6 April, 2008

'Submissions'
Garnaut Climate Change Review
Level 2, 7Treasury Place
MELBOURNE VIC 3000

Dear Sir/Madam

Submission on
International and Domestic Mitigation
And
Land Transport and Electric Power Generation

Please accept my submission on these topics

Yours faithfully

Anthony Hordem

Submission to
Garnaut Climate Change Review

Issues:

1. **Benefits and costs of a range of international and domestic mitigation efforts**

2. **Land Transport and Electric Power Generation**

EXECUTIVE SUMMARY

This submission points out that unilateral mitigation would adversely affect the Australian economy with no impact on global "greenhouse gas" emissions, and that the only way to avoid the forecast catastrophic impacts of climate change is to implement genuinely accountable international mitigation.

This submission discusses the importance of land transport and electricity generation to the Australia economy.

It describes proven and available technologies to reduce the amount of "greenhouse gas" emissions from these industries, in a "carbon-neutral" cycle, as a way of permanently and reliably reducing those emissions.

RECOMMENDATIONS

This submission makes the following recommendations: -

1. That Australia lobbies for international, universal "greenhouse gas" reduction targets.
2. That Australia mandates the adoption of common rail turbo charged diesel engines for the whole road vehicle fleet.
3. That Australia encourages the development of a bio-diesel fuel industry.
4. That Australia adopts nuclear power for base load electricity generation.
5. That Australia develops an underground nuclear waste storage facility in the Gawler Craton.

MITIGATION EFFORTS

A great deal of selective disinformation has been circulated about Australia's contribution to global "greenhouse gases" emissions, reputed to be the cause of potential increases in global warming, with all it's concomitant evils.

A particular propaganda is that Australia's *per capita* emission is very high by world standards.

Zealots never let the facts get in the way of their obsessions. The truth is that Australia's national contribution is only 1% of these gases.

This fact alone indicates that draconian unilateral reductions of "greenhouse gases" by Australia, as proposed by some zealots, would serve no purpose in the world context, but would, on the other hand have devastating effects on the Australian economy and the Australian standard of living.

Actions speak louder than words. It was announced by the Commonwealth Government Greenhouse Office (February 2008), that Australia is on track to achieve it's *Kiyoto Protocol* emission targets by 2012, despite not having "signed up" to *Kiyoto*. Here Australia compares more favourably than the European Union, which despite having acceded to the protocol, will not meet those targets. This demonstrates the futility of non-enforceable "agreements", and that Australia has so far been following the correct course.

International mitigation

If we accept that global warming caused by "greenhouse" gas emissions could impact on the global economy (for if it does it will certainly affect the Australian economy), we must concentrate on mitigation, and to some extent reversal, of those effects.

Australia must lobby the world for a transparent and fully accountable international reduction of greenhouse gas emissions, which must include deforestation, developing countries (especially India and China), and worldwide methane production from animal husbandry. The latter is a significant (perhaps as much as 20%) contributor to "greenhouse gas" emission.

Without universal mitigation issues, unilateral Australian "mitigation" will not only be totally ineffective, but will reduce the Australian standard of living. That is unacceptable.

There are, on the other hand, things that Australia and the world can do together that will ameliorate the problem, and reduce "greenhouse" gas emissions to levels that will not produce any future unwanted effects on the world and all its people.

RECOMMENDATION 1
That Australia lobbies for international, universal greenhouse gas reduction targets.

Domestic mitigation

Australia's high individual emissions are largely attributable to two sources – Land transport and coal fired electricity generation – plus the fact that Australia has a low density, widely dispersed population.

However, as previously stated, Australia contributes only 1% of all the world's "greenhouse gas" emissions.

Consequently there must be other commercial benefits to Australia to help offset additional costs in establishing mitigation technology. The writer believes these will flow from a number of sources including import substitution, best utilization of natural resources, and re-allocation of resources to provide improved national output.

LAND TRANSPORT

Constraints

Australia has a low population density with great distances between major population centres, and as a result has a land transport system that relies heavily on "small" consignment road freight, that is one or two truckloads from supplier to consumer. Similarly, private "door-to-door" transport by motor car for small passenger loads (single cars) is the only practical means in rural and regional areas.

In urban areas, "people moving" by motor car is the only practical means of much individual transport, due largely to Australia's low population density and urban sprawl, the result of the "quarter acre house block" syndrome, and a lack of public transport appropriate to many individual journeys. Affordable public transport will never fill that need.

Neither of these constraints on the use of motor transport is likely to change.

Whilst the writer acknowledges that the fuel efficiency per tonne/kilometre of road transport can never approach that of rail transport, Australia's decentralisation and small population will never permit much wider than present use of rail transport. The capital costs alone rule that out, although some zealots with no knowledge of transport engineering will continue to suggest rail transport as a panacea. They will also probably make suggestions for urban "light rail" and similar people movers in situations where the capital cost is prohibitive.

When built in the 19th Century, rail transport (both urban and inter urban) was a major improvement over animal drawn transport. However the development of internal combustion power and mechanical engineering, together with advances in civil engineering construction, have resulted in much more flexible and cheaper road transport for small consignments and individual movement.

The fact that 19th Century rail links to isolated Australian communities have been abandoned by operating authorities across the nation shows that rail transport in those circumstances is not viable.

Although zealots may suggest that the relative fuel efficiency of rail transport would "save" greenhouse gases, all the other capital and maintenance costs make isolated rail transport massively cost-inefficient. "Greenhouse gas" emissions of track construction alone would surpass the operational savings of isolated rail over road transport for decades.

Use of high efficiency diesel engines

There have been significant road freight vehicle fuel efficiencies over the past decade or two. For example B-Doubles and Road Trains using a single prime mover, and multi-turbo charged and super charged diesel engines increasing fuel efficiency by up to 50%.

The combination of turbo charging (using exhaust gases to drive an air blower) and super charging (using the crankshaft to drive a blower) maximises efficiency, both by harnessing the waste gasses and using the engine crankshaft power selectively. The increased air to fuel ratio raises efficiency, combined with the diesel engine's inherently efficient use of fuel. The use of adaptive computer control and common rail direct injection further improves diesel engine efficiency.

Diesel fuel efficiencies surpass those of "hybrid" vehicle propulsion technologies, without the disadvantages of additional cost of batteries, periodic battery replacement, battery electrolyte disposal, carrying the weight of batteries at all times, additional energy conversion losses (internal combustion motor to electric generator to electric motor) plus the cost of two control systems (internal combustion and electric). Currently "hybrid" vehicles are as much as 30% dearer than comparable straight mechanical drive vehicles.

Testing of petrol powered "hybrid" vehicles in Australia has shown that, whilst achieving superior fuel economy in stop-start city driving, where the electric regeneration system can operate to advantage, they are less efficient than direct mechanical drive on the highway, where regeneration does not occur, and the power losses of the system work against them.

Clearly "hybrids" are not effective for country driving.

By comparison diesel engines with efficient mechanical transmissions are simpler, cheaper and use well established technology requiring no new industry manufacturing or maintenance skills. They can achieve "hybrid" economy in the city, and the initial cost is only about 5% to 8% above a comparable petrol engine vehicle. This is more than made up for with better fuel economy and greater longevity.

Conversion of the passenger and light freight road vehicle fleet to common rail turbo/super charged diesel power will result in fuel savings (and hence "greenhouse gas" emissions) of up to 50%.

Conversion of the existing Australian vehicle fleet will be relatively slow, because Australia has traditionally one of the oldest road vehicle fleets in the developed world. This ""old" fleet is due to the high relative cost of motor vehicles in Australia resulting from political decisions to "protect" a relatively inefficient local industry. It is estimated that this policy increases the cost of a passenger car by $2,000 to $6,000. It would therefore be easy to remove that market distortion to encourage more rapid fleet conversion.

It is notable that vehicle manufacturers are increasingly producing common rail turbo diesel engines for passenger cars and light commercial vehicles, including some "high performance" cars. These offer significant fuel efficiency, up to 50% over identical petrol engined vehicles. The marketplace already recognises the benefits of this power source. Motor truck manufacturers went down this course decades ago.

Emission standards for these engines already exceed EU mandated values for the decade 2010. The technology is here, now, and could be mandated for all new vehicles within the next 4 or 5 years without disrupting the vehicle manufacturing industry.

RECOMMENDATION 2
That Australia mandates the adoption of common rail turbo charged diesel engines for the whole road vehicle fleet.

Development of Bio-diesel fuel industry

However, until a viable, "carbon-neutral" fuel for internal combustion engines is developed, Australia will continue to rely on non-renewable fossil petroleum fuel for land transport.

In the medium term, development of alternative, renewable, "carbon neutral" internal combustion fuel is not difficult, nor expensive, and can be achieved using available technology.

Needless to say, a domestic bio-fuel industry will reduce foreign exchange needs, improve the balance of payments, and help reserve domestic crude oil for essential non-fungible needs.

Given the current price of crude oil over $100 a barrel, practically any bio-fuel process would be favourably priced. Studies carried out with crude oil prices of $70 per barrel showed that most bio-fuels were cost comparable with fossil fuel. Mass production and process maturity would further improve cost competitiveness.

The development of a 100% bio-diesel fuel source will be almost entirely "carbon-neutral", except for some production losses, expected to be no more (and possibly less, due to fewer "waste" process gases) than current refining technology. Current diesel feedstock already includes "renewable" animal fats (tallow) together with plant based material.

Developing technology includes in-situ liquefaction of coal to directly produce diesel fuel, and the use of biological reactors to produce diesel feedstock, and perhaps diesel fuel directly, from "waste" or "weed" plant material that is unsuitable for human or animal consumption. Feedstock from algae is also under development, having been proved in laboratory trials.

Bio-diesel also has the advantage of being naturally low or no sulphur. Airborne sulphur is a major pollutant, acid rain progenitor and irritant. Reducing sulphur emissions will be a side benefit.

If adopted worldwide, these closed carbon cycle measures will almost eliminate the production of greenhouse gases from land transport.

Mineral petroleum can be reserved for essential lubrication purposes, for which it is well suited.

Adoption in Australia alone would have little measurable impact on world "greenhouse gas" emissions, but would have the benefit of reducing petroleum imports, and of cushioning the economy from eventual shortages of petroleum. It is worth doing on that ground alone.

Regions of Australia that would be suitable for large-scale bio-fuel production include the North West of Western Australia, where rainfall and growing season are under-utilised, and the North Queensland coast where sugar cane production has become un-viable. Rather than pay cane farmers to abandon their crops, they can be used for bio-fuel production. At $100 per barrel for crude oil, a "back of an envelope" calculation suggests that may be more profitable than sugar production!

RECOMMENDATION 3
That Australia encourages the development of a bio-diesel fuel industry.

AIR TRANSPORT

Bio-diesel is also the optimum low sulphur fuel for turbojet aircraft, consequently it will also offer its "carbon neutral" benefits to the air transport sector.

ELECTRICITY GENERATION

Because Australia has easily accessible supplies of cheap steaming coal, most electricity is generated from it. This produces copious volumes of greenhouse gases, together with the concentration of toxic heavy metals and radioactivity in stack emissions and ash. The latter are two insidious outputs of coal fired power stations that are routinely overlooked.

Constraints

Proposals for "carbon sequestration" from the flue gases are a technique fraught with difficulty and cost.

There is the obvious difficulty of "sequestering" the CO_2 forever; because if it <u>ever</u> leaches back into the "environment", the whole value of sequestration is lost, and the CO_2 goes back into the atmosphere to wreak havoc.

Never mentioned by its proponents is the difficulty of treating millions of cubic metres of hot, corrosive and gritty flue gas, that is many times greater than the volume of coal burnt. At first glance, the cost of that could at least equal the cost of the coal itself. Considering the much greater volume of gases than coal burnt, it could increase the cost of electricity two or three-fold.

Zealots will say "so what, as long as we save the planet". They overlook the importance of reasonably priced electricity to the way of life of the developed world. They overlook the industrial uses (all manufactured goods incorporate electricity), and particularly the public utility uses such as clean drinking water, water borne sewerage and mass public transport, that are large users of reasonably priced electricity.

There will be initial objections to phasing out coal fired electricity generation from coal miners and industrial unions. However, for the foreseeable future there will be a continuing need for metallurgical coal, and that part of the industry will be relatively unaffected. Movement of capital and labour to alternative power sources using similar skills and technologies will be relatively easy, and the change will be a decades-long process. It will happen incrementaly and almost imperceptibly.

Electricity load and storage

There are two types of electric power demand—base load and peak load.

Base load is more or less constant throughout the 24 hour day, and includes such critical uses as sewerage pumping, refrigeration, hospital and emergency facilities and continuous industrial processes. Only two types of generating plant, coal or nuclear powered steam turbines conventionally supply it.

Neither type can be quickly started or shut down because it takes time to raise sufficient steam pressure, and to disperse it on shutdown. In national grid systems, power station units are started or shut down in advance of times of known demand.

Peak loads, sometimes due to system faults or very rapid change in demand such as morning rush hour in large cities, can often be met only by peak load stations that can come on line in two or three minutes. The common types are hydro stations or gas turbine stations.

Only in places with high and reliable precipitation can hydro power be used for base load. Tasmania is one such place, but even there expensive gas turbine back up has to be provided for times of drought, and severe power restrictions have been imposed there at such times.

Australia may have potential for hydro base power in the far North West, where monsoon rain could be stored in huge untapped catchments. Currently Kununurra on the Ord River derives all its electricity from hydro power (although it retains a diesel power station for emergency back up). Modern high voltage DC transmission may be able to deliver this electricity without unacceptable losses to consumer centres in the south of Western Australia.

Storage of Electricity

Electricity in its own form is difficult and costly to store for any length of time. We are all familiar with the motor vehicle lead acid battery, with a life of but few years and the unhappy habit of failing at the most inopportune moment.

Alternative electricity advocates often overlook the need to store electricity. Coal fired power stations store it in coal; hydro stations store it in water; nuclear powered stations store it in the enriched uranium in the reactor, where energy release is controlled.

Alternative storage in batteries or capacitors is possible, and is done for very short-term and emergency back-up, but would be prohibitively costly and inefficient for base load purposes, with further unavoidable conversion losses in charging and discharging these systems.

For base load and national grid purposes, direct storage of electricity is out of the question. That makes many "alternative" sources of electric power quite impractical.

Alternative electricity sources

Some people advocate a number of alternative electricity generating systems. Many are zealots for their favourite system. Many such systems are fraught with difficulty.

Favourites include solar power (either direct photo-voltaic conversion or as a source of heat for steam raising), wind power, geothermal power, wave power, natural gas power, bio-reactor (methane) power and a host of lesser technologies.

Clearly the sun does not shine 24 hour a day, nor does the wind blow consistently. Wave power depends upon sensitive electrical generators being constructed in a corrosive and storm-prone environment. Geothermal power is available only where hot rocks are accessible at reasonable cost, which may not be close to demand. Bio-reactors have limited capacity, and natural gas is a finite resource.

Storing electricity from ephemeral "alternative" sources is uneconomic at best and is not feasible for any realistic length of time, such as powering a city overnight or on a clam day.

Nuclear power

This leaves nuclear power as the best-tested and proven base load power source.

In the Western world, nuclear power safely provides up to 70% of supply (in France), and a significant proportion in the USA, Canada and other parts of Europe. Its safety is assured, even in the case of mal-function. It should be remembered that more people died at Chappaquiddick than at Three Mile Island.

Modern reactor design is safe and less expensive to build (because of inherent design safety) than earlier designs, including even that at Three Mile Island.

It is also worth remembering that reactor design in the former Soviet Union, notable for the Chernobyl disaster, ignored containment structures that are used at all other power reactors. Needless to say this lacuna would never be repeated. The disaster itself was caused by gross operator error.

Although popular journalistic reports on nuclear power stations always focus on the convection cooling towers, these of course emit no radiation whatsoever, rather dispersing water vapour into the atmosphere, which later condenses as rain.

This is the only heat loss in a nuclear power cycle, unlike a coal fired station where a great deal of heat is also lost up the chimney.

RECOMMENDATION 4
That Australia adopts nuclear power for base load electricity generation.

Radioactive waste avoidance

Atomic reactors can be designed to "burn" all the enriched uranium, and not to make any plutonium. Alternatively, "breeder" reactors can produce more fuel (plutonium) than they consume which can then be added to uranium to be "burned".

Spent fuel is reprocessed until all its radioactive components are used up in the reactor. The "waste" is confined to low activity material.

Nuclear waste storage

A great deal is made by anti-nuclear critics of the need to store radioactive wastes for thousands of years.

This overlooks the concentration and emission of radioactive materials in coal-fired stack gasses. Some of these radioactive materials are concentrated in the ash, a great deal of which is simply stored in surface ash ponds.

The volume of waste from a nuclear power station is comparatively much smaller. There are no emitted gasses or ash.

Australia is uniquely placed to store the small volume of waste from the nuclear power cycle, as it hosts the geologically stable Gawler Craton in South Australia. It is estimated that the Craton has been stable for millions of years. It is said to be one of the most geologically stable areas on Earth. It is the same geological formation that hosts the Olympic Dam copper/gold/uranium mine.

The volume of waste to be stored until safe (estimated to be no longer than 10,000 years) is very small. It represents much less than 1 per cent of the volume of rock excavated from the Olympic Dam mine. These same materials have been contained in the rock of the Gawler Craton for millions of years. Development of a safe commercial waste storage facility in the Gawler Craton could be an international safe storage and income earner for Australia. It is served by secure rail access.

RECOMMENDATION 5
That Australia develops an underground nuclear waste storage facility in the Gawler Craton.

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