



The University of Sydney

FACULTY OF
ECONOMICS
AND **BUSINESS**



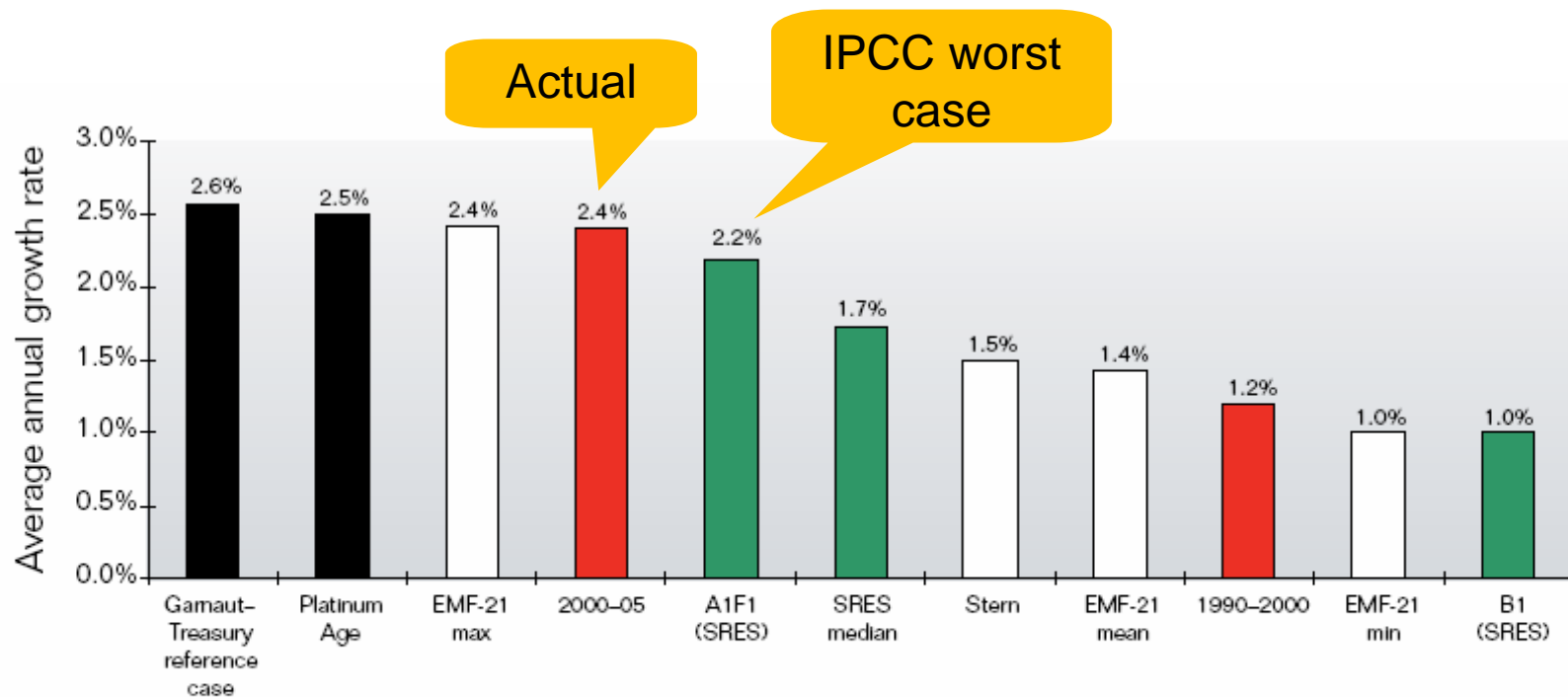
Climate change and land transport: achieving emissions reductions

John Stanley
Adjunct Professor
May 2009

The material in this paper will shortly be published in Transportation
Research A: Policy and Planning



Global emissions are growing at the worst-case end of IPCC predictions



Note: The red bars show average annual emissions growth for various historical periods. The green bars show various SRES scenarios, and the white bars post-SRES scenarios. The black bars give the projections of the Review.

Source: Garnaut Draft Report, 2008





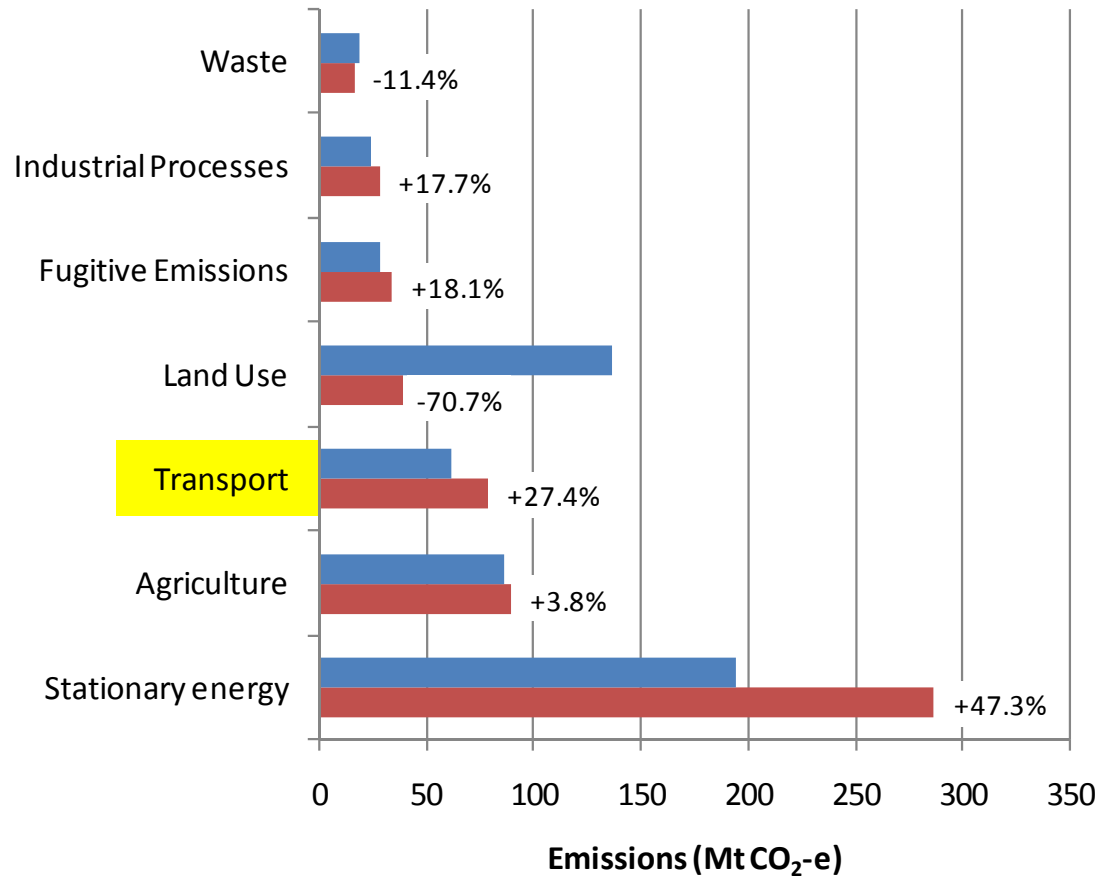
A glimpse of a possible future



Climate change adaptation: the Irish way!



Transport emissions: Australia's 3rd largest and 2nd fastest growing sector for GHG

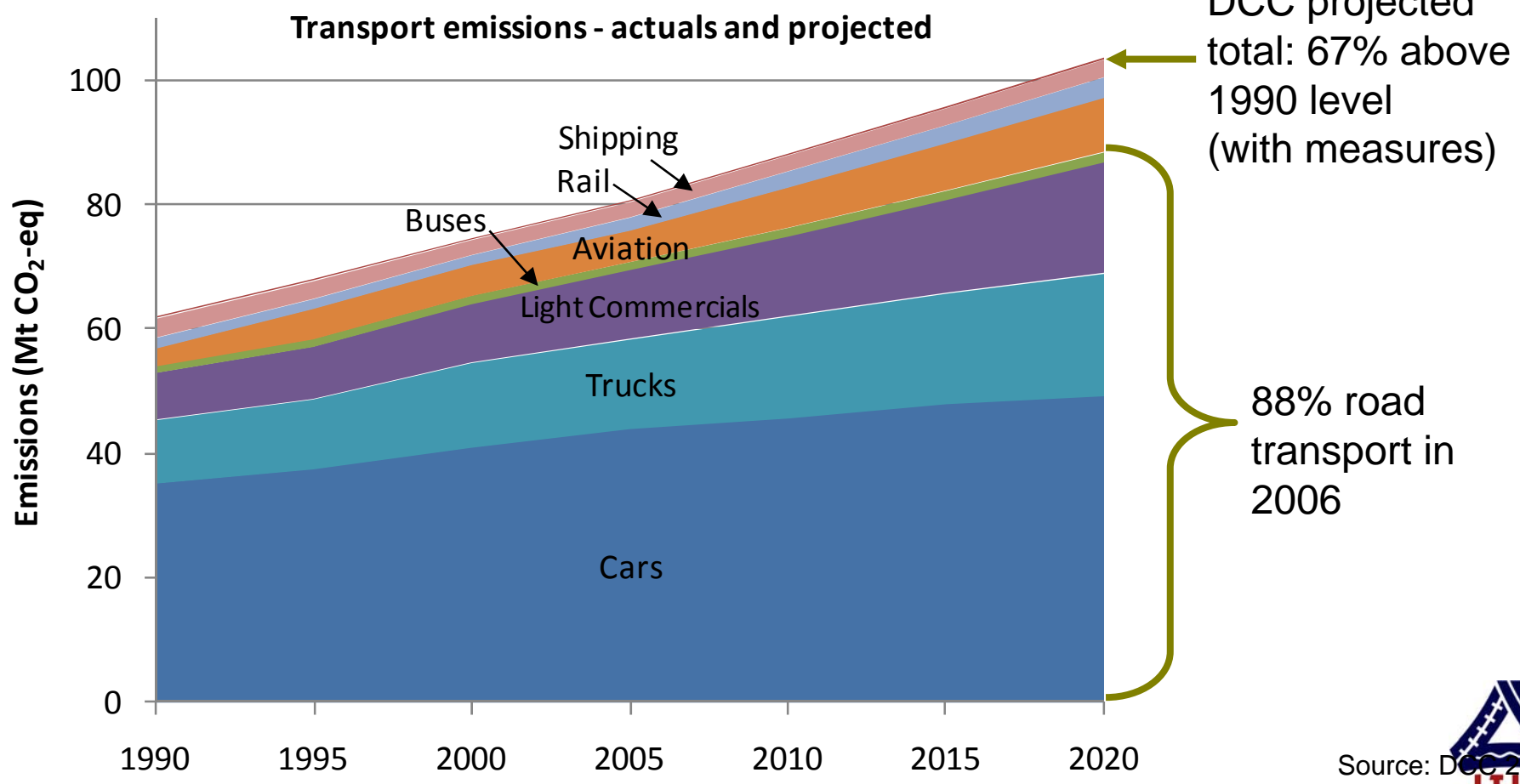


Transport represents 13.7% of Australia's GHG emissions

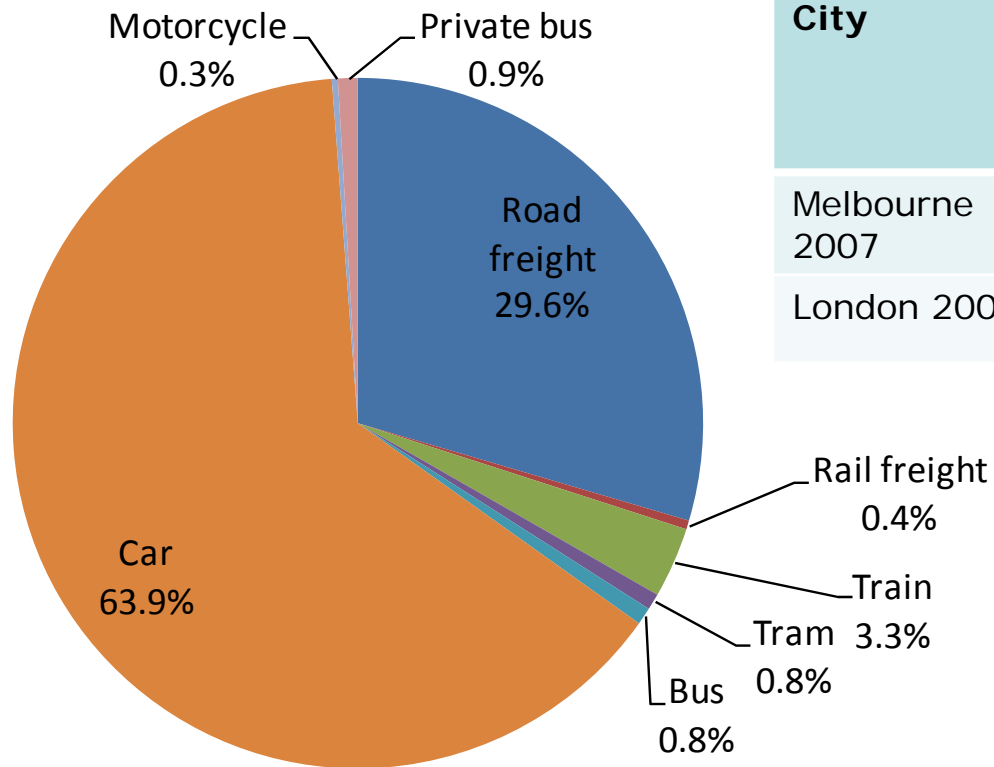
Source: AGO 2008



Road transport is the key to Australia's transport emissions



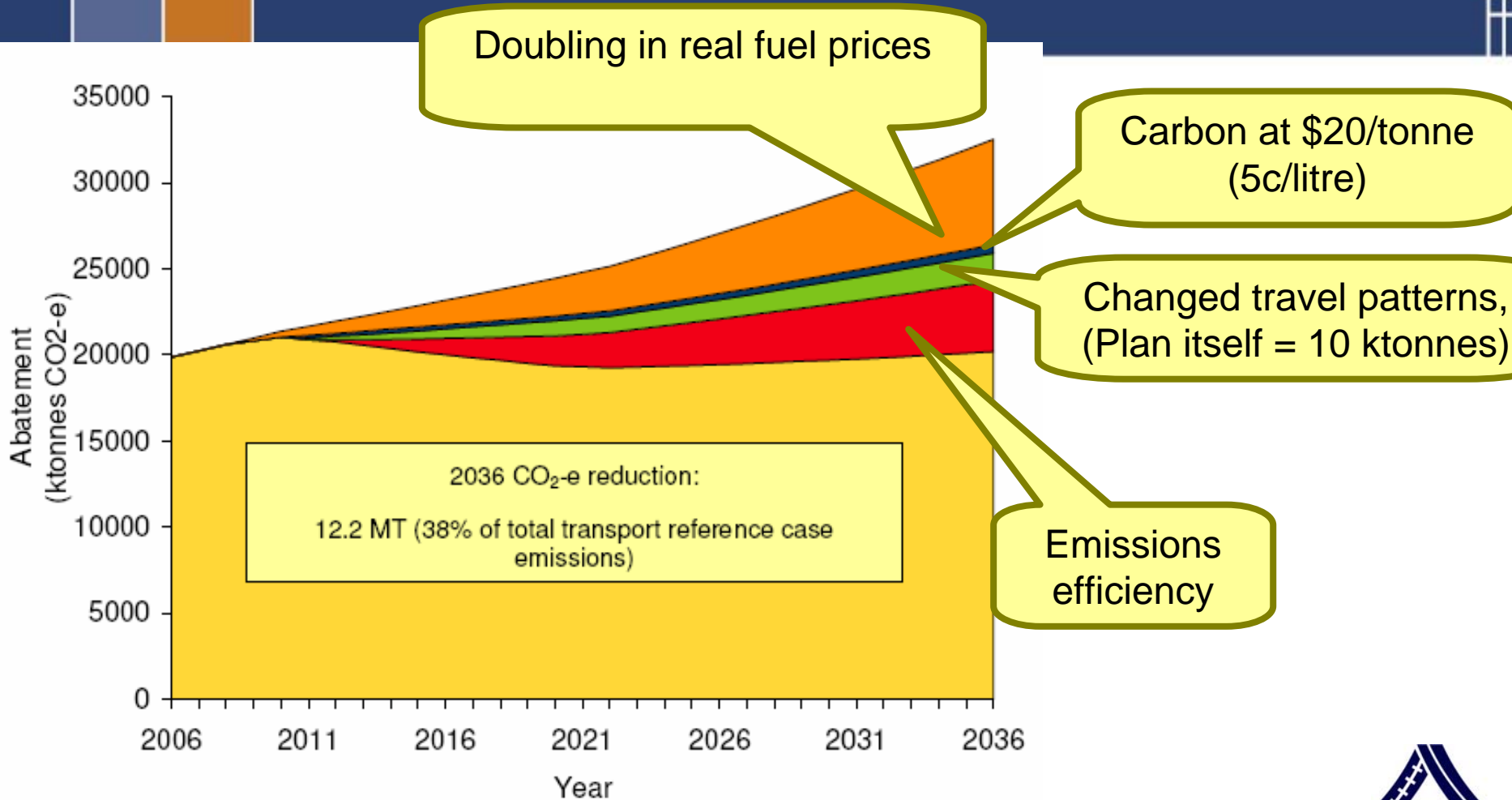
A Tale of Two Cities!



City	Land transport emissions (Mt CO ₂ -eq)	Population	tonnes per person
Melbourne 2007	12.4	3.8 m	3.3
London 2006	8.5	7.0 m	1.2

Sources:
Greater London Authority 2007, DCC 2008 (2006 inventory), DOI 2007, Nous 2008


Victorian Transport Plan emissions forecasts






An exercise

- **Aim:** What magnitude of new measures would be required to meet emission reduction targets for road transport in Australia?
- **Method:** Apply additional measures to BTRE projections of emissions
- **Baseline:** current population and travel demand growth trends



Stage 1: A modest target for road transport: 2020 = 20% below 2000



Six measures to cut emissions

1. Reduce demand for travel
2. Mode shift cars to walking and cycling
3. Mode shift cars to public transport
4. Increase car occupancy
5. Increase freight efficiency
6. Increase fuel efficiency



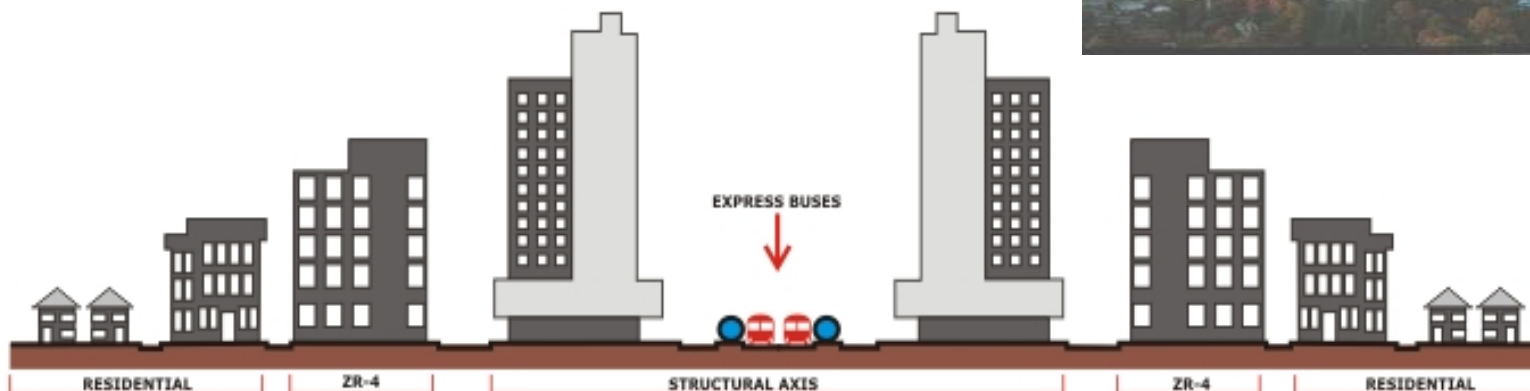
1. Reduce demand for travel



- Fewer and/or shorter trips, e.g.
 - Living closer to daily activities
 - Access services closer to home
 - Trip chaining
 - Working from home
 - e.g. Bento et al. In the Review of Economics and Statistics, comparing Atlanta and Boston (25% reduction in vkms)
- Can maintain *accessibility* while reducing need for *mobility*
- Achieved through:
 - Mixed use urban densification, particularly around public transport
 - Some decentralisation of services
- 10% less car kms than forecast by 2020 = **3.5 Mt** saved

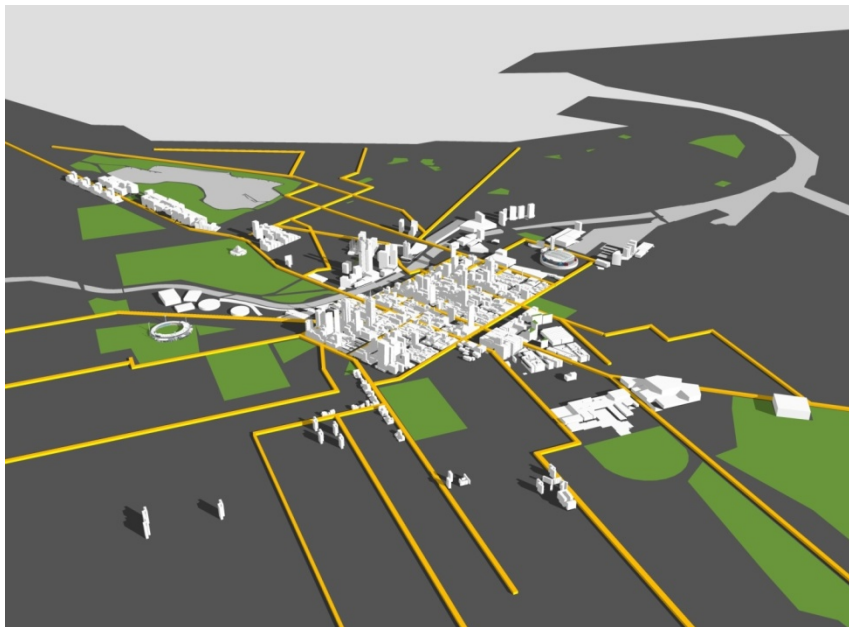
The linear city as an opportunity

The “linear city” as an alternative to sprawl: Curitiba in Brazil





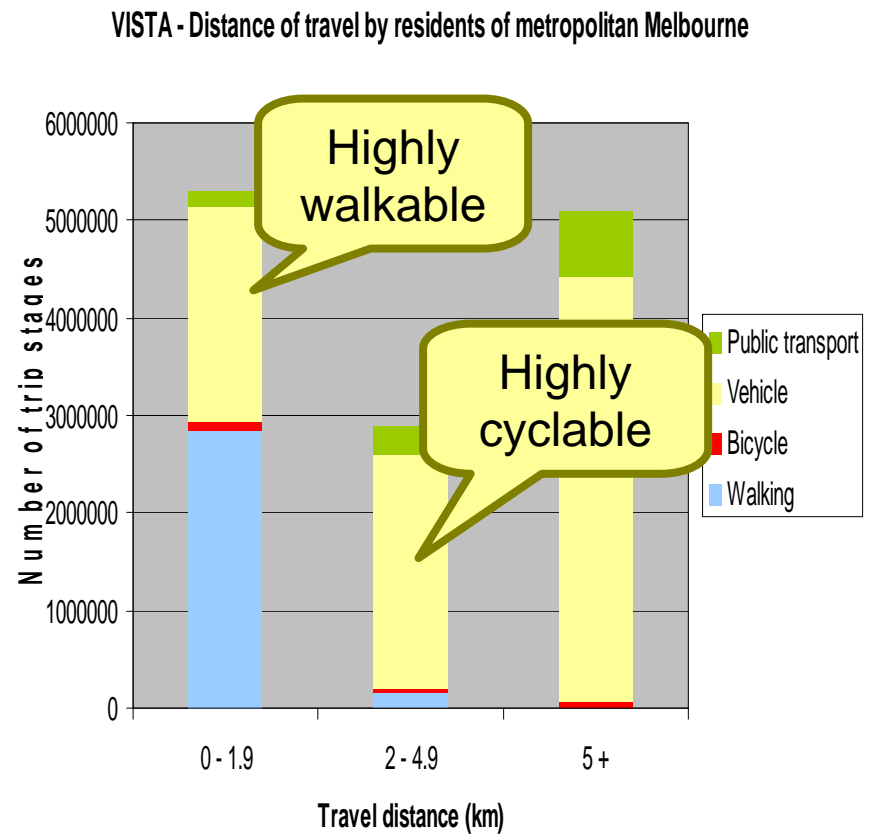
Catering for urban population growth using trunk PT corridors



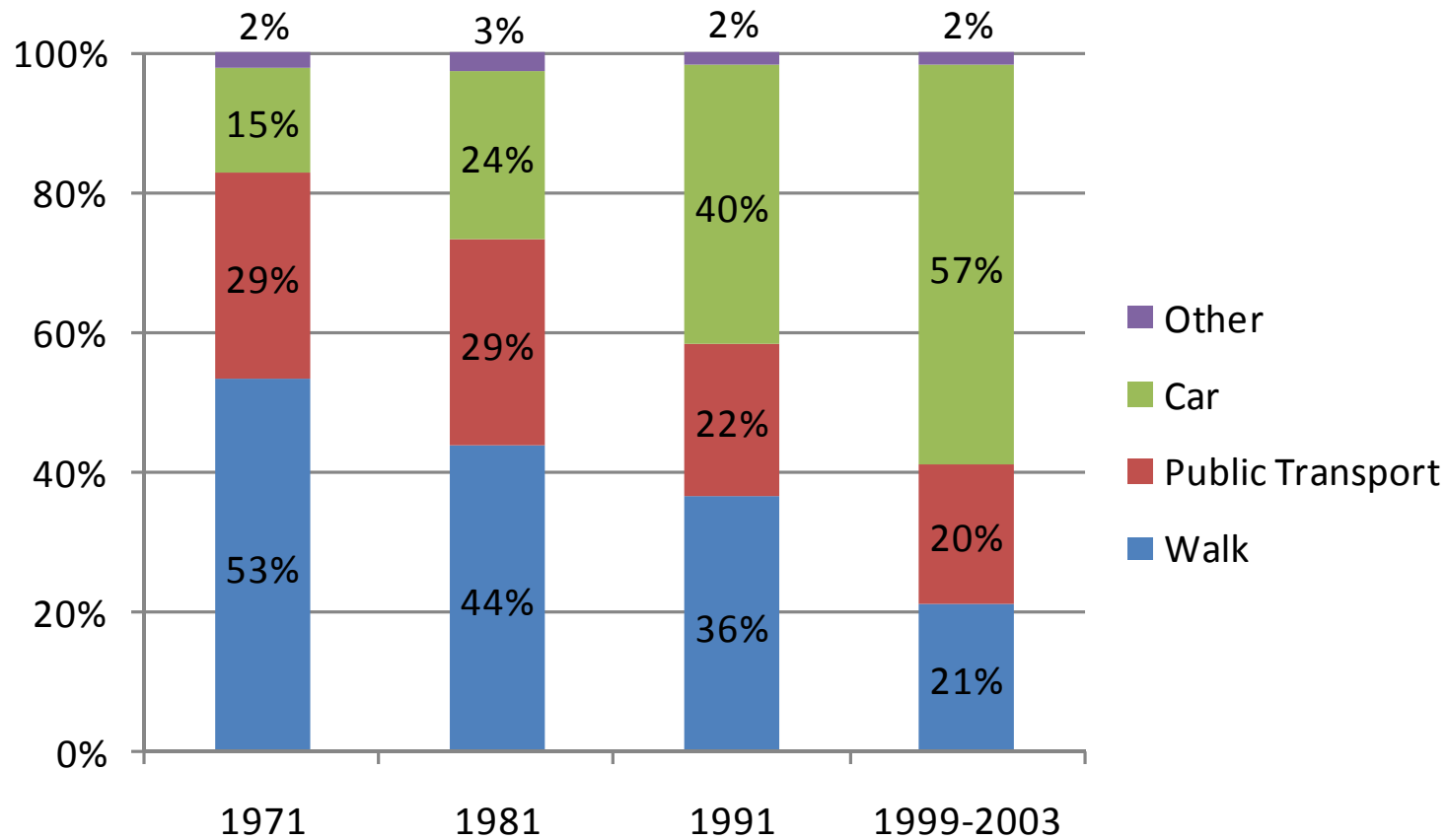
2. Mode shift: car to walking & cycling

- 38% of trips in Australian cities are less than 3km and 52% are less than 5km
 - Many walkable and cyclable trips
- Requires good infrastructure support
- Increasing the walk/cycle share of urban trips by about ten percentage points by 2020 = **4.4 Mt** saved

Note: calculations assume trip distances remain the same in this category (refer measure 1)



Travelling to school in Sydney

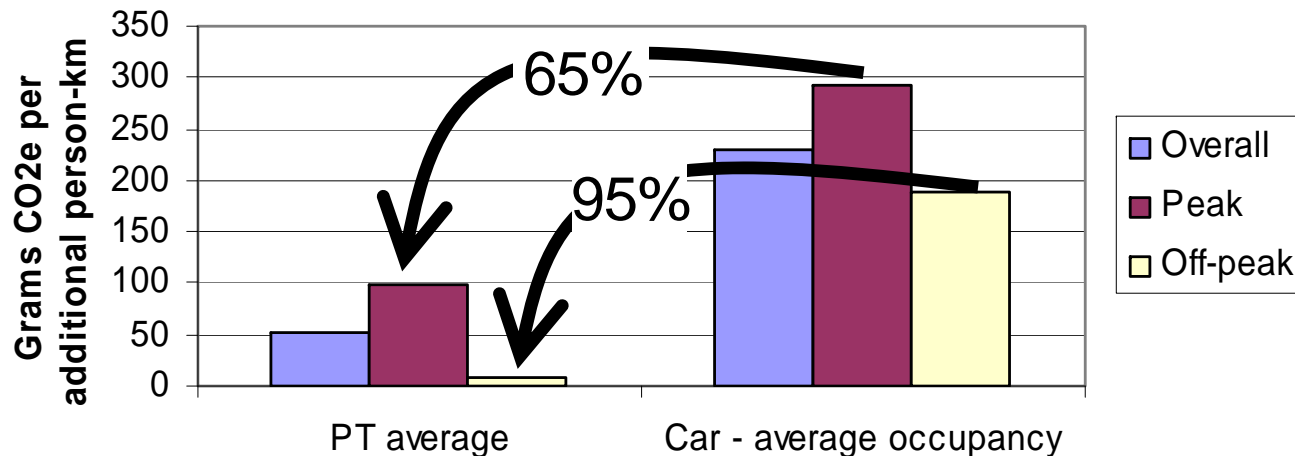


Source: TSC 2003



3: Mode shift: car to public transport

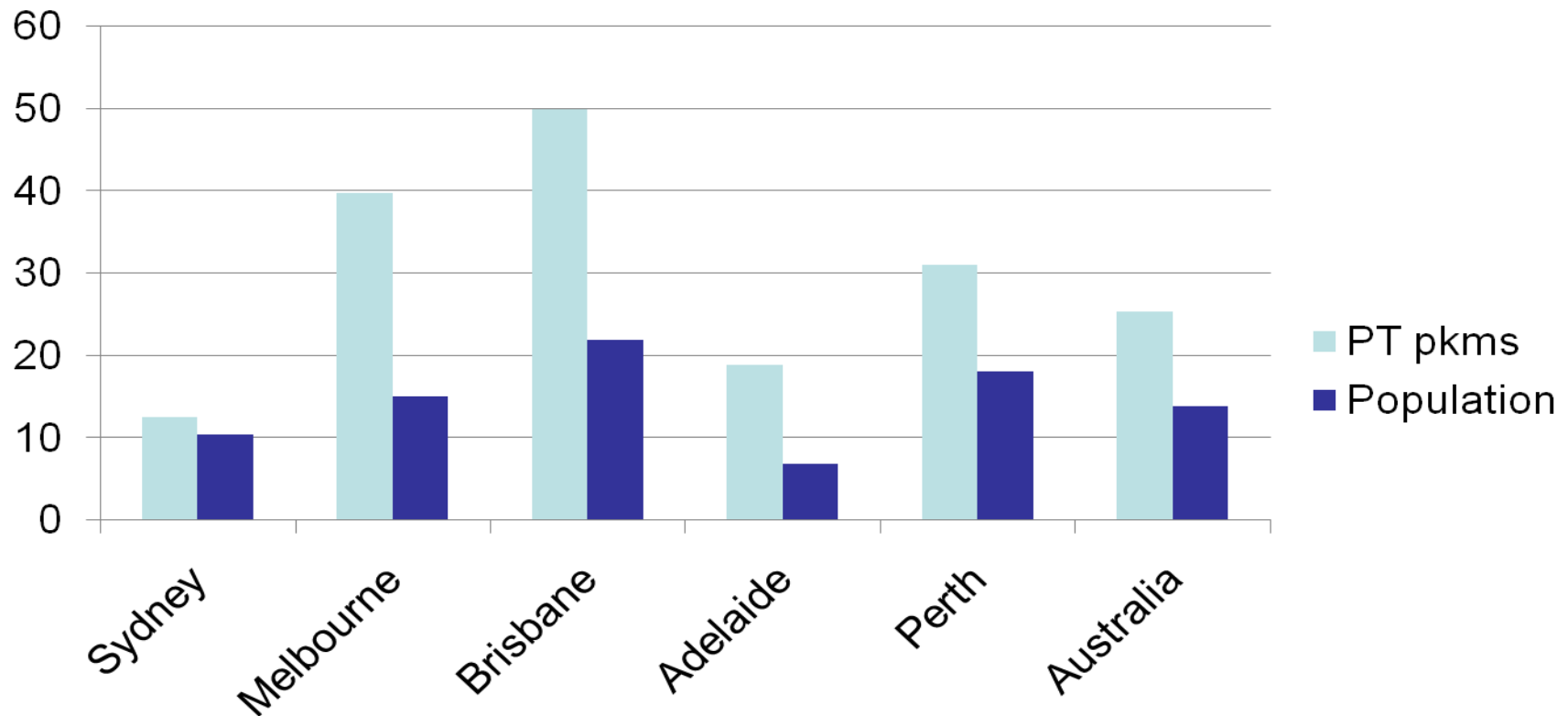
Incremental GHG intensity of passenger transport in Melbourne (2005/06)



Mode shift will reduce both forecast car traffic volumes and congestion.

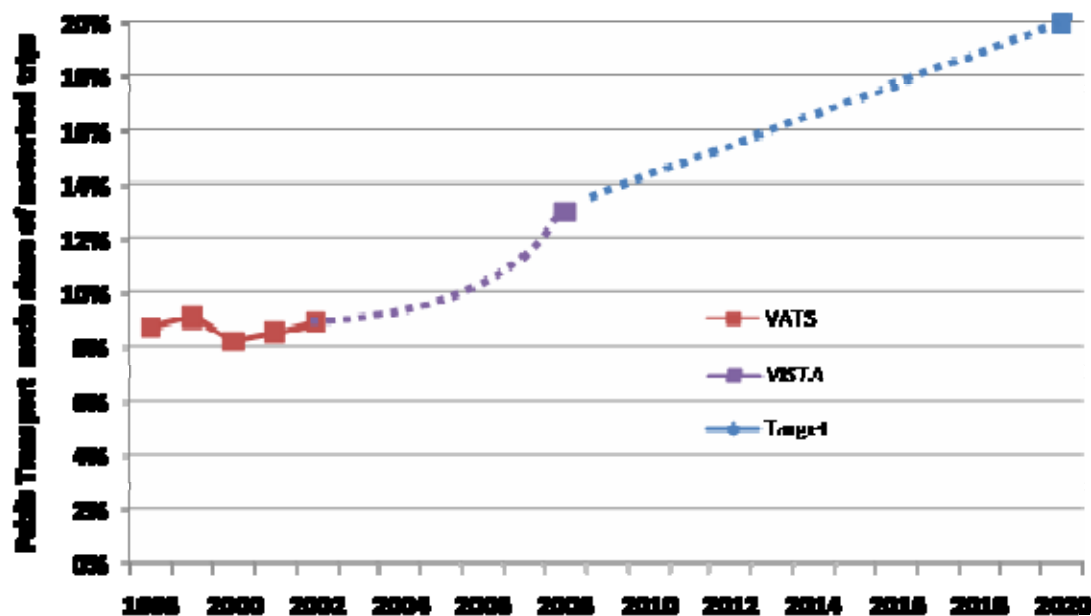
Achieving 20% of motorised kms on PT by 2020 (from 8% in 2000)
= **2.6 Mt saved**

Public transport patronage growth: 1997-2007.



Source: BusVic

Melbourne PT mode share



“Growing Victoria Together” goal:
20% by 2020

Melbourne PT is currently growing at around 11% p.a. (end 2008)

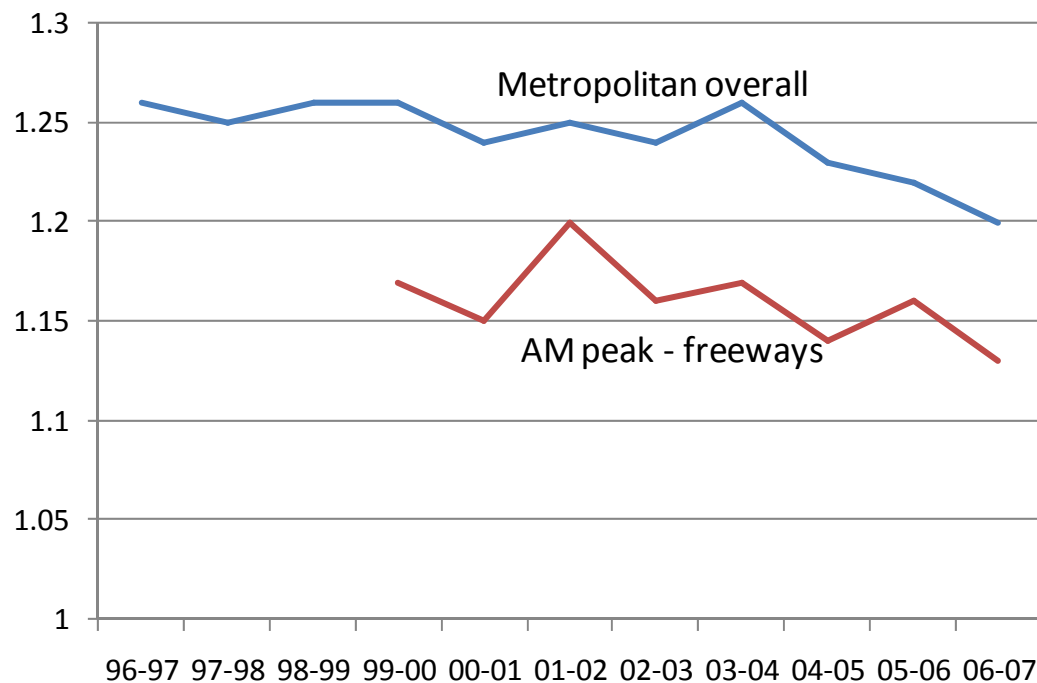
Need 7-8% annual growth in patronage from 2006 to reach 20/2020

Source: Vic Budget 08-09, ABS population estimates,
BusVic projections assume no change in motorised trips per capita and 1.5% future population growth.



4: Increase car occupancy rates

Melbourne car occupancy on arterial roads



Source: VicRoads

When cars are 90% of trips, a small increase has a big effect!

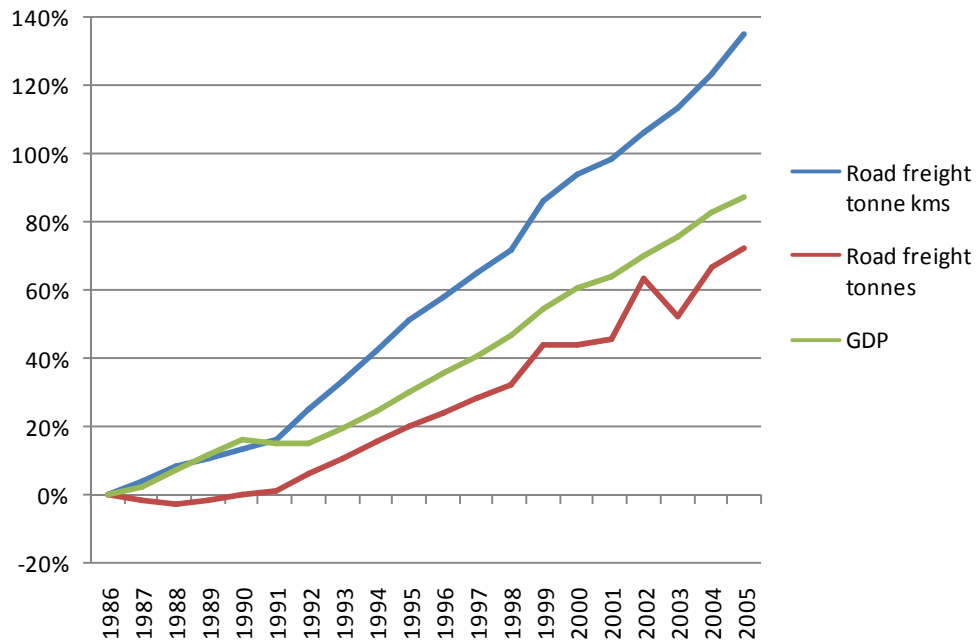
But we are going backwards!

Increase average (all traffic) by 0.2 to 1.6 occupancy by 2020

= **3.0 Mt** saved



5. Freight efficiency



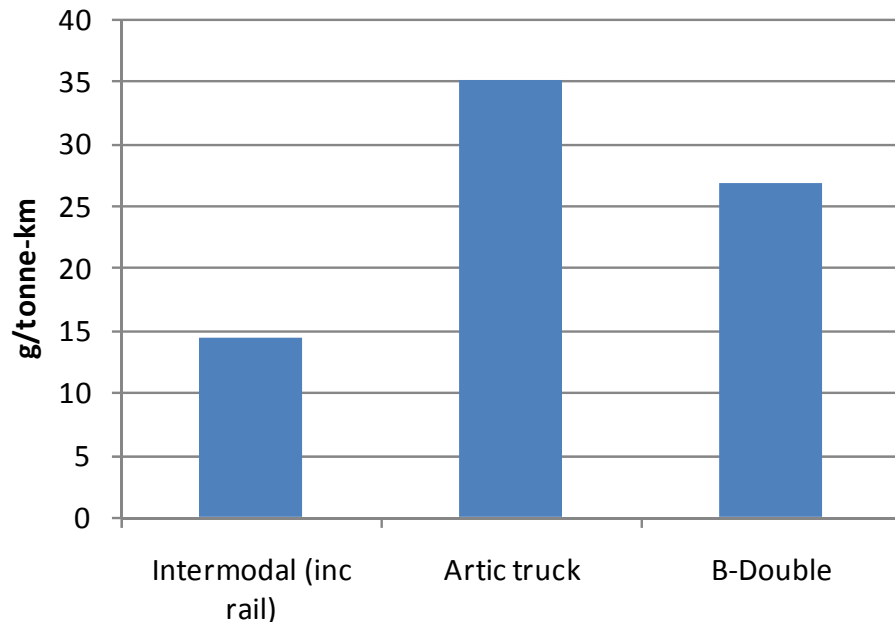
Australian freight tkms are growing at twice the rate of the tonnes moved!

Average distance moved per tonne is up 40%



Moving freight more efficiently

Average greenhouse emission rates on major Australian freight corridors

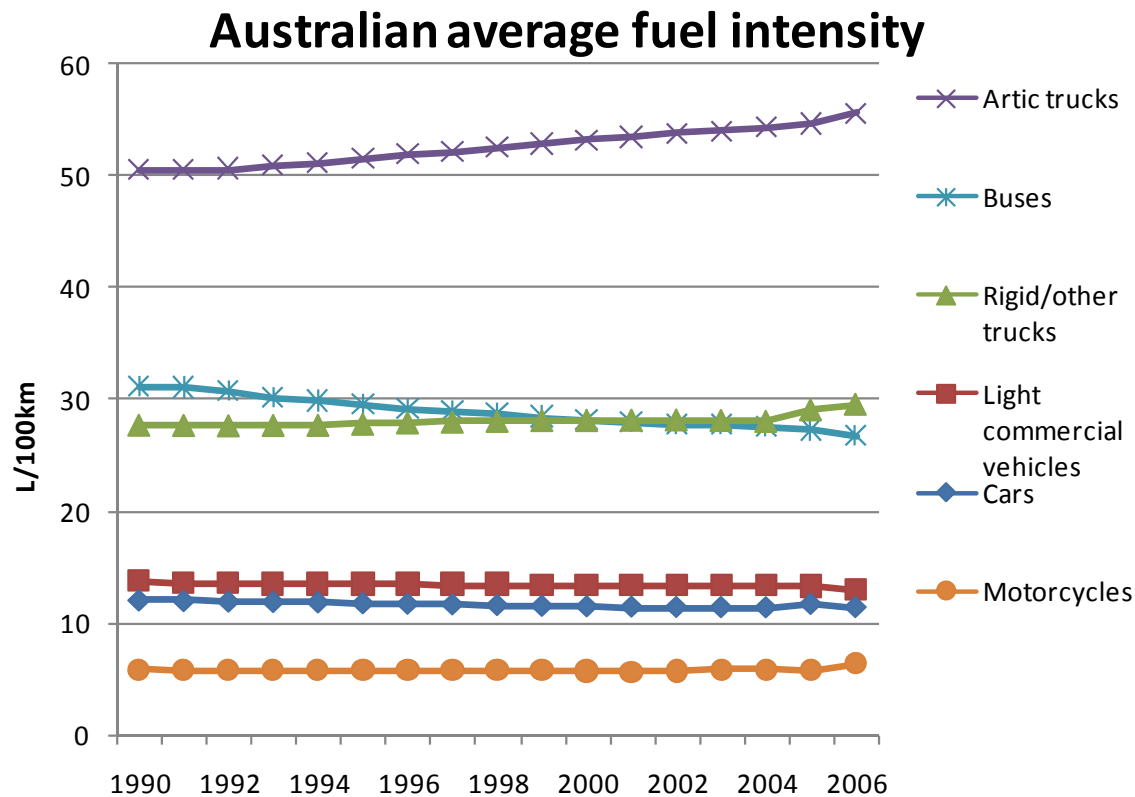


Source: QR 2002

- Melbourne has poor freight efficiency:
 - 49% of truck container slots around the Port of Melbourne are empty
 - 74% of containers have unproductive 'interim' moves
- Reductions achieved by
 - Larger trucks
 - Higher utilisation
 - More efficient distribution networks
 - shifting freight road to rail
- A 30% reduction in fuel usage by 2020 = **11.7 Mt** saved



6: Fuel efficiency

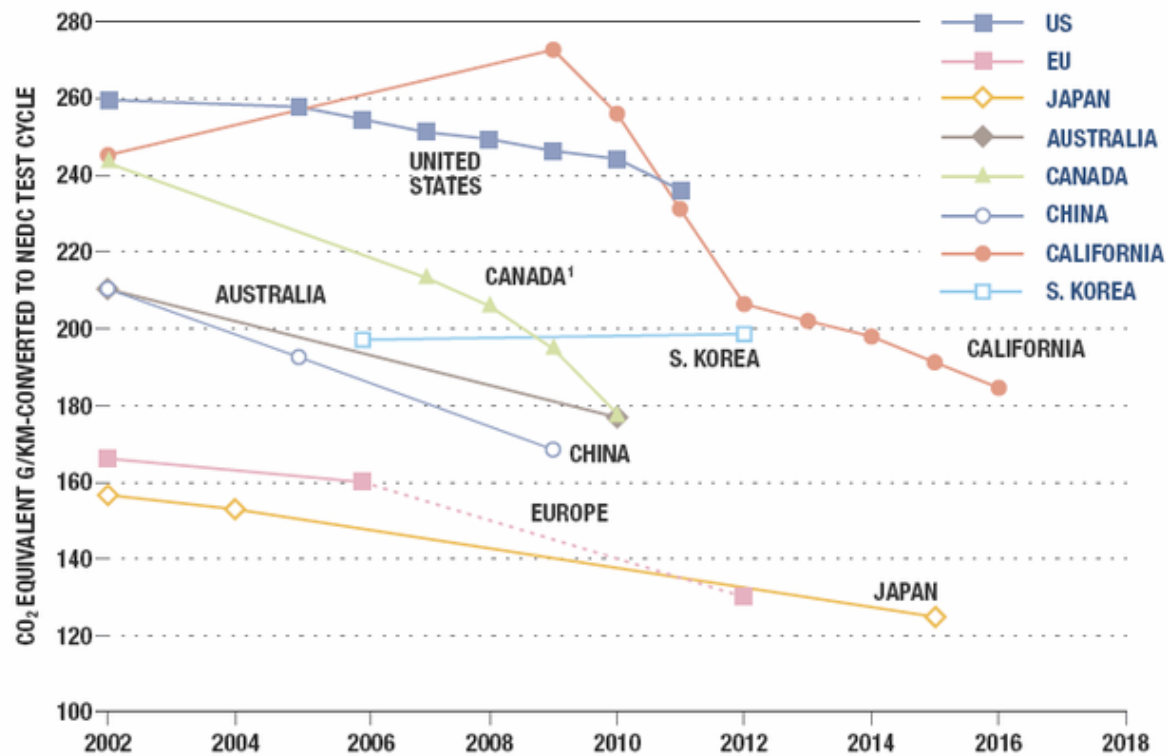


- Overall fuel efficiency is showing no real improvement
- 30% improvement for cars and 18% for trucks by 2020
= **12.6 Mt** saved
- Requires mandatory fuel economy targets
- But... fuel efficiency alone will encourage more traffic – “sticks” will also be needed

Sources: BTRE 2007, ABS SMVU 2007



New car emissions performance targets



Source: International Council on Clean Transportation 2007

EU is canvassing:
95 g/km in 2020 and
70 g/km by 2025

The best Australian
manufactured car is
210 g/km (4cyl Camry)

Hybrid Camry will be
around 126-147g/km

Toyota Prius = 106 g/km





Some issues with fuel efficiency

- We are still buying and manufacturing relatively fuel-inefficient vehicles
- Most efficient vehicles are expensive
 - All five cars $<126\text{g/km}$ are $>\$28\text{k}$
- Governments “flood” second-hand markets with large V6 cars
- Average age of car = 10 years
- Average age of truck = 15.7 years



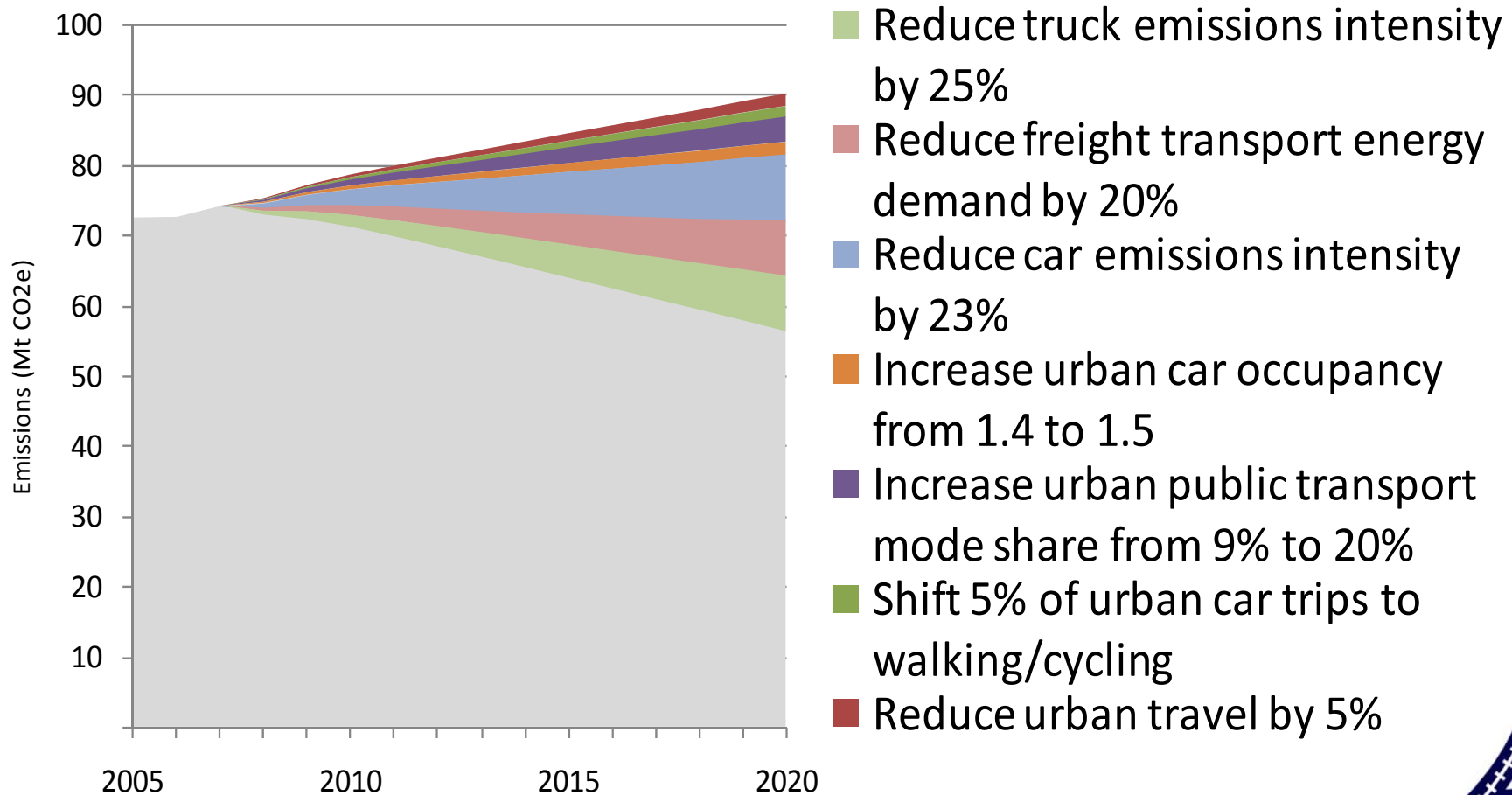
Australian land transport 2020: one path to 20% below 2000 emissions




Measure	Target	2007	2020	Emissions saved (Mt)	Share of savings
1. Fewer/shorter car trips (kms)	Less urban car kms	-	10%	3.5	9.2%
2. Shift car to walking/cycling	Active urban trans. mode share	16%	26%	4.4	11.6%
3. Increase public transport mode share	Urban PT mode share (all trips)	7.5%	15%	2.6	7.0%
4. Increase car occupancy	Urban passengers/car	1.4	1.6	3.0	8.0%
5. Freight efficiency	Less fuel	-	30%	11.7	30.9%
6. Car Emissions intensity	Less than 2007	-	30%	8.2	21.8%
Truck emissions intensity	Less than 2007		18%	4.4	11.5%
<i>Car emissions intensity</i>	<i>g/km</i>	<i>220</i>	<i>155</i>		



The wedges





Some alternative scenarios for achieving 2020 = 20% below 2000

Measure	Target	2007	A	B	C
1. Fewer/short car trips (kms)	Less urban car kms	-	10%	20%	25%
2. Shift car to walking/cycling	Active urban trans. mode share	16%	26%	34%	39%
3. Increase public transport mode share (kms)	Urban PT mode share (all trips)	8%	15%	20%	21%
4. Increase car occupancy	Urban passengers/car	1.4	1.6	1.8	1.9
5. Freight efficiency	Less fuel	-	30%	30%	30%
6. Car emissions intensity	Less than 2007	-	30%	18%	13%
Truck emissions intensity	Less than 2007		18%	13%	8%
<i>Car emissions intensity</i>	<i>g/km</i>	<i>220</i>	<i>155</i>	<i>181</i>	<i>191</i>

High level benefit assessment

Measure	Congestion relief	Improve productivity	Social Inclusion	Reductions in short term	Job creation
Reduce travel demand	✓	✓	✓		
Mode shift to public transport	✓	✓	✓	✓	✓
Mode shift to walking, cycling	✓	✓	✓	✓	
Increase vehicle occupancy	✓			✓	
Improve freight efficiency	✓	✓		✓	
Vehicle emissions efficiency	✗	✓		✗	in Aus?

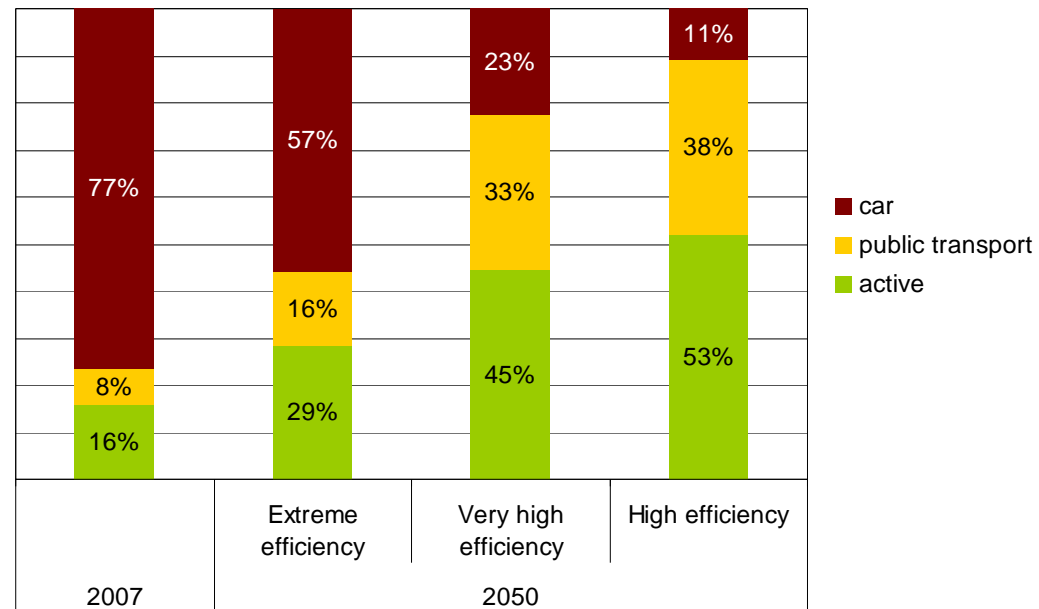
2050 target = 80% below 2000

Measure	Target	2007	2020 (A)	2050 Extreme efficiency	2050 Very high efficiency	2050 High efficiency
1. Fewer/short car trips (kms)	Less urban car kms	-	10%	10%	25%	30%
2. Shift car to walking/cycling	Active urban trans. mode share	16%	26%	29%	45%	53%
3. Increase public transport mode share	Urban PT mode share (all trips)	7.5%	15%	16%	33%	38%
<i>Car mode share</i>	<i>Urban pax/veh</i>	<i>77%</i>	<i>59%</i>	<i>57%</i>	<i>23%</i>	<i>11%</i>
4. Increase car occupancy	Urban passengers/car	1.4	1.6	1.7	2.6	2.8
5. Freight efficiency	Less fuel	-	30%	30%	60%	80%
6. Car Emissions intensity	Less than 2007	-	30%	92%	84%	75%
Truck emissions intensity	Less than 2007		18%	89%	83%	75%
<i>Car emissions intensity</i>	<i>g/km</i>	<i>220</i>	<i>155</i>	<i>18</i>	<i>36</i>	<i>54</i>

Note: model probably underestimating emissions for 2050 – higher cuts may be required

Urban transport will probably be very different in 2050!

Urban transport mode shares





Transport objectives to tackle climate change

- 1. Reduce demand for motorised travel**
 - Land use planning (density, co-location)
 - Maximise walking and cycling
- 2. Mode shift to low carbon modes**
 - Cars > Public Transport
 - Trucks > Rail
- 3. Improve vehicle utilisation**
 - Higher car occupancy
 - More efficient freight movements
- 4. Reduce vehicle emissions intensity**
 - More efficient vehicles (the largest single contributor)
 - Smaller vehicles
 - Alternative fuels (problematic at present)
 - Intelligent transport systems
 - Better driving practices



An action plan

1. **Significantly improve fuel efficiency (mandatory targets)**
2. **Comprehensive road pricing (replacing existing charges with full externality pricing)**
3. **More compact, walking and cycling friendly urban settlements**
4. **Increased investment in public transport**
5. Invest in rail freight and inter-modal hubs
6. Freight efficiency
7. Reallocate road space to prioritise low emission modes
8. Behaviour change programs