
General Submission to the Garnaut Climate Change Review

By

**Robert G Shaw C.Eng., M.I. Chem.E., M.A.W.A.
Hunters Hill, NSW**

SUMMARY

Humanity is emitting greenhouse gases at three times the rate that the world can absorb them. Australia particularly is emitting at about ten times the rate its population is entitled to.

World fossil fuels consumption, particularly coal consumption, is increasing at an unsustainable rate to the extent that all fossil fuel reserves are likely to be exhausted in 30 years.

Australia has immense under- or un-utilised resources in wind energy, sunshine, land and monsoon water run off. These could be put to use to solve our greenhouse problems and the world's fossil fuel exhaustion problems by exporting green energy in the form of biofuels rather than coal.

We must substantially change, to a low carbon economy. Coal power must be replaced by a wind powered electricity grid with hydroelectric energy balancing, preferably using our cities' large water storage infrastructures. Transport's use of liquid petroleum fuels must be more than halved by green energy plug in hybridisation of all road and off road vehicles. The remaining half of liquid petroleum fuels should be replaced with home grown biofuels.

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1. The problem and the opportunity in a nutshell

The world's problem is that humanity is putting into the atmosphere 3 times more CO₂ (37 Gt CO₂ per year)⁽¹⁾ than the world's biosphere can absorb (13 Gt CO₂ per year). (The 37 Gt is CO₂ only. It does not include the CO₂ equivalence of our nitrous oxide and methane emissions). Half the excess CO₂ is staying in the atmosphere, causing global warming and all its problems and the other half is slowly acidifying the oceans. Overuse of fossil fuels, land clearing, agriculture and cement and steel production are the areas of concern.

With a world population of 6.5 billion a ration of CO₂ emission is only 2 tonnes per person per year (i.e. 13/6.5). Australians put out about 25 tonnes of CO₂ per person per year⁽²⁾ or more than ten times their ration. We have to reduce our CO₂ emissions by 90+% to be fair to the rest of humanity. 2 tonnes per year would only cover our cement production and air travel.

The World Coal Institute⁽³⁾ suggests we have 41 years left in oil reserves, 63 years in natural gas reserves and 147 years worth of coal reserves *based on present consumption rates* but our consumption of fossil fuels is increasing, particularly coal. The percentage annual increases in world consumption of oil, gas and coal are 2%, 3.5% and 8.8% per annum respectively. Projecting these annual increases forward suggests we will exhaust all fossil fuel reserves in 30 years. We have to start changing how we do energy, or either fossil fuel will finish us by global warming or we will finish all the fossil fuel.

Australia has huge areas of unused land and sunshine and we allow 15 to 20 Murray Darlingfuls of monsoon rain to run off into the Arafura Sea each year. To the south of the continent is the windiest part of the globe, the Roaring Forties. Our potential for wind power and biofuel production is enormous. We have enough land and sunshine and water to biofuel half the world. All biofuels should be exploited from all crops and crop wastes to give the same product range as petroleum, but carbon neutrally on presently unused land. Biofuel production is more labor intensive than coal mining, particularly in remote areas.

It is our duty as part of the human race to exploit all this renewable or carbon neutral energy potential to save humanity from itself and make Australia very wealthy in the process.

It is the world's poorest countries that will be the first victims of global warming.

2. Wind power to replace coal power

Clean coal is a pipe dream and, in reality, coal fired power stations are now as obsolete as steam locomotives. Clean coal is technically feasible but will never compete with wind power. (It is also unlikely we will find enough sequestration sites for the huge volumes of compressed or liquid CO₂). Nuclear power is in a similar position and cannot compete. On the driest inhabited continent in the world, it should be emphasized that wind power needs no cooling water. Cooling water is a major financial and environmental cost for both coal and nuclear power. Algal CO₂ biosequestration in ponds will also use far too much water (about 7.5 Murray Darlingfuls of water in evaporation losses).

The conversion of existing coal fired power stations to natural gas firing is cost effective but still too carbon intensive for our 2 tonnes per person per year CO₂ ration. It can be considered as a temporary and transitional measure.

Many countries are heavily committed to wind power, Great Britain, Germany, Spain, Denmark and Holland. These countries have obviously done their financial analysis and decided that wind power is the most cost effective low carbon alternative in their circumstances. Australia has a much lower population density and hence a much greater abundance of wind power per capita. It also has much larger water storages due to our unreliable rainfall. These water storages can be used as hydroelectric storage batteries for supply demand balancing.

Wind power can be used for base load electricity provided it is backed with hydro electric energy storage. Generation of wind power at sea has to be brought ashore and sea water can be used to store wind energy in remote areas, hydro electrically, on the shore line.

Photovoltaic solar energy is even more expensive than clean coal. Solar hot water heaters are however cost effective. We must work towards 100% green wind power on the grid. I buy 100% accredited green power at home for an extra 4 cents per kWh (16 cents). I have had quotes for solar panel power at 80 cents per kWh.

3. Transport energy and CO2 emission reduction

The other big emitter is all forms of transport fuel. We can do a lot to reduce travel and then use green energy to power what is left.

3.1. Stop 'going' and use the internet

We all spend a lot of time and energy going to work, going shopping, going to school, etc. With the growth of the internet, clearly we should be exploiting this fully to reduce greenhouse gas output by reducing unnecessary travel (and traffic jams) where possible.

3.2. Green electric underground trains

Australian cities are very car dependant. Underground green electric trains with their low rolling resistance, built in regenerative braking and lack of junctions, along the lines of the London Underground, are clearly the way to go to reduce this car dependence. The London Underground has trains every few minutes. Cars in traffic jams are ridiculously wasteful of energy and very slow. Victoria Road in Sydney peak hour is down to 12 km/hr i.e. below cycling speed. Bicycle sales are soaring.

3.3. Biofueled plug in hybrid cars, buses, trucks, tractors, excavators

Obviously regenerative braking should be compulsory on all land transport. All vehicles should be biofueled plug in hybrids which can whenever possible run on green electricity from the grid or recovered braking energy. Green grid electricity will always be cheaper than liquid biofuels and does not pollute city air. Some solar panels on the roof of hybrids are a possibility as a partial energy source. Unfortunately most of the existing vehicle fleet is not hybrid or biofueled. We need to develop a vehicle conversion industry to make ordinary vehicles into biofuel plug in hybrids (Mitsubishi workers and factory?).

To convert a petrol driven car to E85 requires tuning modifications, but Swedish Saab has already done all this and makes cars that will run on any mix of ethanol and petrol. Brazil also is skilled in this area. To convert a diesel truck to biodiesel needs little change.

I think it is possible to add an alternative electric drive to a car or bus with a battery pack and extra electrically driven wheel, much as an outboard motor is fitted on the back of a boat. I call this a **Solar Hybridizing Auxiliary Wheel** or **SHAW** drive for short. This conversion is particular suited to city vehicles where driving in traffic over short distances leads to high fuel consumption and city air pollution.

3.4. Wind electric drive at sea

With modern technology, wind power of ships at sea can be a lot more effective than the days of sail. A windmill with sails at a very fine angle to the wind, like close hauled jibs, can generate sufficient power to sail directly upwind, without tacking, at approximately half the wind speed. This does need some development work but sailing boats, using a similar principle, were built in the 1930's. A wind electric ship can carry four times the area of sail of a conventional Bermudan rig. The windmills are very slow revving compared to normal wind generators. I would enjoy converting a Sydney river cat to this form of propulsion.

3.5. Air travel

I think it may be some time before a jet biofuel is developed but there is no reason why a biokerosine cannot be blended up. Air travel and cement making will account for our ration of CO2 emission.

4. Irrigation water and crop yields

If we are to biofuel half the world, we need 3 to 5 times higher crop yields than is the norm for Australia. We need to emulate Europe's crop yields. This requires a more reliable agricultural water supply than at present.

Biofuel agricultural development is also required to increase yields but at present sugar cane for ethanol and palm oil for biodiesel appear the most economical⁽⁴⁾.

Although rainfall patterns from global warming are still in flux, it would appear that the tropics are expanding southward bringing the monsoon rains south with them.

This southward movement of water will probably need some augmentation.

The tropics expansion is due to a significant increase in the Hadley circulation.

Also the east Australian current appears to be strengthening, increasing the catchment rainfall and the flow in the Northern Rivers of NSW. Unfortunately this only affects coastal rainfall, the wrong side of the Great Dividing Range.

There does not appear to be evidence that Australia's total rainfall has decreased.

Australia is very fortunate in that it has two large inland basins, the Lake Eyre Basin and the Murray Darling Basin, both draining to the south. We may need to build some water moving infrastructure to ensure that plenty of monsoon water gets into the northern end of these catchments (20 to 25 degrees of latitude south).

Australia is fairly flat. Water can be moved along the flat with very little energy, a fall of only one in 50,000, and still move at 50 km/day⁽⁵⁾. The flows involved are far too big for pipes. We are talking pumped canals here but keeping water moving minimizes evaporation loss. Cloncurry (in the Gulf) and Cunnamulla (on the Warrego, a tributary of the Darling) are both 189 metres above sea level but 1500 kms apart. It would take 30 metres of pumping only to travel the distance. Perhaps then we could have a permanent flow in the Darling.

Sydney Water pumps about 1/3rd of Sydney's water supply from Tallowa Dam up to Warragamba Dam, a lift of 600 metres, using about 2 kWh per kL. 30 metres is a mere trifle and, as is traditional in Australia, could be pumped with wind power.

5. Reforestation

Hopefully Australia has irresponsible land clearing under control now.

Wood is however a very important biofuel to be exploited. We must obviously plant and grow trees faster than they are cut down, for carbon neutrality.

With better water availability, we could reforest large areas of marginal land and increase our carbon dioxide ration. It takes 6 trees about 30 years to absorb one tonne of CO₂. To increase our ration of CO₂ emissions by 1 tonne per person per year would require an extra 3.6 billion trees planted on 22,000 square kms (0.29% of Australia).

I have personally experimented with scrap hardwood saturated in vegetable oil (old fence palings soaked in old fish and chip shop oil) with some success in an old steam boat. The resulting fuel, about 30% by weight oil, has about the same calorific value as coal and could be called "biocoal". Biocoal production would also be more labor intensive than coal mining.

6. Conclusion

As a retired chemical engineer, with many years experience in a closely related field to the global warming problem, I have to conclude that biofuels in plug in hybrid vehicles, and wind power backed by hydroelectric energy storage on the grid, are the major changes to reduce our Australian CO₂ emissions by the required 90%.

Obviously a reallocation of labor from coal mining to biofuel production will be necessary but very large biofuel production will bring much more foreign revenue and employ more labor than coal mining.

These changes augmented with more internet use, green electric trains and reforestation have to be the way to go.

In the interest of brevity I have left out much technical detail. Please ask questions.

**Robert G Shaw C.Eng., M.I. Chem.E., M.A.W.A.
Hunters Hill, NSW**

References

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- (2) Sydney Morning Herald 18.8.2007 "the cost of comfort"
- (3) World Coal Institute Coal Facts 2007 Edition
- (4) www.platts.com
- (5) $v = 0.55C.D^{0.63}.s^{0.54}$ Hazen-Williams formulation

Other informative reading

"The Weather and Climate of Australia and New Zealand" by Andrew Sturman and Nigel Tapper

"The Revenge of Gaia" by James Lovelock

"The Weather Makers" by Tim Flannery

"The Rough Guide to Climate Change" by Robert Henson

"Heat" by George Monbiot

Kent's Mechanical Engineers Handbook vol 1. Section 2 Combustion and Fuels