Carbon Credits and Surface Transport

Jason. van Paassen[1], Darryl. Watkins[1]
[1] Parsons Brinckerhoff Australia Pty Ltd, Brisbane, QLD, Australia

1 Introduction

The level of sustainability of our current lifestyle, particularly in terms of surface transport related energy consumption and resultant greenhouse gas emissions, is a critical question. It is critical because our choices are now known to have an impact upon future generations. Future generations have no control over our actions. Is our attitude and current level of inaction one that supports the notion of "inter-generational equity". We would suggest the answer to this is, unfortunately, a resounding "no".

What legacy will we leave future generations from our current, and historically poor use of sustainable surface transport solutions? What are the forecast future impacts resulting from greenhouse gas emissions? This paper explores these and other related issues.

The primary focus of this paper then relates to the greenhouse gas contributions made by surface transport. Possible solutions are also discussed, including the use of carbon credits as a mechanism to cap the individual level usage of non-greenhouse gas friendly surface transport modes.

2 The evidence of climate change

The debate about whether the perceived unusual climatic events we have been experiencing over the past decade or so are the result of climate change is one that catches the interest of everyone, including the media.

The press hail the arrival of climate change with catch cries of "*Planet is warming; its official*". The grounds of this belief have certainly been bolstered with the recent release of a Journal Article in *Science* magazine that published a detailed analysis of a series of global climatic records from 800AD to the present day:

"Warm temperatures that have spread around the world are greater than those of any other period in the past 1200 years…The research found the 20th century standing out as having unusually warm temperatures...The present warm period that began in the late 20th century was the most widespread and longest temperature anomaly of any kind since the ninth century" (Courier Mail, 2006)

The evidence detailed in the *Science* Journal Article is compelling. Figure 1 below illustrates one of the datasets that supports the authors' claims.

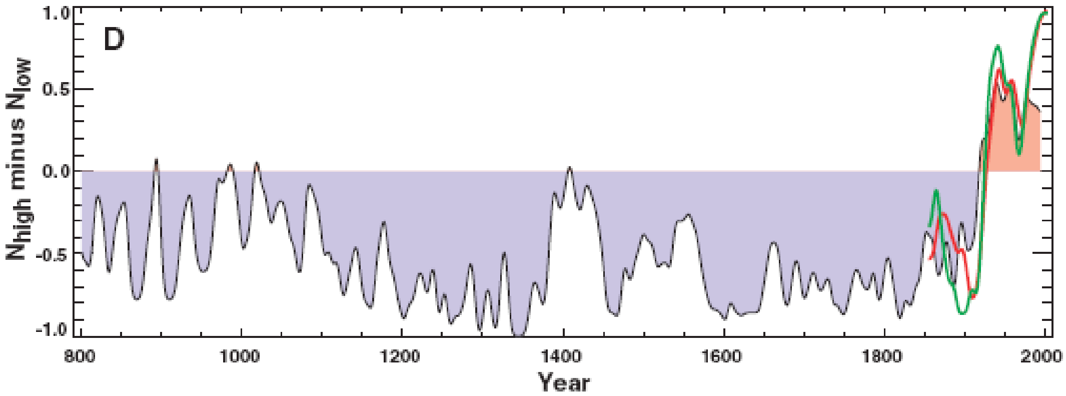

Figure 1 Temperature variations (normalised values), Osborn and Briffa (2006)

From the recent historical temperature analyses undertaken by Osborn and Briffa (2006) they have concluded:
"The 20th century is the most anomalous interval in the entire analysis period, with highly significant occurrences of positive anomalies and positive extremes in the proxy records…The most widespread and thus strongest evidence indicative of a significantly warm period occurs during the twentieth century, when greenhouse gas concentrations were at their highest during the analysis period. The proxy records indicate that the most widespread warmth occurred in either the mid or late-twentieth century, but instrumental temperatures provide unequivocal evidence for continuing geographic expansion of anomalous warmth through to the present time".

The conclusions of Osborn and Briffa (2006) are based on the application of a scientific approach, that is, one that requires clear and measurable evidence. Similarly, others have also reached the same conclusion from the available evidence. For example, in "High Tide", Lynas (2005) states:

"In total, the world's mountain glaciers are now thought to be losing about a hundred cubic kilometres of water every single year…The worldwide thaw began to accelerate in 1977, and since the end of the 1980's – following a succession of the warmest years ever recorded – the rate of global glacier melt has speeded (sic) up even further".

Other practical evidence is also cited by Lynas in the form of impacts on existing Pacific Ocean and Alaskan human communities as well as other physical impacts such as glacial and sea ice changes across the globe.

Similar evidence to that of Osborn and Briffa is also nominated by Hillman (2004) *"Global temperatures rose by about 0.6 degrees Celsius during the Twentieth Century, with about 0.4 degrees Celsius of this warming occurring since the 1970's"*. These conclusions are also supported by the data presented in Figure 2, Hillman (2004).

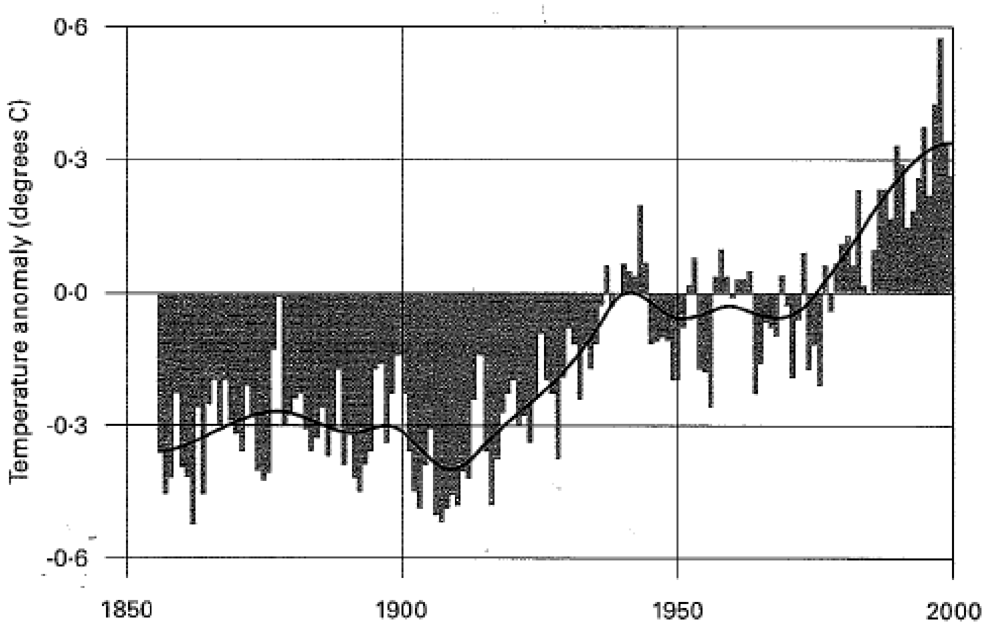

Figure 2 Changes in global-average surface air temperature compared with the long-term average for 1961 – 1990 (Hillman, 2004)

From an Australian perspective the views of one of Australia's eminent scientists, Dr Tim Flannery, a well known advocate of environmental awareness and action, are also difficult to ignore. In "The Weather Makers", Flannery (2005), draws on his and other researchers experiences relating to changes in the patterns of flora and fauna distribution throughout the world. Indeed in Flannery (2005) he raises the question as to whether climate change may be considered to be the reason behind the recent extinction of many species throughout the world, for example:

"As the reason for the extinction of the golden toad became thoroughly comprehensible, frog researchers worldwide began to re-evaluate their experiences, for since 1976 many had observed amphibian species vanish before their eyes without being able to determine the cause. Could climate change, they wondered, be responsible?"

In terms of another frog species though Flannery's (2005) conclusions are much clearer, *"The latest analyses suggest that at least in the case of the gastric brooder and day frog, climate change was the most likely cause for their disappearance"*.

The evidence summarised above clearly supports the conclusion that climate change, in the form of global warming, has indeed occurred and that this change has resulted in detrimental environmental impacts that have been and are continuing to be played out on a global level. The following section looks at the possible future scenarios that may yet be played out for ours and the following generations. Certainly, these scenarios provide a glimpse as to the possible futures if no immediate action takes place to arrest the momentum of these changes to the environment.

3 Future scenarios

The reality of climate change is now with us. Many agencies, authorities and organisations now recognise the need to act before the effects become too unmanageable and widespread. For example, recently in Queensland, as a guest speaker at the "Earth Dialogues Forum" the ex Russian President, Mikhael Gorbachev, provided an insight into his understanding of the existing global level impacts due to climate change and the possible future scenarios:

"*60 per cent of the world's environmental systems had been undermined by inappropriate attitudes towards nature by human beings…Even if we make every effort, many ecosystems cannot be restored to health. This is a very severe problem. I very much would like you to enjoy nature, to enjoy the environment that surrounds us but you have to be very careful, you have to be very prudent".*

Table 1 below provides a broad summary of the likely future scenarios that are considered to be the realistic natural global response to climate change. It is important to note that many of these changes have already started, at least to some degree.

Table 1 – A selection of future scenarios

Melting of land glaciers and sea ice The relatively minor temperature increase (0.6 degrees Celcius) that has occurred to-date has already had a measurable effect on land glaciers and sea ice. For example, Hillman (2004) states that the sea ice in the Northern Hemisphere has decreased in area the size of the UK per decade since 1972. As would be expected these changes are anticipated to result in increases in global sea levels, this is discussed further below.
Increase in temperature affects the distribution of animals and extinction of species The anticipated increase in temperature of up to 5.8 degrees Celcius by 2100 will change the vegetation and animal distribution across the globe. It is expected that a large proportion of species worldwide will become extinct, with resultant knock-on effects across the food web. As Flannery (2005) suggests *"If we carry on with business as usual, in all likelihood three out of every five species will not be with us at the dawn of the next century"* Clearly, to have a 60% loss of species is a catastrophic outcome. A case in point are coral reef systems worldwide, e.g. the Great Barrier Reef. Impacts to the Great Barrier Reef not only affect environmental values but also adversely impact communities due to a loss of economic value attributable to losses in tourism and secondary industries. Specifically, Hughes (2003) in a *Science* article suggests *"By 2030 catastrophic damage will have been done to the world's reefs, and by 2050 even the most protected of reefs will be showing massive signs of damage".* In the Australian context, this will clearly be a devastating environmental and economic outcome for Queensland.
Increase in temperature will affect food production and water distribution Changes in the temperature across the world will affect the viability of cropping areas and therefore food production. Increased levels of drought and reduced rainfall will also reduce the viability of cropping regions. Changes to the distribution of freshwater will also occur. Flannery (2005) suggests "*In its effect, a rapid shift to another kind of climate could place a similar stress on our global society, for it would alter the location of sources of water and food, as well as their volume…Human health, water and food security are now under threat from the modest amount of climate change that has already occurred. If humans pursue a business-as-usual course for the first half of this century….the collapse of civilisation due to climate change becomes inevitable*".

Changes in sea level and temperature will produce climate change refugees Given the expected changes in both temperature and sea level parts of the world will likely become uninhabitable. These changes will result in “climate change” or “environmental refugees”. The redistribution of the environmental refugee population will then result in higher density populations or overpopulation in other more habitable parts of the globe. The environmental refugees will not be restricted to the human population. It will also affect the natural environment, that is, both animal and plant communities. However, for many of the plant and animal communities their options to relocate will be limited as they generally cannot rapidly adapt or change their environment as quickly as human populations. For those species that cannot adapt, extinction is the likely outcome (Flannery, 2005). Al Gore (2006), the ex-Vice president of the United States and now author and movie producer of “An Inconvenient Truth” supports this view “*Global warming, together with cutting and burning of forests and the destruction of other critical habitats, is causing the loss of living species at a rate comparable with that of the extinction of dinosaurs 65 million years ago*”. If the expected changes to the glacial and sea ice do occur it is anticipated that an increase of up to 6m in sea level by 2100 is a realistic and sobering possibility. Clearly, low lying coastal areas will be most affected for example, the Pacific Islands, Maldives, Florida, New Orleans, New York, Netherlands, United Kingdom, Bangladesh, India, China, amongst many others. Certainly, Lynas (2005) suggests that these effects are already being felt, for example in the Pacific Island areas of Tuvalu and specifically the small Funafuti Atoll tidal surges are already fracturing communities. Similarly, Flannery (2005) has postured that the Inuit of Shishmaref in Alaska are now considered to be the world’s first official climate change refugees. For us as a global community this is clearly not a “healthy milestone”.
Increased frequency of storm and drought events Changes in the temperature distribution will affect the current distribution of storm events and also change the intensity of these events. Hillman (2004) indicates that within the scientific community *“There is particular concern about the potential increased frequency of extreme events, such as storms, as these tend to have severe effects on the population and built environment*”.
Climate change will adversely impact the world economy Impacts upon food and water distribution will adversely affect the economic viability of regions including reductions in property value and the ability for a population to be economically sustainable. The recent experience in New Orleans with the aftermath of Hurricane Katrina vividly illustrates this point.

The possible future scenarios identified above clearly require a definitive assessment of the likely future economic cost of a “doing nothing” or “business-as-usual” response to climate change.

4 The contribution of surface transport

Lynas (2005) suggests that “*Transport is still the fastest-growing contributor to global warming. Anyone who drives their car more than 10,000 miles (16,000km) per year will probably have already used more than double their sustainable carbon budget. The alternatives here are simple: reduce car use, switch to foot or bicycle for shorter journeys, and buses or trains for longer ones”.*

As highlighted in the previous sections our individual surface transport activity and demands negatively impact upon the worlds climate balance. It should be noted that surface transport in the context of this paper relates to the energy use relating to personal travel and also the industrial sectors contribution realised as freight movement. Clearly, other sectors within the Australian context also contribute to energy use and greenhouse gas emissions (e.g. power for industry, households and the like), however, these are not considered as part of this paper.

Australian Government Greenhouse Office (2006) figures (see also Figure 3 below) indicate that "*Forty one per cent of final energy use is for transport, almost all of which comes from petroleum products. Transport use is expected to grow quickly to 2019-20…The transport sector is forecast to account for around 90 per cent of the total increase in final consumption of petroleum over this period".* Australia's forecast continued reliance on fossil fuels for surface transport can only serve to exacerbate climate change impacts into the future.

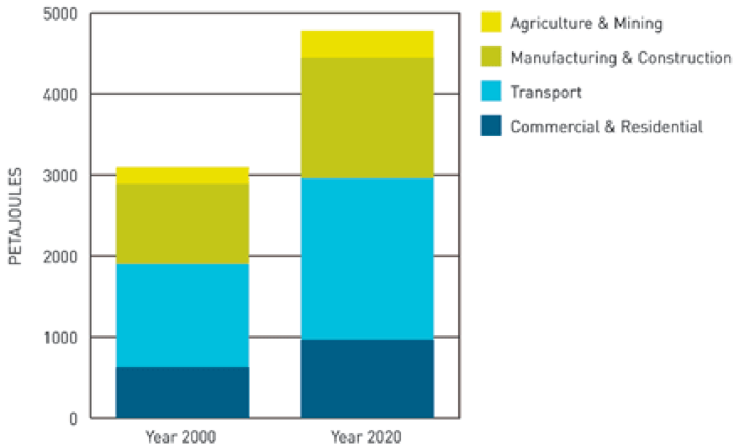

Figure 3 Total Australian final energy consumption, Australian Government (2006): Data from ABARE Australian energy: National and state projections to 2019-20, 2003

As a comparison to the Australian situation Hillman (2004) states that in the UK transport utilises 35% of final energy, with the domestic sector utilising 30%, industry at 22% and services with 13%. The transport contribution can be further broken down to 60% being used by individuals, 24% by industry (primarily used for freight) and 16% by service industries. This therefore translates into roughly about 21% of the final energy use being used by individuals for transport demands. A comparison to the UK is considered a reasonable one because UK's urban form, car-dependant society and cultural values are similar to Australia. Essentially, the UK situation provides a "mirror" for our behaviour in Australia. Based on the transport sector contributions this seems to be a relatively fair comparison.

Data from the Australian Governments National Greenhouse Gas Audit (undertaken by the Greenhouse Gas Office) indicates that in 2004 greenhouse gas emissions attributable to transport were 76.2Mt CO_2-e or 13.5% of the net emissions, see also Figure 4 below. Unfortunately from a greenhouse gas emissions perspective transport has been one of the sectors within the economy that has continually grown rather than decline. As the Australian Greenhouse Gas Office (2006) has concluded "*Transport emissions are one of the strongest sources of emissions growth in Australia. Emissions from this sector were 23% higher in 2004 than in 1990, and have increased by about 1.5% annually. The strongest period of growth in transport emissions occurred in the early 1990's and since that time the longer term growth rate appears to have slowed, despite an apparent pick-up in emissions in 2004".*

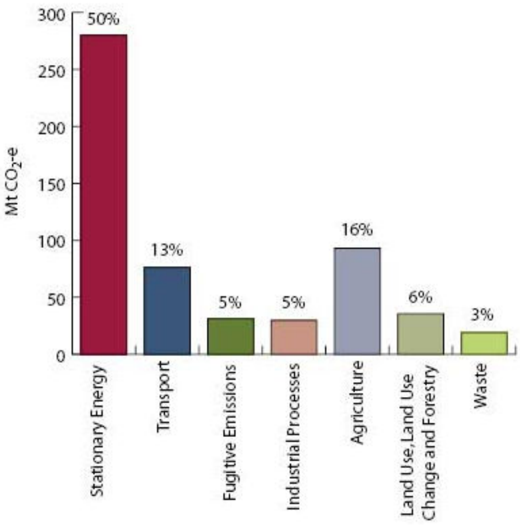

Figure 4 Greenhouse Gas Inventory by Sector in 2004, Australian Government (2006): Australian Greenhouse Office, National Greenhouse Gas Inventory 2004

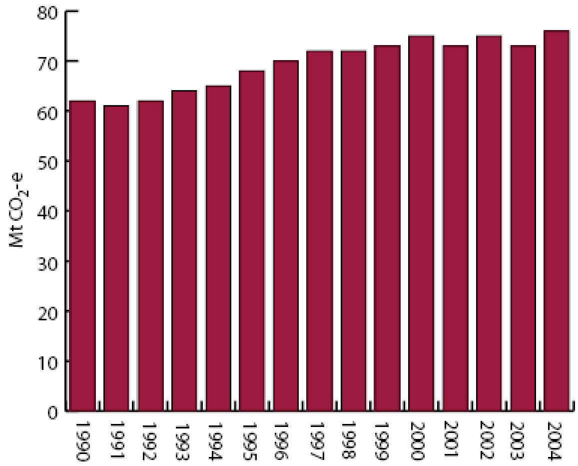

Figure 5 Total transport emissions, 1990–2004, Australian Government (2006): Australian Greenhouse Office, National Greenhouse Gas Inventory 2004

In addition to net emissions by sector data the Greenhouse Office also publishes data defining the contributions made by each transport mode. The key results by mode are as follows:

- Road transport was the main source of transport emissions in 2004 (89%, 68.1 Mt) and accounted for 12.1% of national emissions
- Emissions from road transport increased by 25% (13.5 Mt) between 1990 and 2004
- Passenger cars were the largest transport source contributing 41.7 Mt
- Emissions from passenger cars increased by 18% (6.3 Mt) between 1990 and 2004
- The growth in emissions from passenger cars reflects growth in activity and the influence of technological change
- Emissions from Light Commercial Vehicles (LCV's) and trucks have also grown strongly
- Other modes contributions are smaller; domestic aviation contributed 6% (4.8 Mt) of transport emissions, domestic shipping 2% (1.6 Mt), and railways 2% (1.7 Mt).

(Greenhouse Gas Office, 2006)

In terms of surface transport the key point from the above statistics is that passenger cars account for 8.3% of national emissions and their contribution has increased between 1990 and 2004, see also Figure 6 below. From an environmental perspective we are clearly going the wrong way. As a society we need to implement actions that reverse this trend, in particular our reliance on hydrocarbon based fuels for transport. It is all about the fuel used and the resultant emissions, not just vehicles.

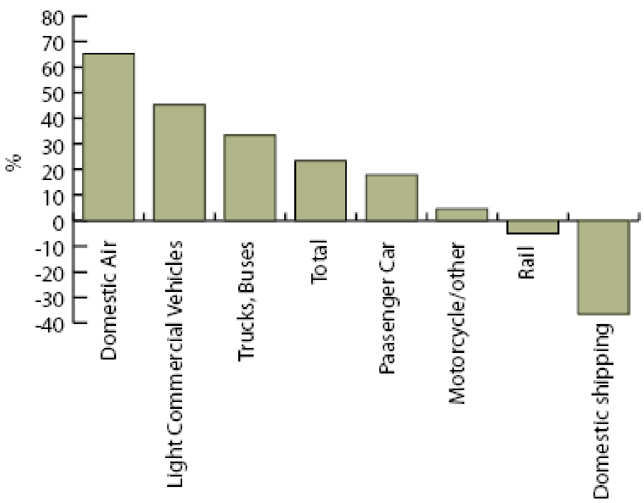

Figure 6 Comparison of growth in transport emissions by subcategory, 1990–2004, Australian Government (2006): Australian Greenhouse Office, National Greenhouse Gas Inventory 2004

Positive signs do exist. Interestingly, Australia has reduced its emissions per capita over the period 1990 to 2004 by 12.7% from 32.3 to 28.2 tonnes CO_2-e (Greenhouse Gas Office, 2006). The challenge will be to continue reducing our emissions. Certainly, despite these recent reductions the forecasts of the Australian Greenhouse Gas Office indicate that Australia's net emissions will increase into the future, see also Figure 7 below. This is contrary to the need to accelerate our reduction in emissions over coming years. Clearly, we have a challenge ahead if we are to achieve any significant reduction in emissions. A fundamental change is mandatory, and the only option is change.

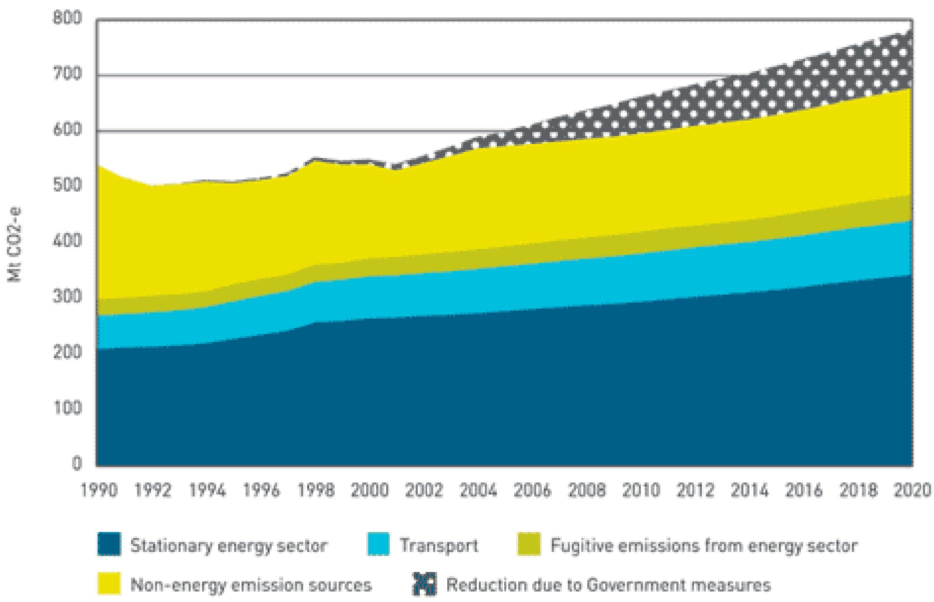

Figure 7 Greenhouse gas emission projections, Australian Government (2006): Australian Greenhouse Office, 2004

5 What do we need to do?

Based on the discussions above there exists a clear requirement to stop, or at least slow, the damaging effect that carbon dioxide has on the environment. Indeed Flannery (2005) indicates that by 2050 each individual needs to be targeting a 70% reduction in greenhouse gas emissions. Others indicate a lower 60% target or an upper target of 80%. Certainly, while continual advances in technology serve to improve the effectiveness and efficiency of many aspects of energy use (including related reductions in greenhouse gas emissions) the actual quantum of energy consumption by each individual must still be reduced. Similarly, while government policy can point industry and each of us as individuals towards energy saving regimes, it still remains the responsibility of each group to reform their energy consumption levels by taking steps to curb our insatiable demand for energy. It is also clear that the longer we take to put actions in place, over time the more drastic our collective responses will likely need to be to restrain climate change.

Outlined below is an overview of the various responses that may be required at the governmental and individual levels to respond to the challenge of achieving valuable reductions in greenhouse gas emissions.

5.1 Government

As with many environmental objectives, it is commonly the position of government to provide direction for industry and individuals, generally through regulation. The various approaches that may be considered at the governmental level are outlined below.

All levels of government have a role to play in the monitoring and regulation of greenhouse gas emissions.

There are several possible mechanisms that could be employed by government to change existing behaviour, these include administering levies on large-engine cars; rebates on hybrid/alternate fuel vehicles; greater taxing of fossil fuels; congestion charging and the implementation of effective travel demand management measures. To-date, consumers have not been paying the "full cost" of the impact that surface transport has on the environment. These measures would begin to redress this imbalance. The additional income from the above measures could then be directed into alternative fuels research, "greener" electricity production, increased public transport services and infrastructure and improvements to walking and cycling facilities.

The concepts identified above are certainly of value in reducing greenhouse gas emissions. However, a recent concept that may be considered by government is the implementation of a "carbon credits" scheme based on the principles of "contraction and convergence" (C&C). However, for C&C to be effective it will require the buy-in from the global community, similar to the ban on CFC's in the 1990's.

Hillman (2004), the principal advocate for the C&C approach, stipulated that such an approach requires the following elements:

- *Contraction* – an international agreement is reached on how much further the level of carbon dioxide can be allowed to rise before changes in the climate it produces become totally unacceptable. Once this limit has been agreed, it is possible to work out how quickly current global emissions must be cut back to reach this target.
- *Convergence*: Global convergence to equal per capita shares of this contraction is phased towards the contraction target by an agreed year.

Hillman (2005) has indicated that based on research a "safe" limit for atmospheric CO_2 concentration is 450ppm. At this level the climate change effects would likely stabilise. It is important to note that the pre-industrial revolution (year 1750) concentration was 280ppm while now (2002) this concentration currently stands at 373ppm. Clearly, it is imperative for us as a community to alter our current CO_2 emissions levels so that we will effectively limit climate change impacts into the future.

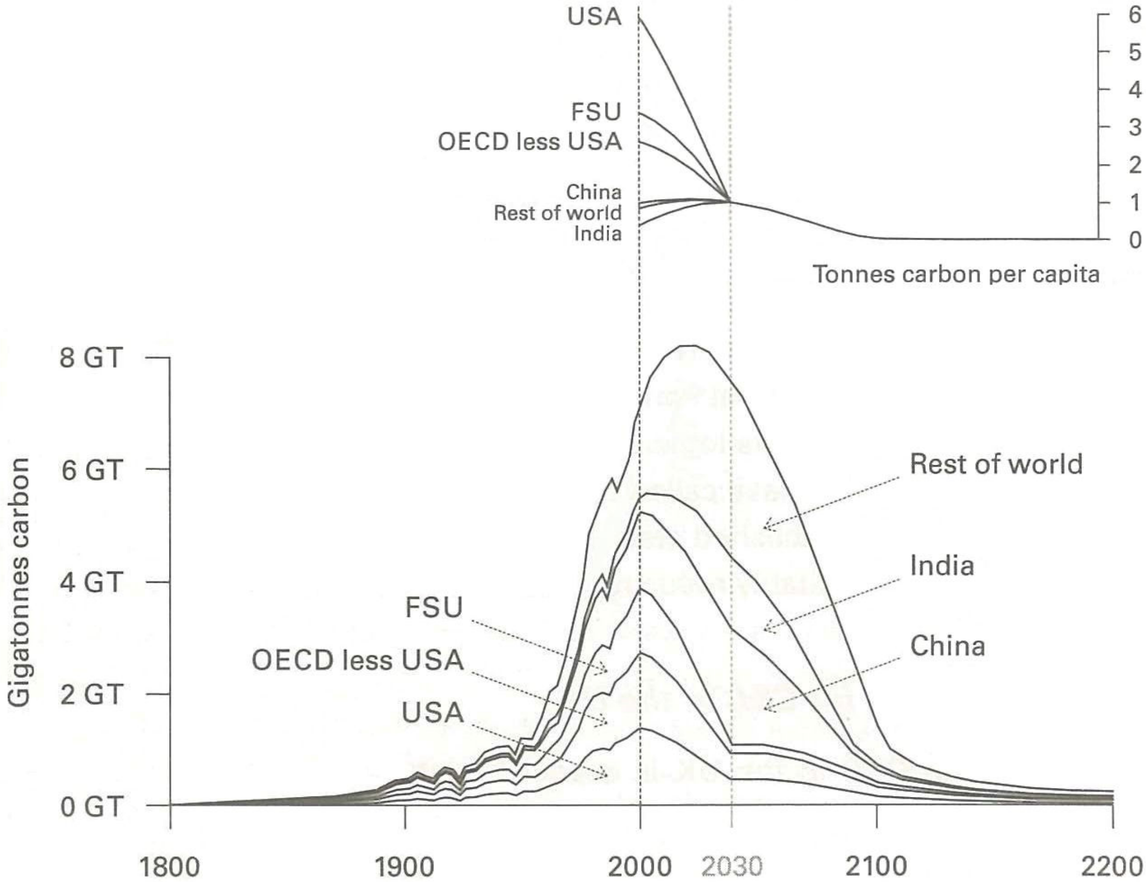

Figure 8 Carbon dioxide emissions under C&C for a maximum of 450ppm atmospheric concentration achieved by 2100, with "permits" for per capita emissions converging to equality achieved by 2030, Hillman (2004)

The implementation of such a system does however rely on action at all levels within our communities, that is, at the governmental and most importantly at the individual level. The role of the individual is further discussed below.

5.2 The individual

Currently, energy demand per person is rising and Australia is leading the charge. In reference to the Kyoto Protocol, Wikipedia states that "*As of 2005, Australia was the world's largest emitter per capita of greenhouse gases"* (Kyoto Protocol, Wikipedia, 2006).

Many individuals may think that they are helpless in the push to reduce greenhouse gas emissions, and are simply waiting for technological advances to solve the problem for them. To date, increased efficiencies for energy use have been negated, or surpassed, by the rapidly growing demand for energy. It is therefore up to the individual to reduce their own consumption of energy in order to realise the effects in energy efficiency. Hillman (2004) in "How to Save the Planet" has a number of suggestions for reducing emissions, for example by reducing the number and length of personal car trips. However, the other key suggestion made by Hillman is the use of C&C principles. A key element for each individual is the use of a "carbon credits" card type scheme, see Figure 9 below.

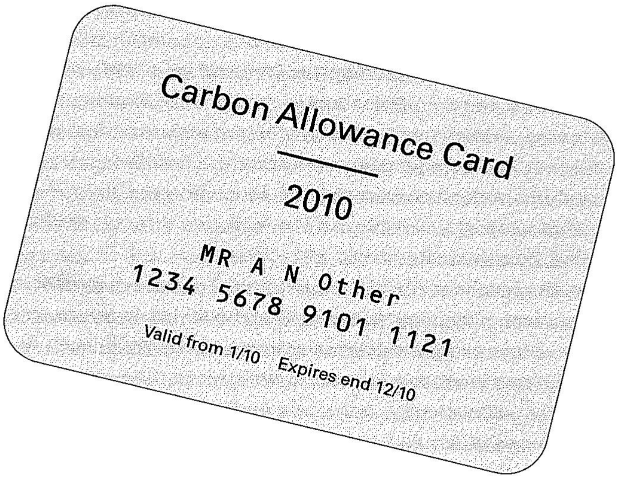

Figure 9 Carbon Credit Card, Hillman (2004)

The "carbon credits" card scheme would work by each individual using such a card. Each individual would have available on their card a yearly allocation of carbon credit value. The card would be presented when purchasing energy or travel services, and then the amount of carbon would be deducted accordingly from the card. Such an approach would provide each individual with an understanding of the "carbon cost" associated with their energy use, including transport choice impacts. An example scenario may play out like this:

"You pull into a service station. It's been a busy year and you've driven a lot, for work and leisure. When you put your card into the pump, a screen says you have exceeded your annual carbon allowance. To fill the tank you're going to have to buy some carbon credits, on top of paying for the fuel. Oh well, at least you've been taking shorter showers at home". (Sydney Morning Herald, 2005)

An interesting example, but it certainly demonstrates the philosophy. On the other side of the coin for those who are prudent in their use of carbon credits they may have a different story to tell, for example:

"Your neighbour, old Mrs Rossini, doesn't drive and last year spent some of her savings buying better insulation for her house. The pensioner's investment is paying off: her energy card is in credit and that means she will earn some much needed cash. The carbon credits you purchased at the petrol station you effectively bought from her". (Sydney Morning Herald, 2005)

The above examples clearly demonstrate that, like in any system there will be "winners" and "losers".

Table 2 below provides an example carbon budgeting sheet that can be used to determine a carbon budget for each individual. Such a budget demonstrates the "carbon cost" of each of our choices and at the same time helps each of us understand what changes we would need to make to reduce our individual emissions.

Table 2 - Household and individual carbon budgeting - Annual carbon dioxide emissions (kg CO_2), Hillman, 2004

Energy Use	Kilograms co-efficient	average household	average individual	Your use
In the household for each kilowatt hour (kWh)				
electricity1	× 0.45	2,000	870	**?**
gas	× 0.19	3,400	1,480	**?**
for each litre				
heating oil	× 2.975			**?**
In travel for each kilometre				
petrol car: as driver	× 0.20	{ 2,420	{ 1,050	**?**
diesel car: as driver	× 0.14			**?**
rail: InterCity	× 0.11	{ 200	{ 90	**?**
other services	× 0.16			**?**
Underground	× 0.07			**?**
bus: London	× 0.09	{ 230	{ 100	**?**
outside London	× 0.17			**?**
express coach	× 0.08			**?**
bicycle	× 0.00	{ 0		
walking	× 0.00			
air2: within Europe	× 0.51	{ 4,210	{ 1,830	**?**
outside Europe	× 0.32			**?**
Total kilograms CO2		12,460	5,420	**?**
tonnes CO2		12.5	5.4	**?**

1 The calculation of the carbon dioxide emission co-efficient is based on the current fuel mix for electricity generation
2 Although varying by region and by altitude, these carbon dioxide emissions have been multiplied by an average factor of three to take into account of the warming effect equivalent of the other greenhouse gases in the upper atmosphere
(Sources: Various including the Carbon Trust, IEA; DfT, National Travel Survey; DEFRA, Environmental reporting, 2003; National Energy Foundation; and data from Transwatch Company Limited)

Changes to our choices that can be considered to help us achieve our carbon budgets may include buying local produce. This is because non-local produce contributes to additional emissions as goods are transported a greater distance between producer and consumer. According to Worldwatch Institute, a Washington D.C.-based non-profit organisation *"…since 1980 there has been a 25% increase in the distance that food travels to get from the farm to the table"* (Epoch Times International, 2006).

Other changes to our transport choices are also identified in Transport plans formulated by the various levels of government. These plans generally include actions that are focussed at the individual level. In terms of surface transport the common activities are outlined below in Table 3. If we are to achieve and limit ourselves to the carbon credit or budget available to each individual these are the types of “Travelsmart” choices that are required.

Table 3 – Travel smart activities to reduce greenhouse gas emissions, Australian Greenhouse Office, Travelsmart, 2006

Switch to smart travel choices
Plan your travel to reduce the number of single passenger car trips that you make. Making one less car trip per week will save you fuel, running costs, parking fees and will reduce greenhouse gas emissions. Each kilometre in a family car costs up to 70 cents. Walking and cycling are sustainable and healthy travel choices. You can save costs and time by combining your travel with your daily-required 30 minutes of exercise. Cycling 10 kilometres each way to work instead of driving saves about $770 in transport costs and 1.3 tonnes of greenhouse gas emissions each year. Walking is free! Use a phone call, fax or letter to replace a car trip Working from home, for some or all of the time can significantly reduce your transport costs. Use public transport, avoid traffic congestion and save costs on parking, tolls and car running expenses, while gaining time to catch up on reading or resting. A full bus or train emits much less greenhouse gas per person than a car. Public transport information is a phone call away or available on the Internet. Try different travel choices and find out if you can avoid buying or keeping a second car. Upgrading your bicycle instead can save you thousands of dollars each year.
Choose a less polluting car
Buy a fuel-efficient car: save up to 20 tonnes over its life. Fuel consumption of similar cars can vary by 30% depending on brand and options. Reducing your car’s fuel consumption from 12 litres/100 kilometres to 8 litres/100 kilometres would cut fuel costs by one-third.
Use cars efficiently
Every litre of petrol saved reduces greenhouse gas emissions by 2.9 kilograms. Drive smoothly and avoid stop-start traffic: save up to 30% of greenhouse emissions. Keep the engine tuned: save up to 15% of greenhouse gases (up to a tonne a year for a family car). For the first couple of minutes of a car trip the engine is cold and this will result in an increase of fuel consumption per kilometre. Avoid short car trips by using a bike, walking or combining several tasks into one longer trip. Car pool for travel to work, school and on social trips. Carry four people instead of one while generating the same amount of greenhouse gas – and have fun! Ensure your tyres have the maximum recommended air pressure so they roll more easily: save up to 100 kilograms of greenhouse gases each year, and extend tyre life.

Remove unnecessary weight from the car – 50 kilograms less weight decreases greenhouse gas emissions by nearly 2%. Removing unused roof racks and external sun visors can save hundreds of kilograms of greenhouse gases per year.
Switch from petrol or diesel
Converting to LPG reduces greenhouse gas emissions by between 10 and 15% and substantially reduce your fuel costs.
Air-conditioning
Use air-conditioning sparingly. An air-conditioner set on high can increase fuel consumption by more than 10%.

As indicated previously the critical issue for surface transport (and, for that matter, other modes of transport) is our current reliance on hydrocarbon based fuels. As identified above in Table 3 a change in behaviour in terms of fuel choice will certainly go a long way in helping to reducing our greenhouse gas emissions. This fuel change may be realised earlier than previously anticipated due to the recent increase in the fuel price and also the reaching of “peak oil”.

6 Conclusion

We all have a role to play in solving climate change. An attitude change to our individual choices and comprehension of our individual impacts is the first step.

The changes required by each individual are not overwhelming. By 2050 we each need to aim to reduce our greenhouse gas emissions from all sources between 60% and 80%. This covers all greenhouse gas emission sources from transport to home energy use (gas, electricity based sources).

In terms of surface transport, changes in our individual transport choices, such as reduced reliance on private car use alone will reduce our emissions by just over 8%. Replacing hydrocarbon fuelled car trips with walking and or cycling will certainly go a long way in re-balancing the carbon budget.

If the calls for change are not taken on within our communities other mechanisms may also be considered into the future by government agencies worldwide, for example, the adoption of carbon credits or carbon budget type policies. These policies may also be aligned with the introduction of national based policy directives such as “contraction and convergence (C&C)”. These “pricing” type strategies may be required if we are to ensure changes in attitude do indeed occur internationally.

From the perspective of transport certainly one of the key challenges, and clear solutions, is removal of our reliance on “fossil fuels”. This is a seemingly simple solution, but it is one that has large economic implications. However, this change may nevertheless be realised earlier than expected given the inexorable rise in the price of fuel and the striking of “peak oil”.

Based on the available evidence and expected future scenarios the time for focussed action at both the individual and global level is clear.

Every generation has its challenges. Climate change is the challenge for ours and also for the next generations. As Flannery (2005) suggests for each of us as individuals and also collectively as an international community *“Never in the history of humanity has there been a cost-benefit analysis that demands greater scrutiny”*.

References

Osborn, T. J & Briffa, K. R; The Spatial Extent of 20th-Century Warmth in the Context of the Past 1200 Years, Science Journal, 2006

Courier Mail Article, “Planet is warming; its official”, 11-12 February, 2006, Agency France - Press/AAP

Lynas, M; High Tide: How Climate Crisis is Engulfing our Planet, Harper Collins, 2004

Hillman, M & Fawcett, F; How We Can Save the Planet, Penguin Books, 2004

Flannery, T; The Weathermakers: The History & Future Impact of Climate Change, The Text Publishing Company, 2005

Hughes, T.P et al; Climate Change, Human Impacts, and the Resilience of Coral Reefs, Science, 2003

Gore, A; An Inconvenient Truth – The Planetary Emergency of Global Warming and What We Can Do About It, Rodale Books and Melcher Media New York, 2006 and “www.climatecrisis.net”

Australian Government, http://www.pmc.gov.au/publications/energy_future/chapter1/2_sector.htm

Australian Greenhouse Office, National Greenhouse Gas Inventory 2004, Climate Change Risk and Vulnerability: Promoting an Efficient Adaptation Response in Australia, 2006

Wikipedia; Kyoto Protocol, 2006

Sydney Morning Herald Article, “Sell me your CO_2”, James Button, Friday October 7, 2005

Worldwatch Institute; Think Globally, Eat Locally, Epoch Times International, 2006

Australian Greenhouse Office; Travelsmart, 2006

(Note: The views expressed in the above paper are solely those of the authors and are not necessarily the views of our employer organisation)