Submission to National Aviation Policy

Ben Rose, 18/4/08

About the Author

The author is an environmental consultant and CO2 / energy auditor, with 3 years experience in high school teaching, 16 years experience in agricultural extension and 5 years' consulting. Recently, he has conducted 16 CO2 / energy audits for commercial companies from small offices to a large mine. Of the 16 commercial audits conducted by the Author, at average of least 20% cuts were identified as easily achievable by energy efficiencies using existing technology. In the area of fleet vehicles and travel, the 'no cost' reductions identified were even higher.

He has developed educational materials and an emissions calculator for direct and indirect emissions of households and small businesses, now being used by the WA State Department of Planning and Infrastructure and has been giving talks on global warming Australia's CO2 emissions since 2003. GHG-Energy-Calc can be downloaded from www.ghgenergycalc.com.au. Other educational materials including the Background Paper to the Calculator can be found on www.carbonneutral.com.au. He has also been consulting to Carbon neutral on forest sink CO2 sequestration, Greenhouse Friendly accreditation and the development of a Carbon Reduced certification for businesses. He sits on the executive committee of the WA Conservation Council and is a member of Sustainable Transport Coalition of WA. However this submission does not necessarily reflect the policies of these bodies and is not made on behalf of either of these organizations. The views expressed in this submission are those of the Author.

Introduction

This submission focuses first on 2 key principles relating to greenhouse emissions and 'peak oil', then addresses several 'key questions' to be considered' from the National Aviation Policy Issues Paper Section 4.1

1. Reducing greenhouse gas emissions and the impact of 'peak oil'

i. The linked issues of Greenhouse gas emissions and increasing scarcity/ rising prices of aviation fuel should take precedence over the other issues raised in Discussion Paper. Greenhouse gas emissions of aircraft are already understated by some 200 % (see Appendix).

ii. The future of aviation must not be viewed in isolation. Planning for inter-city passenger transport infrastructure should be integrated over all modes. To achieve hard emission reduction targets and provide transport security for a future of increasingly scarce fuel, policy should aim for a shift to fast rail and road transport and an over-all reduction in demand for air travel over the next 10 years.

An emissions reduction target of 20% by 2020 is becoming increasingly likely and in order to achieve this, reductions must be made in the form of more than 20 'wedges', representing reductions in many sectors. Aviation is often excluded from such considerations, probably because the official Department of Climate Change (DoCC) National Emissions Inventory estimates aviation as accounting for about 0.85 % of our emissions. This is grossly understated (Appendix 1), as:

- It only considers domestic aviation; international flights account for more 190% more emissions than domestic.
- It only includes 'tailpipe emissions', ignoring the 10% additional upstream additions incurred from the production of the aviation fuel
- It does not count non-CO2 emissions

The true greenhouse emissions impact of aviation (not counting embodied emissions of airport infrastructure) is some 6 times that stated by the DoCC emissions inventory – making it almost 5% of our total emissions. Aviation should therefore be one 'wedge' for decreasing emissions.

Need to factor high carbon and fuel prices into transport modelling

It is very dangerous to make the short sighted assumption that air travel must continue to grow as it has for the past 10 years. ‘Peak oil’ has already arrived (ASPO, 2008) and the oil price has trebled in three years. As stated above, Australia will soon be committing to a ‘hard target’ emissions reduction of 20% by 2020.

As a starting point, economic modelling of any transport mode should include removal of all perverse fossil fuel incentives, inclusion of ‘user pays’ fuel taxes, a carbon tax of $40 per tonne and sensitivity analyses with fuel price increases of up to 500%. All of these are not unlikely to happen before 2020. Modelling under these scenarios is likely to show that passenger air transport will become significantly more expensive and less cost effective than fast rail or road bus.

Integrated planning of long distance travel modes

Planning of aviation, long distance rail, long distance bus and ferry transport should all be covered in the same planning process and integrated with planning to meet hard CO2e emissions targets. Planning each mode in a separate ‘silo’ with its powerful commercial interest lobbies is likely to give an unbalanced result, with one mode favoured over another and many factors not taken into account.

An integrated approach to planning inter-city and regional passenger transport would highlight the fact that passenger rail travel is much less emissions intensive than air (Table 2 below) Figures for the UK show that in 2004-5, per passenger CO2 emissions intensity of electric was less than 1/5 that of domestic air. If the non-CO2 greenhouse emissions from jet aircraft are included (contrails and nitrous oxides/ ozone) aircraft are more than ten times more emissions intensive than electric rail. Although electricity emissions per MWh in the UK are lower than in Australia, supplementation with wind generation along the route could reduce electricity emissions per MWh to below UK levels.

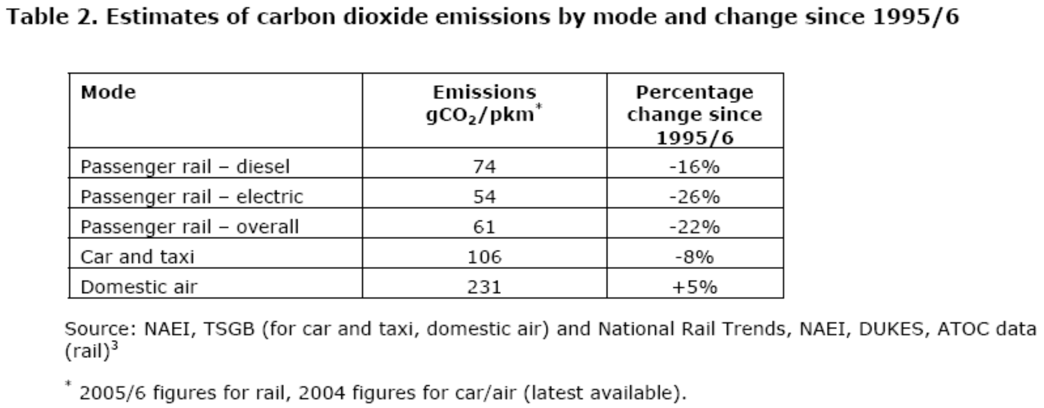

Table 2. Estimates of carbon dioxide emissions by mode and change since 1995/6

Mode	Emissions gCO_2/pkm^*	Percentage change since 1995/6
Passenger rail – diesel	74	-16%
Passenger rail – electric	54	-26%
Passenger rail – overall	61	-22%
Car and taxi	106	-8%
Domestic air	231	+5%

Source: NAEI, TSGB (for car and taxi, domestic air) and National Rail Trends, NAEI, DUKES, ATOC data (rail)[3]

[*] 2005/6 figures for rail, 2004 figures for car/air (latest available).

ref: http://www.railplus.com.au/pdfs/ATOC-rail-is-greener-report.pdf

The 5- fold difference in emissions intensity cited above is under-stated, due to low relatively low passenger loadings on trains and the consideration of CO2 emissions alone. Energy intensity per passenger km for long haul aircraft is estimated to be 0.38 kWh for long haul aircraft and 0.58 kWh for short haul, assuming passenger loading of 75% (Rose, 2007. *GHG-Energy Calc – Background Paper*. www.carbonneutral.com.au). For fast regional services with electric trains (in Sweden), the load factors vary from typically 20 to about 40 %, while the energy consumption varies from 0.07 kWh per pass-km (for the highest load factor) to 0.18 kWh/pass-km. (Royal Institute of Technology, Stockholm, 2006. http://www.kth.se/fakulteter/centra/jarnvag/publications/Energy_060925.pdf). At similar passenger loads, it can be inferred that Swedish passenger rail would be up to ten times more energy efficient than long haul air.

Given the need for deep emissions cuts and uncertainty about the price and continuing supply of aviation fuel in the longer term, many major routes would be better served by fast electric rail. It will be found that to meet emission reduction targets, a policy of assisting growth in fast rail, bus and sea transport and contraction of air travel is needed.

The first and obvious step to rationalizing use of transport modes is to remove ‘perverse subsidies’ for aviation i.e. aviation fuel taxes should be introduced and full ‘user pays’ applied to all aviation services, including airports. This should entail imposing a tax on aviation fuel equal to that of road fuel (currently about 38c per litre plus 10% GST) and including aviation in emissions trading (several cents per litre fuel price increase). The fuel taxes would probably only partly compensate for the public spending required to service the airports and additional airport taxes may also be needed. With these reforms, the price of air travel would increase substantially and demand would be reduced accordingly, having the desired effect of reducing aviation emissions.

Fast electric rail links between the major capital cities

Over 80% of domestic flights are between the state capital cities (ABS, 2008). ‘There are 69 flights each way per day between Sydney and Melbourne. These travellers could be moved in a more climate-friendly way. Brisbane–Gold Coast– Newcastle–Sydney–Canberra–Melbourne is a corridor whose distances and travel demand are well suited to high speed rail. The high speed rail service would also serve key regional centres along its route, for which car travel is currently the main option’. (Canberra business Council, 2008).

With removal of the favoured treatment of aviation as described above, the price of air tickets will rise and tax revenue will increase. The tax revenue generated should be spent on dedicated fast dual rail tracks linking the central stations of the major cities. It may be possible for some rail routes to be adjacent to interstate electricity powerlines and the line electrified and supplemented by wind generators along route.

The existing slow heavy rail trains used on most routes between our major cities are at least 40 years out of date. They use up to 6,000 kW of diesel power to transport up to 400 passengers at average speeds of less than 80 kph. For example the Journey from Sydney to Perth takes about three days and costs significantly more than by air, mainly due to higher staff costs to run the heavy diesel train for such a long time. They are clearly not a viable inter-city transport option for the future.

High speed (300 kph) electric rail (HSR) is already a commercial success in China, Europe and Japan. The trains built by Alstom, France have the following specifications (*Alstom 2007*).

- **Modular design:** 7 to 14 cars (130 to 250 m)
- **Seats:** 250 to 650
- **Mass:** 270 to 510 tonnes
- **Power:** 6,000 to 12,000 kW (22 kW/t) *(about 18 kW per passenger)*
- **Traction equipment:** Quadri-voltage 25 kV 50 Hz / 15 kV 16.7 Hz / 3 kVdc / 1.5 kVdc, water cooled IGBT traction converters, permanent magnet motors

These trains run on high grade conventional rail tracks.

However the construction costs HSR are high. The proposed Sydney-Canberra 270 km HSR link was costed at $3.7 b in 1998. (Quantm, 2008) http://www.quantm.net/attachments/ACF1ED.pdf). While construction cost reductions have since been identified, allowing for a 50 % increase in cost to $5.5b today, the cost would be about $20m per kilometre (typical of other HSR systems). This route would be amongst the most expensive in Australia as it traverses mountainous terrain for much of the route.

At 38.4 million passenger domestic departures per year (ABS 2008 Year Book. http://www.abs.gov.au/AUSSTATS/abs@.nsf/7d12b0f6763c78caca257061001cc588/83370CA43C85CE6ECA2573D20010BE45?opendocument), increasing airport and fuel taxes an average $100 per domestic flight would raise $3.8b per year, which would pay for a Sydney-Canberra HSR link in less than 2 years. Travel time Sydney – Canberra by HSR would be about 1 hour. Sydney-Melbourne and Brisbane would be under 4 hours.

However, if HSR is found to be uneconomic in the Australian situation, a fast train running at half this speed would still provide a respectable overnight travel time of less than 8 hours Sydney-

Melbourne and 2 hours Canberra – Sydney. A fast rail link with LNG powered trains (see below) at less than ¼ the construction cost would surely be viable and could be electrified in future.

Ticket prices should be priced significantly less than air tickets and the system would be virtually immune from the looming security issue of oil shortages and rapidly increasing oil prices. Supplementing the electricity supply with up to 30% wind generation (a figure already attained by some Scandinavian countries) along the routes would further increase the security of this system and reduce the per passenger greenhouse emissions.

Fast long distance rail links with gas or diesel powered trains

While HSR would be too expensive to link Perth and Adelaide with Sydney and Melbourne, there are lower speed rail options that would be viable. A dedicated non-electrified fast (180 kph) rail, initially running LNG powered passenger trains could be constructed at much lower cost. The 1420 km Adelaide – Darwin rail line is rated at 115 kph and cost about $1.2b – $0.8b per km. A 180 kph rail Perth – Canberra rail ink (3,800 km) would surely be feasible for less than $2 million per km – less than $7.6b.

Australia should be involved in research and development of 'new generation' carriages. With first class aircraft style sleeping pods for comfortable overnight travel and facilities for use of computers and telecommunications, travellers could sleep and work and conduct business en-route.

Express 'road train sleeper buses'

Road coaches provided a cost effective alternative to flying for interstate and regional travel until the 1980's. Their main disadvantage was the low level of comfort provided. Specially designed large articulated double deck coaches with sleeping pods similar to those described above could be introduced for the longer regional services. Carrying 60 passengers, such vehicles would be at least as fuel efficient and comfortable as fast rail, with the disadvantage of being much slower. As for the rail options above, this would not be viable under the existing aviation fuel prices and perverse incentives for air transport.

2. Response to 'Key Questions', Section 4.1 of the Issues Paper

2.1 What practical steps can the aviation industry take right now to reduce greenhouse gas emissions? Are carbon offset schemes enough?

Carbon offsets increase the price of a ticket from Perth to Sydney by only $20 – 40 which, even if mandatory would not significantly affect demand. Majority voluntary uptake is not likely, with less than 5% currently offsetting. Take the scenario of all passengers' flight emissions - 31 million tonnes CO2e per year, (Appendix 1) being offset by tree planting, which is currently the main offset method available. It would take 100,000 ha planted per year at a typical sequestration rate of 300 t CO2e per ha for 300 – 500 mm rainfall agricultural land. If the 'plantable' area is assumed be 10% of the total 30 million ha of agricultural cropping land, i.e. 3 million hectares were planted to offset flight emissions alone it would all be planted in 30 years and this offset option would be exhausted.

However, I believe that carbon offset should be encouraged. There is a lot of agricultural land that would benefit from tree planting. However, even if offsets were mandated, this can only ever be a partial 'stop gap' solution to mitigating transport CO2 emissions.

The main steps the aviation industry needs to take to reduce per passenger CO2e emissions are:

1/ Encourage per passenger fuel efficiency standards for all flights, with financial penalties for airlines that do not meet the standards. This will entail:

i. Airport charges based on total flight emissions not the number of passengers or flights
ii. The use of the largest possible aircraft (e.g. A380) with the highest number of seats (i.e. all economy class).

iii. >95% passenger loading, re-schedule flights less than 90 % loaded; current passenger loading averages 79%, (ABS, 2008).
iv. A change from ‘frequent, guaranteed flight’ schedules to less frequent flights with larger aircraft and a requirement for re-scheduling of flights with less than 90% passenger load.

2/ Any other minor fuel saving practices that are often mooted, such as towing planes on taxi-ways and scheduling to reduce ‘que time’ while waiting to land should also be implemented as a matter of urgency. However the effect on emissions would be minor compared to (i) to (iv) above.

I believe that all of these measures by the aviation industry, combined with government fiscal and funding intervention to foster cheaper alternative fast land travel alternatives will be necessary to curb demand for air travel and reduce travel emissions.

2.2 What measures should the aviation industry be taking in the short-medium term to reduce emissions, such as clean engine technology and clean aviation fuels?

‘Pipe dreams’ of renewable fuels or low emission air travel should not be taken seriously. There are already riots in some countries due to the more than doubling of grain prices, partly due to increased demand from bio-fuel operations.

The latest generation of large aircraft with potential for per passenger fuel efficiency of 3 L/ passenger km (compared with about 4 L/100 passenger km for Boeing 747) are most likely to be the efficiency benchmark for the next 30 years – the expected life of these aircraft. Any strategy should logically be based on this assumption. The ‘demand side’, scheduling, levies and aircraft configuration measures listed above are the only tools that are certain to reduce aviation emissions at low cost.

That is not to say that research on low emission flight technology should not be encouraged, but it needs to be recognized in any transport strategy that the ‘dice is loaded’ against achieving further significant greenhouse emissions reductions in aviation. Even the latest generation aircraft are at least 4 times as energy intensive and more than 8 times as emissions intensive as long distance rail or bus. (Rose, 2007). We are certainly locked into current jet technology for the next 30 years It should also be noted that increases in fuel efficiency of jet engines generally entail higher fuel burn temperatures which increase nitrous oxide/ ozone emissions.

2.3 Given the international nature of aviation, what opportunities are there to minimise greenhouse emissions and trade emission permits through emission trading schemes?

Aviation fuel for both domestic and international flights should be included in an emission trading scheme, whether this is national or international. This will increase ticket prices (though only marginally) thereby exerting some downward pressure on demand for air travel.

For reasons stated in Section 1 of this submissions and the Appendix, carbon trading at the higher medium term foreseeable carbon price rate of $40 per tonne CO2 will be nowhere near sufficient to reduce greenhouse gas emissions from aviation. This alone would result in about 12 cents increase per litre in aviation fuel price, which would translate to less than 5% increases in ticket prices. The addition of GST and tax equivalent to road fuel (i.e. removal of the existing perverse incentives) will be necessary and would add about 48c per L to the aviation fuel price. A major international agreement would be needed to override a 1930’s agreement exempting aviation fuel for international flights from tax. Australia should be a leader in international efforts to implement carbon and other taxes on aviation fuel. There is no such impediment to taxes being levied on domestic aviation fuel.

I believe that the other transport policies outlined in Section 1 will be necessary in addition to aviation fuel taxes to reduce aviation emissions. International agreements will eventually be necessary to implement carbon and other taxes on aviation fuel and the other measures outlined in this submission on an international scale. As at 30 June 2002, Australia had bilateral air services arrangements with 57 countries and emissions reduction principles should be the basis of negotiating all of these agreements (ABS, 2003). Meanwhile, Australia should develop the partnership recently initiated by Kevin Rudd with the EEC, leading the world and implementing aviation emissions reduction measures in step with them.

Appendix 1

Air Travel Emissions Understated

This appendix explains why only about 1/6th of Australia's real greenhouse gas emissions from air travel are officially reported. There are three main reasons for this:

1. The National Greenhouse Gas Inventory (NGGI) only covers domestic aviation. Including the international flights from Australian airports increases this figure by some 190%.
2. Kyoto Protocol greenhouse gas national inventory reporting only accounts for 'tailpipe' CO2 emissions i.e. CO2 that would be produced if aviation turbine fuel were burned in at ground level. Including the 'upstream' CO2 emissions from the production of the fuel increases the real emissions accountable by aviation by an additional 10%.
3. The additional radiative forcing effect of other greenhouse gases - nitrous oxides, ozone and contrails - produced by jets at high altitude are not counted. Total radiative forcing (greenhouse effect) of aircraft emissions is 2-4 times that of CO2 alone (International Panel on Climate Change, 1999). Accounting for these emissions makes the true global warming impact of aviation in Australia about 270% higher again that 1 and 2 above.

Officially, Australia's aircraft emissions were reported under the National Greenhouse Gas Inventory as: "Domestic aviation contributed 6% - 4.8 million tonnes of transport emissions." This figure equates to about 0.85% of Australia's total CO2 emissions. Applying 1-3 above, the real figure is about 5.6 times higher – about 4.8% of Australia's total emissions.

Table 1 below includes GHG emissions from international flights (estimated by the Author from ABS international arrivals and departures statistics) and non-CO2 emissions. The Author estimates that the real figure for global warming potential caused by Australian domestic and international flight kilometers based on 2003 statistics is about 31 million tonnes CO2e.

Table A.5.1 Estimation of emissions from air travel by Australians, derived from ABS published statistics, 2003

Derived from ABS stats	**Domestic**	**International**	**Total**	**TOTAL million tonnes CO2e**
Million passenger km	34,643	64,252	98,895	
Average km air travel (20 million population)	1,732	3,213	4,945	
Thousand litres of fuel(2)	1,850,000	2570080	4,420,080	
Tonnes CO2e using DoCC full cycle figure for turbine fuel burned at ground level	4,810,000	6,682,208	11,492,208	
Total tonnes CO2e using the 2.7 times multiplier for jet aircraft in flight	12,987,000	18,041,962	31,028,962	31 million t

Notes:

1. *Fuel use was estimated using 4L/1000 passenger km for international and 5.3L/ 1000 km for domestic flights.*
2. *Full cycle CO2 emissions were estimated using the DCC emission factor of 2.8 (AGO, 2006)*
3. *A multiplier of 2.7 times CO2 was applied to give total radiative forcing expressed in CO2e. (IPCC, 1999)*

As a result of the current under-reporting, the real global warming impacts of air travel are often not officially recognized by Government. Consequently, national greenhouse reduction strategies and public awareness campaigns have ignored air travel and the level of community awareness of the impacts is still low.

Added to this are the current advertising campaigns by airlines offering cheap emissions offsets. The most misleading (even fraudulent) aspect of these campaigns is that flight emissions are grossly understated by using the AGO emission factor based on tailpipe CO2 emissions rather than actual global warming impact of jet aircraft in flight at high altitudes.

Australians travel, on average half as far by air as we do by car. The average distance per head of population traveled by air is about 4940 km per year (derived from ABS international and domestic travel data, 2003), compared to about 9,900 km traveled by road (ABS, 2005). About 69% of international flights are for holidays. Air travel continues to grow due to its low cost, and the lack of alternative bus and train services on longer routes. There are several reasons for the low cost of air travel, one being lower labour costs due to shorter travel times. However, another major reason is that there is virtually no tax on aviation turbine fuel. Under a 1930's international agreement, it is levied at only a few cents per litre compared to, for example 38c/L for road transport fuels in Australia and over 80c/L in Europe. If a 38c/L levy were applied to aviation turbine fuel this mean a price increase of about 40%.

If a carbon cost of $30-40 per tonne CO2e were applied (the current European 'cap and trade' abatement scheme does not apply to air transport) the cost of aviation turbine fuel would rise by a further 10%. It can be argued that taxes reflecting 'intangibles', including environmental, public infrastructure and health costs should be added. It can also be argued that a GST or VAT tax should be applied to the whole cost of tickets worldwide. This would raise the cost of jet fuel to well over 50% higher than current levels and would 'level the playing field' in line with road fuel costs. As fuel comprises about 30% of the cost of flying, fares would be expected to rise by up to 20%. Rising crude oil prices will add to this. However, with the popularity of overseas holidays and increasing affluence of many, it is unlikely that even a doubling of ticket prices would be sufficient to significantly curtail the growth in air travel.

In view of the already significant contribution of aviation to global warming and the 'deep cut hard emission targets' that already being set by some countries, it is likely that other, more equitable measures will eventually need to be taken to restrict air travel.

References

ABS, 2008. *ABS Year Book Australia, 2008. Transport Movements*
http://www.abs.gov.au/AUSSTATS/abs@.nsf/7d12b0f6763c78caca257061001cc588/83370CA43C85CE6ECA2573D20010BE45?opendocument

ABS, 2003. *ABS Year Book 2003.*

AGO, 2006. *Factors and Methods Workbook.*

Intergovernmental Panel on Climate Change, (IPCC), 1999. *Summary for policymakers Aviation and the global atmosphere*

IPCC, 1999. 'Aviation and the Global Atmosphere'
http://www.grida.no/climate/ipcc/aviation/068.htm
Rose, B., 2007*. GHG-Energy Calc, Background Paper..*
http://www.carbonneutral.com.au/rose_bj_2006._ghg-energy-calc_background_paper_august_2006.pdf