significant longer-term effects. The EWLNA cites one finding of the UK Standing Advisory Committee on Trunk Road Assessment (SACTRA) study of 1994 that the elasticity of traffic demand in relation to roadway expansion is between 0 and 1 per cent.

The Victorian Competition and Efficiency Council (VCEC) made reference to the same SACTRA study in its 2006 report “Making the Right Choices: Options for Managing Transport Congestion”79. The VCEC report noted that the SACTRA study suggested negligible traffic increases in the first three years of a new road, but increases of 50-100% in the longer term. VCEC concluded that “it is important that induced demand effects be included in project appraisals. Failure to account for induced demand could lead to estimation errors in the benefits and costs of new road infrastructure”.

THE WAY FORWARD
If one considers that the road elements of the EWLNA recommendations, including the east-west tunnel, are likely to increase overall traffic levels, then this implies an equivalent increase in greenhouse emissions.

The EWLNA discusses greenhouse issues in the Overview report. In considering measures to reduce transport emissions, the EWLNA refers to another report prepared for the Victorian Office of Climate Change by the Nous Group, "Understanding the potential to reduce Victoria’s greenhouse gas emissions". The report contained a 'wedge' analysis of possible initiatives to reduce emissions up to 2050.

Four wedges were identified to reduce emissions from transport, and an estimate of the potential reduction in CO2e emissions from each set of initiatives was made. Of the four wedges considered, by far the greatest potential reduction in emissions is shown to come from improvements in vehicle fuel efficiency. The benefits of other wedges, including a shift to public transport and rail freight, are reported as relatively insignificant.

<table>
<thead>
<tr>
<th>Transport wedge from Nous Group analysis for Office of Climate Change</th>
<th>Reduction in CO2e by 2050 (Mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing travel demand</td>
<td>3</td>
</tr>
<tr>
<td>Improved vehicle fuel efficiency</td>
<td>17.5</td>
</tr>
<tr>
<td>Increased vehicle occupancy</td>
<td>1.4</td>
</tr>
<tr>
<td>Shift from cars to public transport and from trucks to rail freight</td>
<td>1.5</td>
</tr>
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While an important element of a transport strategy, the capacity of improved vehicle fuel efficiency to cost-effectively and quickly generate such significant greenhouse emissions reductions has been challenged by some. For example, Gary Glazebrook has calculated that it would cost $200-300 billion to replace the entire Australian vehicle fleet and would take about 23 years on present turnover rates. There are also concerns about the ‘rebound effect’, which is the incentive for people to drive further in a more fuel-efficient car, thereby negating much of the potential emissions saving.

The assumption within the Nous analysis is that a further 10% of private passenger transport could be transferred to public transport (and just 1% of road freight transferred to rail) by 2050 above a business-as-usual reference case. The reference case assumed that public transport mode share would increase in line with MOTC forecasts to about 15% by 2030. This suggests an overall target of around 25% (the current 10% plus 5% growth plus a ‘wedge’ of another 10%) of all trips being made on public transport by 2050. As 20% is the government's current target to be met by 2020, this appears to be a somewhat unambitious goal rather than a transformational initiative.

A critical assumption in the Nous analysis relates to the price of oil. The reference case reflects the ABARE long-term price of only $40 per barrel (compared to over $140 in July 2008). The Nous report recognises that this figure may be conservative, and notes that future rises could "accelerate a shift to more fuel efficient vehicles". It doesn’t acknowledge that increased oil prices also drive demand for public transport, especially in the short term. With peak oil and carbon pricing around the corner, historical projections of future transport demand are no longer appropriate.

It seems that a significant shift in priorities towards public transport was beyond the scope of Eddington’s analysis and was not considered. Eddington’s forecast sees very little change in mode share into the future. The main reason that improved vehicle fuel efficiency is so strongly supported is that it is considered able to reduce transport emissions relatively quickly. However, one would assume that it would be possible to significantly expand public transport services, including an extension of the rail network, over the 42 year time period of the study.

The EWLNA appears to foresee a future in which personal mobility continues to dominate, with a switch to more fuel-efficient vehicles being the main way of reducing transport emissions. However, the supply of public transport needs to be increased to meet the inevitable future increases in demand and economic risk that will result from rising oil prices. It also needs to be increased to encourage a shift onto less greenhouse-intensive transport modes to reduce greenhouse emissions. Trains and trams have the additional advantage of being able to be powered by renewable energy which would greatly increase the greenhouse emissions advantage that they already hold.

Public transport infrastructure is cheaper to build and operate than expanding road networks, and would therefore be a cost-effective way of responding to the forecast growth in transport demand. Expansion of public transport services would also reduce health costs, and offer the social and economic advantages of providing mobility to those without access to cars. As oil prices increase further, demand for public transport will only increase.

As the CSIRO Fuel for Thought report highlights,

- Australia will be forced to manage its response to reducing greenhouse gas emissions and the risk of increasingly costly and scarce oil supply simultaneously rather than sequentially;
- Technology alone will not be sufficient to meet the potential fuel supply gap;
- Early action to accelerate the availability of less fuel intensive modes of travel is key in avoiding impacts; and
- In the more likely case of higher oil prices emerging abruptly (rather than slowly and steadily), Australia can only seek to minimise rather than eliminate all impacts. To do so requires preparing in earnest now.”
The critical issue now is how the government responds. The EWLNA will be considered as part of a strategic, long-term vision for sustainable transport throughout Melbourne. Such a vision could include major investment in extended public transport services, backed up by pricing signals, such as road tolling, to encourage more efficient use of existing infrastructure.

There needs to be a step change in the provision of public transport. Despite increased investment and record patronage levels, supply is failing to keep up with demand – let alone actively drive a shift from oil-dependent, emissions-intensive private cars to a more sustainable transport mode.

The government can continue with a model of transport infrastructure planning in which personal mobility remains paramount, or it can choose options that drive a fundamental change towards sustainability. Transport in future will be constrained by both the need to urgently reduce greenhouse emissions and the availability of cheap oil. With the long lead times in transport infrastructure provision, planning for such a future needs to start today.

**RECOMMENDATION 22**

The Eddington Report should be viewed as a major contribution to the development of a long-term transport strategy for metropolitan Melbourne that clearly demonstrates significant reductions in transport emissions.
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Public transport’s role in reducing greenhouse emissions – A position paper


