

# Australasian Centre for Governance and Management of Urban Transport

## HIGHLIGHT 1

Planning Australian transport to stabilise the  
climate at 2-3 degrees C hotter than today

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# Atmospheric CO<sub>2</sub> must be limited to avoid dramatic climate change

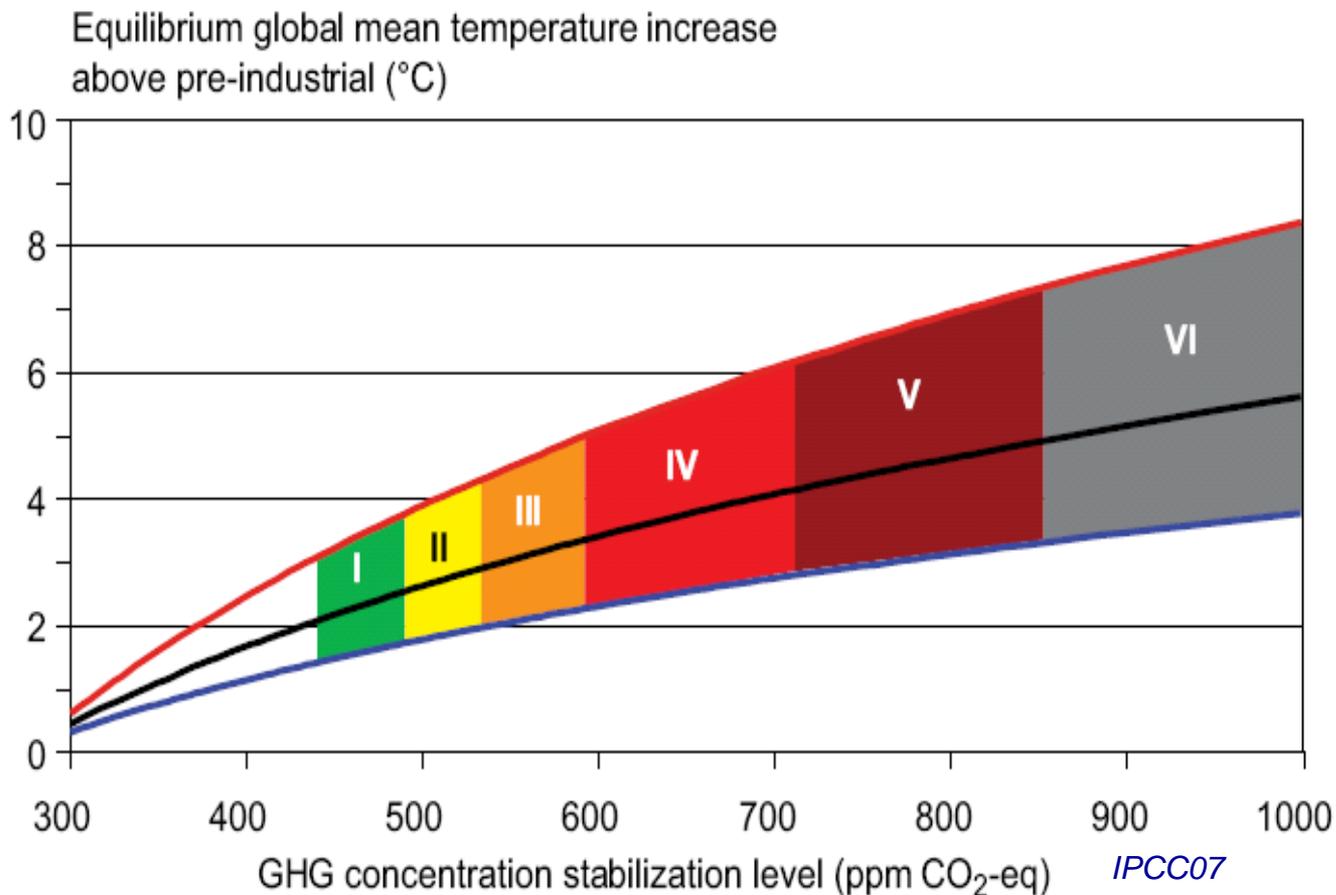
*CO<sub>2</sub> 400ppm (CO<sub>2</sub>e 450-500ppm) will see a possible 2 -3 degree Celsius temperature rise.*

- Average temperatures have risen 0.7°C.

- Current CO<sub>2</sub> is 380ppm and increasing by more than 2ppm/yr.

- Current CO<sub>2</sub>e is 430-480ppm.

- Global transport CO<sub>2</sub> emissions could be adding up to 0.4ppm-CO<sub>2</sub>/yr.



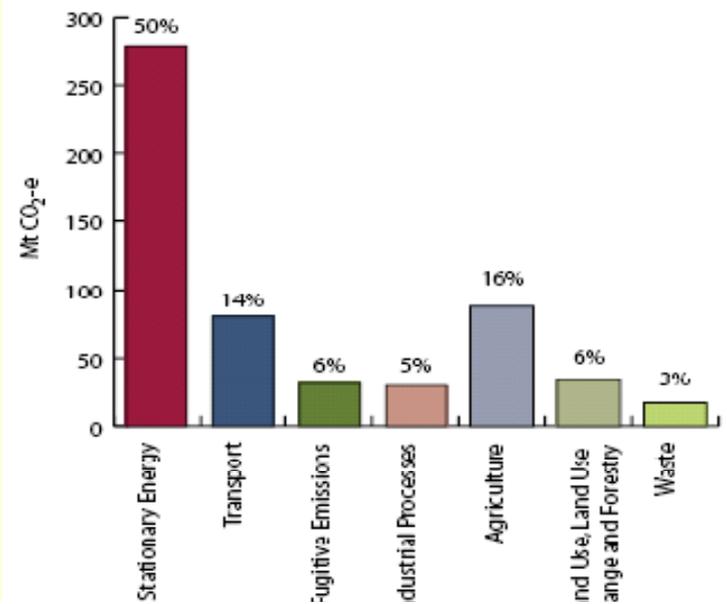
# Australian Transport Data

Transport emissions have increased by 30% since 1990.

The energy sector has grown from 287M tonnes/yr in 1990 to 391M tonnes/yr in 2005.

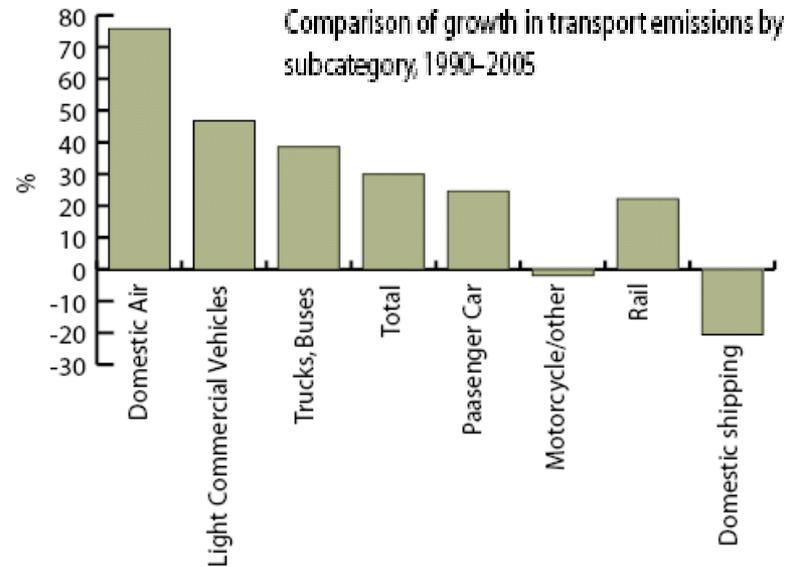
Passenger cars account for 21% of energy sector GHG emissions, and more than 50% of transport emissions.

In Melbourne about 92% of motorised journeys are by car

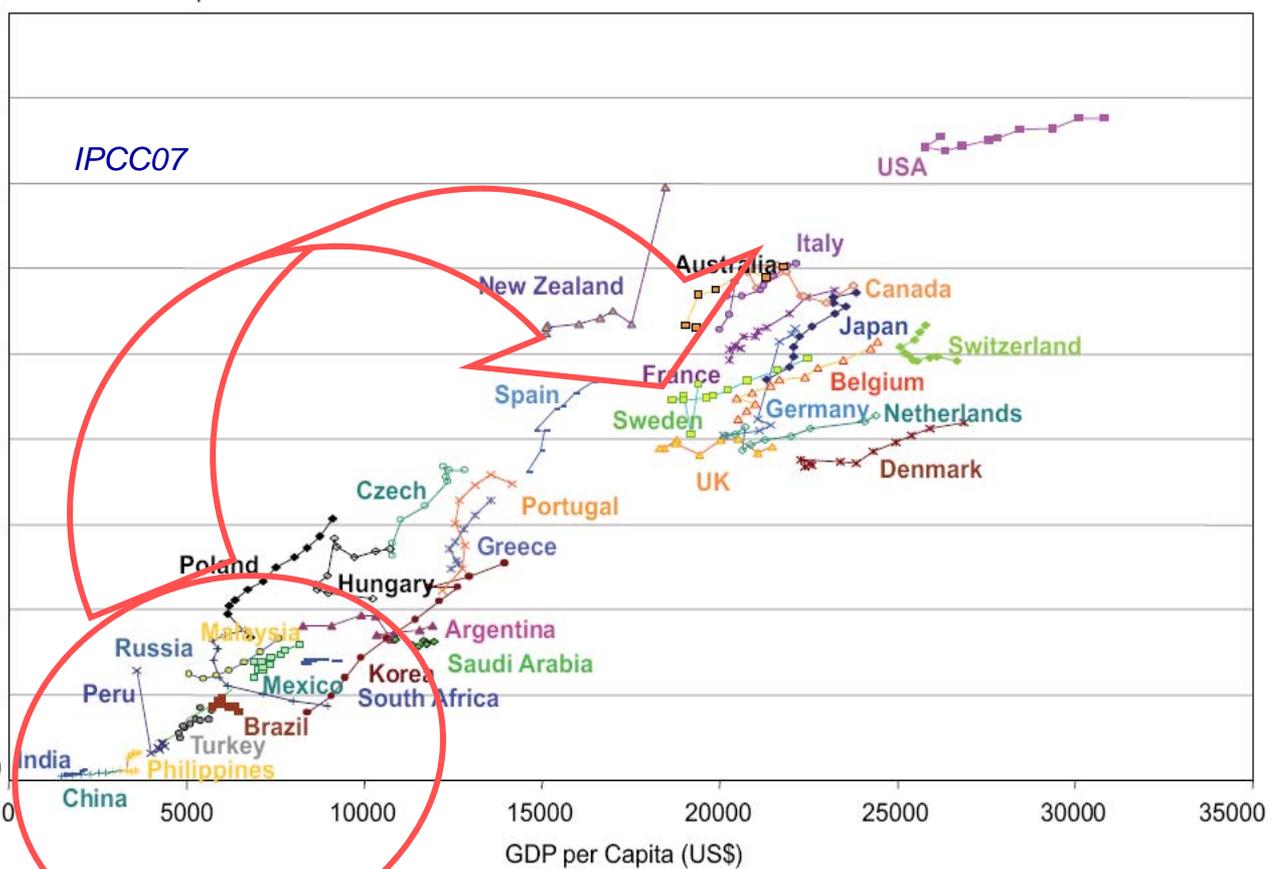


Australia's greenhouse gas emissions by sector in 2005

Australian Greenhouse Office 2007 inventory data



Vehicle Ownership/ 1000 Persons



In Australia car ownership has increased tenfold since 1947.

Both in Australia and globally car ownership is growing

Car ownership grows with GDP: increasing wealth means greater car ownership, greater total passenger kilometres.

There is significant international pressure to 'catch up'.

# How big a change is needed to avoid dramatic climate change?

1. By 2030 **global** emission of GHGs may need to be one quarter of their current value if dramatic climate change is to be avoided: *eg a 4-fold reduction.*
2. Such a reduction will commit us to a temperature rise of about 1-2°C above year 2000 levels, about 2-3°C in total, by 2030.
3. High emitting developed countries like Australia may be **further** required to reduce emissions to those much closer to the world average: *eg **contraction and convergence** means we decrease while others increase.*
4. For Australia this would mean a 4.7fold reduction on present emissions.
5. Total reductions for Australia therefore could be  $4 \times 4.7 = 18.8$ fold on current levels.

*By 2030 Australian transport emissions may have to be reduced by a factor of almost 20 if we are to have a sustainable transport system.*

# Australia: business as usual

## Current passenger car data

	2001	2005	2030**
Passenger vehicles	9,861,807	11,101,506	14,700,000
Total vehicle kilometres	143.8 billion V-km	155.1 billion V-km	200 billion V-km
V-km/vehicle	14,594	14,083	14,000
Total petrol	16,436 MLitres	18,144 Mlitres	22,000Mlitres
Average fuel use	11.4 litre/100km	11.7 litre/100km	11.0 litre/100km
CO2 produced	37 Mtonnes	41 Mtonnes	50 Mtonnes
V-km/ kg-CO2	3.9 V-km/kg-CO2	3.8 V-km/kg-CO2	4.0 V-km/kg-CO2
P-km/ kg-CO2*	5.4 P-km/kg-CO2	5.3 P-km/kg-CO2	5.6 P-km/kg-CO2

ABS 2005

\*Assuming occupancy of 1.4

\*\*Assuming population of 26Million

*An 18.8 fold decrease in GHGs would allow only 2.7Mtonnes of transport CO<sub>2</sub> in 2030. This would require 100 passenger kms/kg-CO<sub>2</sub> in 2030 based on projected demand.*

# What can be done to reduce urban passenger transport emissions by a factor of 18.8 by 2030?

1. Increase vehicle occupancy to increase passenger kms/kg-CO<sub>2</sub>.
2. Increase vehicle efficiency by increasing vehicle kms per unit of fossil fuel energy used.
3. Reduce CO<sub>2</sub> produced per unit of fuel used.
4. Reduce demand for car travel.

# Improve occupancy rates.

Car occupancy rates for Melbourne (journey to work):

1951                      1.37 P-km/V-km

2001                      1.08 P-km/V-km.

(National figures are similar)

*Problem: forced increase of occupancy runs counter to the psychology of private car ownership.*

# Increase vehicle energy efficiency.

1. Australian fleet average fuel consumption has not altered significantly over the last 10 years.
2. Current low fuel consumption vehicles consume 5 litres/100km, over 8.8 V-km/kg-CO<sub>2</sub> (12.3 P-km/kg-CO<sub>2</sub>).
3. Fleet average vehicle age is over 10 years, penetration is slow.
4. BTRE predicts a 9.1% rise in vehicle efficiency by 2020 (BAU).
5. Scarcity of conventional oil will push up well-to-wheel kg-CO<sub>2</sub>/MJ thus offsetting efficiency gains.
6. Current hybrid cars use 10%-15% less fuel than the best small cars. This improves under full occupancy.
7. Fuel cell vehicles are not expected to penetrate significantly by 2030.

*At best we could expect fuel consumption to reduce 2-fold by 2030.*

# Use alternative fuels to reduce CO<sub>2</sub>/MJ.

## Ethanol

1. Current world production of ethanol is about 50,000ML. Production of ethanol in Australia is about 75ML, capacity is estimated to be over 150ML.
2. Current ethanol production is 0.5% of passenger fleet petrol consumption, but 0.2% of energy consumed.
3. Conversion of all current sugar production to ethanol would produce around 3,000ML, about 10% current energy consumption.
4. Conversion of all Australian sugar, wheat and coarse grain to ethanol would produce around 16,000ML, about 50% current energy consumption.
5. Australian BTRE predicts ethanol use to increase to 0.3% of fuel volume consumed by 2020.



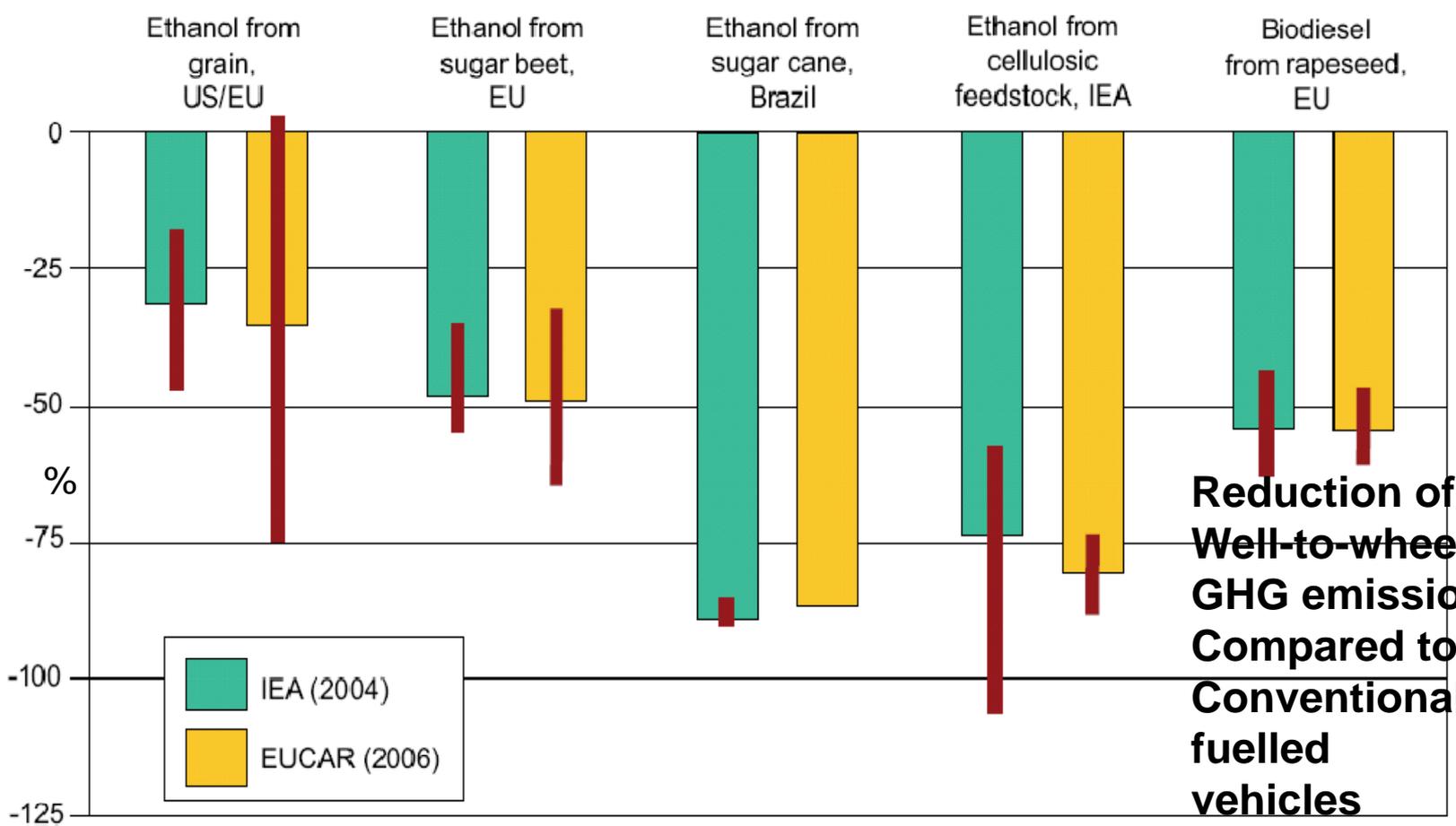
US E85 flex fuel car.  
[www.iowacornethanol.com](http://www.iowacornethanol.com)



<http://www.renewablefuels.com.au>  
Australian E10 fuel..

# Bio-diesel

1. Current world production of bio-diesel is around 3500-5000ML. Production of bio-diesel in Australia is around 50-75ML, capacity is estimated to be over 500ML.
2. Conversion of all Australian oilseed (and waste oil) to bio-diesel would produce around 1500ML, about 10% current energy use.



IEA-IPCC07  
 Additional data from  
 Biofuels Issue Paper  
 Beer et al 2006

**Reduction of Well-to-wheels GHG emissions Compared to Conventionally fuelled vehicles**

# Use gases, electricity and geo-sequestration to reduce CO<sub>2</sub>/MJ.

1. CNG and LNG have higher P-km/kg-CO<sub>2</sub> but the difference is small and methane leakage could offset this due to its higher warming potential (21 x CO<sub>2</sub>).
2. Hydrogen can replace fossil fuels but little benefit will result to CO<sub>2</sub> emission unless generated by renewables (wind or solar-thermal with water electrolysis).
3. Electric cars or electric hybrids can have near zero emission of CO<sub>2</sub> but again electricity must be generated by renewables.
4. Currently 8% of total Australian electricity production is renewable.
5. Fossil fuel electricity could be CO<sub>2</sub> neutral if emissions are sequestered. World wide only 40% of such emissions are technically suited to geo-sequestration.

# Bottom line?

*Full implementation of changes in efficiency and adoption of alternative fuels could see passenger car CO<sub>2</sub> emissions reduced 2.5-fold by 2030.*

# IPCC position on 2030 and beyond.

Technology	Carbon reduced/vehicle (%)
1. Diesels	18
2. Hybridization	30 (36 for diesel hybrids)
3. Biofuels	20-80
4. Fuel cells with fossil hydrogen	45
5. Carbon-neutral hydrogen	100

WBCSD-  
IPCC

*Various studies presented by the IPCC suggest car GHG's could be reduced by up to 1.5-fold by 2030.*

# Bottom Line?

*Given the reductions in GHGs needed by 2030, a sustainable transport system cannot be based on cars.*

# So: shift to public transport in Australia?

1. Current public transport (buses and trains) obtains on average twice as many passenger kms/kg-CO<sub>2</sub> as cars (2-fold increase).
2. Shifting from passenger cars to trains and buses will improve occupancy (non-peak).
3. Mode shift could double the average occupancy (2-fold increase).
4. Improvements in technical efficiency (vehicle kms/kg-CO<sub>2</sub>) could see a 1.5-fold increase by 2030.
5. By 2030 public transport could be (2x2x1.5) 6 times as greenhouse efficient as present day car travel (32 passenger kms/kg-CO<sub>2</sub>).

***Improvements to public transport will not be sufficient to meet the required 18.8-fold reduction in total transport GHGs.***

# Other motorised systems.

Vehicle	Occupancy	P-km/CO <sub>2</sub> e (FFC)
Car (gasoline)	2.5	6-8
Car (diesel)	2.5	8-12
Car (natural gas)	2.5	7-10
Car (electric)*	2.0	10-33
Scooter (two-stroke)	1.5	11-17
Scooter (four-stroke)	1.5	17-25
Minibus (gasoline)	12.0	14-20
Minibus (diesel)	12.0	17-25
Bus (diesel)	40.0	33-50
Bus (natural gas)	40.0	29-40
Bus (hydrogen fuel cell)**	40.0	40-67
Rail Transit	75% full	20-50

Passenger-kms/kg-CO<sub>2</sub>e for various vehicles

*No single motorised system can bring about the reductions in CO<sub>2</sub> required to get 105 P-km/kg-CO<sub>2</sub>.*

\* Electricity from a mix of fossil fuels

\*\* Hydrogen from natural gas.



# Summary:

1. To have a sustainable Australian transport system by 2030, transport GHGs may have to be reduced 18.8-fold.
2. At best, passenger cars in 2030 could emit 2.5 times less per passenger-km than current cars, but it is more likely to be about 1.5 times less.
3. At best, public transport in 2030 could emit 6 times less per passenger-km than current cars.

*Since reductions from both passenger cars and public transport are insufficient to provide a sustainable transport system by 2030, demand for motorised travel must be reduced.*

***The question is how?***