SUBMISSION TO THE SENATE INQUIRY INTO THE INVESTMENT OF COMMONWEALTH AND STATE FUNDS IN PUBLIC PASSENGER TRANSPORT INFRASTRUCTURE AND SERVICES - John Davidson.

SUMMARY AND CONCLUSIONS

1. This submission:

a. Is directed at item c in the terms of reference: "An assessment of the benefits of public passenger transport, including integration with bicycle and pedestrian initiatives".

b. Is driven by a concern about the impact of people transport on CO2 emissions.

c. Examines the potential impact of technical change on the relative merits of people transport alternatives including public transport, cars, bicycles, scooters and walking.

d. Concentrates on developments based on established technologies.

e. Assumes that:

i. Electricity used to drive electrical transport will be clean electricity.

ii. Changes are more likely to be accepted if they do not require any significant loss in quality of life.

2. It was concluded that:

a. **Cars vs public transport:**

i. The investigation for this submission did not explore the potential for technical advances to reduce **public transport emissions*,** apart from cleaning up electricity and possible replacement of diesel or natural gas buses with electric buses. However, full electrification of an extended bus service may be hard to justify unless electricity storage developments allow electrified buses to spend time away from the overhead wires

ii. Emissions from public transport may actually rise if steps are taken to improve the quality of service. (Shorter waiting times and more extensive service.)

iii. Plug in hybrid technology for cars is attractive because it can be started without special infrastructure and then evolve into pure electric as electricity storage costs/capacity, charging rates and facilities improve.

iv. Other improvements might be expected from better design, materials of construction etc. (The current fuel consumption record for a petrol driven car carrying a driver is only 0.027 litres/100 km so there is scope for improvement for commercially available cars.)

v. Increased use of **plug in hybrid in cars** will lead to reductions in car related emissions in excess of 90% **for urban applications.**

vi. Less dramatic reductions in **car emissions** are expected in rural areas.

vii. In the medium term, the **replacement of cars with public transport** is unlikely to be justified in terms of reducing CO2 emissions. The converse may actually be true.

viii. Any decision to extend the use of public transport would have to be justified in terms of dealing with congestion and/or improving the service to those who do not have access to cars.

b. Regulations could be used to drive down **the average fuel consumption of new cars** without the need for increases in the price of fuel.

c. The use and development of **electric powered bicycles** should be strongly supported. They have the potential to increase the use of low emission bike travel by:

i. Extending practical bike travel distances, particularly for the not so fit. (While allowing exercise levels to be controlled.)

ii. Making bike riding more attractive in hilly areas.
iii. Allowing bikes to be used when reaching the destination a sweaty wreck is undesirable. (Ex: Travel to work.)
d. Increasing the movement of people by the use of **walking** and the riding of un-powered **bicycles and scooters** could be encouraged include construction of more dedicated tracks, protection from weather, noise and fumes as well as the availability of showers at destinations.

(*NOTE: Unless otherwise stated emissions are per passenger km.)

DETAILS:

Cars vs public transport:

Table 1 compares emissions for a number of transport alternatives for Melbourne during peak hour. (Source Public Transport Users Association (PTUA) HYPERLINK "http://www.ptua.org.au/myths/index.shtml" http://www.ptua.org.au/myths/index.shtml)

Table 1: Comparison of Transport Alternatives – Melbourne Peak Hour

Transport mode	**Energy use (MJ per passenger-km)***	**Emissions (g CO_2-e per passenger-km)**	**Comments**
Petrol Car	3.7	286	12 litres/100km, 1.1 passengers
LPG Car	3.7	256	" "
Ethanol (E10) Car	3.7	253	" "
Electric Tram	0.15	52	80 passengers "Well used system" Current Victorian electricity
Diesel Bus	0.28	22	40 passengers "Well used system"
Ethanol (E10) Bus	0.28	19	" "
Natural Gas Bus	0.28	18	" "
Diesel Train (V/Line)	0.20	16	
Electric Train	0.04	14	Crowded 6 car "Comeng" Current Victorian electricity
250cc Motorcycle	1.60	124	
1000cc Motorcycle	2.30	178	

***NOTES:**

1. "Energy used" is the total energy in the fuel or electricity, not the energy required to move the vehicle.
2. Source of data used by PUTA: "Emissions intensity figures from Australian

Greenhouse Office", *AGO Factors and Methods Workbook 2006*. (HYPERLINK "http://www.climatechange.gov.au/workbook/pubs/workbook-nov2008.pdf" http://www.climatechange.gov.au/workbook/pubs/workbook-nov2008.pdf)

3. Both electric trains and trams running on clean electricity would have zero operating emissions.

The above table can be misleading:

1. It compares public transport with high passenger loadings with a 12 litre/100 km car with an average of only 1.1 passengers.

2. Public transport routes may be far less direct than the routes taken by car.
3. Public transport loadings will drop when the service is improved by extending the area serviced or reducing waiting times.

Table 2 gives a more realistic comparison between a small low fuel consumption car and more lightly loaded public transport. In addition, calculated figures are included for plug in hybrid cars. The plug in hybrid calculations assumes:

1. A 15% saving due to braking regeneration.
2. A typical **urban** weekly trip mix of 5x30, 1x10, 1x100 km trips.
3. Battery recharged at the end of each trip.

Table 2: Comparison of Transport Alternatives – Not Peak Hour

Transport mode	**Energy use (MJ per passenger-km)**	**Emissions (g CO_2-e per passenger-km)**	**Comments**
Electric Tram	0.60	208	20 passengers (Melbourne average) Current Victorian electricity
Diesel Bus	0.56	44	20 passengers
Diesel - Swiss Federal Railway	0.33	26	Average
Small VW	0.93	72	3 litre/100 km **Average 1.1 passengers**
Small VW	0.51	40	3 litre/100 km **2 passengers**
Small VW	0.26	20	3 litre/100 km **4 passengers**
Small VW converted to plug in hybrid	n/c	13	**50** km battery range with **clean electricity** **1 passenger**
"	"	n/c	3.3 **50** km battery range with **clean electricity** **4 passengers**
"	"	n/c	18 **30** km battery range with **clean electricity** **1 passenger**
"	"	n/c	8.8 **30** km battery range with **clean electricity** **2 passengers**
"	"	n/c	5.9 **30** km battery range with **clean electricity** **3 passengers**
"	"	n/c	4.4 **30** km battery range with **clean electricity** **4 passengers**

The above figures suggest that, in urban environments, small plug in hybrids will be more emission efficient than all the other alternatives except electric trams and trains

operating on clean electricity. However, for the trip mix used, a 100 km battery range would mean that the car would operate as a pure electric and have the same emissions as the electric tram or train. Current pure electric cars do have batteries with ranges above 200 km. Battery cost is thousands of dollars. Expected advances in batteries or ultra capacitors should reduce the cost and/or increase the battery/capacitor travel range.

The use of plug in hybrid technology is not the only way of improving the fuel consumption of cars. Better design, lighter materials, designing for fewer passengers would all help. It may also help if regulations were changed so that safety depended more on the use of automatic controls to avoid crashes than he ability of cars to withstand crashes.

The situation would be different for rural areas because of longer distances travelled between charging opportunities. In some areas, plug in hybrids may offer negligible gains and reduction in car emissions would depend on better design etc. However, in most rural areas the only public transport would be diesel buses. The above table suggests that the relative emission benefits of cars vs buses will depend on passenger numbers. It should be noted that rural public transport services are always going to be very limited. Most rural dwellers would see the loss of their car as a serious attack on their safety and quality of life.

The investigation for this submission did not look in any detail at the possibilities of reducing bus related emissions. In urban areas there is always the possibility of electrifying buses although this may be hard to justify for an extended bus service. Developments in electricity storage or the use of hybrid technology may allow electric buses to spend some time away from overhead power sources.

It was concluded that it would be difficult to justify any decision to extend the use of public transport on the grounds of reduced emissions and that extensions would have to be justified in terms of dealing with congestion and/or improving the service to those who do not have access to cars.

Un-powered Bicycles and Scooters:

1. Not much scope for technical advances to increase the use of the un-powered bicycles/scooter option. However:

a. Their use as extenders of the practical distance between destination and train/bus/parking station might be encouraged by the ongoing development of lighter, more portable versions. (**Comment:** More effort should be taken to encourage the use of scooters in this role.)

b. In hot, humid regions, the ongoing development of better/cheaper (cooler, faster drying after rain, more odour/sweat resistant, more fashionable) fabrics may help.

c. In cold, wet regions the ongoing development of better/cheaper protection from wind and rain may help.

2. The use of un-powered bicycles would be more attractive if:

a. More dedicated bicycle routes were available.
b. More routes gave protection from the weather, vehicle fumes and noise.
c. Cars and walkers were separated from bicycles.
d. Showers were available at destinations.

Electric Powered Bicycles:

A limited number of electric powered bicycles have been sold in Australia to date. The models available combine an electric drive with a normal pedal and gear set. The bikes can be pedalled with or without the use of the electric drive or driven by electric drive alone. Electric bikes have received little attention even though they have the potential to significantly extend the use of low emission travel by:

1. Allowing people of minimal fitness to travel significant distances, on both flat and hilly areas.
2. Allowing users to control the level of exercise without having to compromise on speed.
3. Allowing bikes to be used when reaching the destination a sweaty wreck is undesirable. (Ex: Travel to work.)

Walking:

1. Not much scope for technical advances to increase the use of the walking option. However:
a. In hot, humid regions, the ongoing development of better/cheaper (cooler, faster drying after rain, more odour/sweat resistant, more fashionable) fabrics may help.

b. In cold, wet regions the ongoing development of better/cheaper protection from wind and rain may help.
c. Airport style moving walkways and escalators in congested areas may extend the practical walking distance between destination and train/bus/parking station.

2. Walking would be more attractive if:
a. More walking routes were available.
b. More routes gave protection from the weather, vehicle fumes and noise.
c. Walkers were separated from bicycles.
d. Showers were available at destinations.