The Need for Nuclear Power to Address Climate Change
1 – Introduction

Robert Parker 14th April, 2014

This is the first in a series of articles dealing with the use of nuclear power to address climate change. For many people this is a contentious concept and for some their response will be hostile and incredulous. As a "baby boomer" my own journey into advocacy for nuclear power hopefully explains why its immediate adoption is essential to saving our civilisation and environment.

My concern about climate change was ignited in 2005 when climate change awareness was growing and people were angry. We had a general revulsion against consumerism and rampant consumption. Corporate greed and ineffectual politicians were the enemies of the people and the environment and renewable energy solutions were thought to restore some level of control over our lives and return us to living in harmony with nature.

A wave of behavioural doctrines and solutions spread through the climate change movement. I researched alternative energy solutions and found that rarely was any analysis done to justify their adoption and at times perverse outcomes have resulted. A notable example is that of biofuels[i] where markets have determined that more money can be made by displacing food production or by destroying tropical habitats especially of the Orangutan.

But regardless of the evident failure of "renewables" to make any real dent in our greenhouse gas emissions the "back to nature" movement would brook no opposition. For some, science and technology were seen as a part of this attack on our environment and so conceptually straightforward technologies harvesting nature's free energy became the vogue. Typically we saw the large scale adoption of decentralised power systems such as roof top solar. The intermittency of these systems which entrench the use of emissions intensive gas turbines was and remains an inconvenient truth.

We will only get one chance to refashion our economy around low carbon technologies and people need to be held accountable for their opposition especially when it has no analytical basis. As James Hansen[ii] has recently observed:

"People who entreat the government to solve global warming but only offer support for renewable energies will be rewarded with the certainty that the U.S. and most of the world will be fracked-over, coal mining will continue, the Arctic, Amazon and other pristine public lands will be violated, and the deepest oceans will be ploughed for fossil fuels. Politicians are not going to let the lights go out or stop economic growth. Don't blame Obama or other politicians. If we give them no viable option, we will be fracked and mined to death, and have no one to blame but ourselves."

I detect similarities in science denial between the anti-nuclear power brigade and the climate change sceptics. Again as James Hansen points out *"There is no reciprocity from the supporters of renewable energy"* with their preferred option being fossil fuel backup of renewable energy. *"In other words replace carbon free nuclear power with a dual system,*

renewables plus gas. With this approach CO_2 emissions will increase and it is certain that fracking will continue and expand into larger regions."

The case I am making is for a clean low carbon industrial future being in harmony with and nurturing nature. For it is nature in the wondrous cosmic events such as the implosion of giant stars that gave our planet with immense improbability those elements essential to life such as iron, chromium, molybdenum or cadmium. These were created when stars in their final death throes fashioned and expelled these elements along with uranium and thorium into the cosmos. By a massive fluke these then aggregate into structures such as the Earth to enable life to flourish.

Mankind's creativity can harness these elements from the magic furnace of the cosmos and use them to protect rather than assault our environment. My desire is to stop the industrialisation of our landscapes and to never entertain the massive network of towers and transmission lines that typify wind farms and solar plants. In an increasingly stressed landscape I wish to see nuclear powered desalinated seawater pumped inland so that we can remove many of the dams currently choking our increasingly climate stressed rivers.

As an engineer I became concerned that harvesting wind and solar power could not provide the amount of energy required to refashion our industrial economy around low carbon technologies. Nor could they do it in the time frame or within the carbon budgets that are required. We know the targets. We've been told often enough that a stabilisation target of 450 ppm carbon dioxide equivalent gives about a 50% chance of limiting global mean temperature increases to 2°C. This means Australia would need to reduce its annual emissions by 90% by 2050 which means that our electricity must be generated with emissions less than 90 grams per kilowatt hour.

A quick review of Australia's energy consumption shows where our efforts need to be directed if we are to address our emissions by 2050.

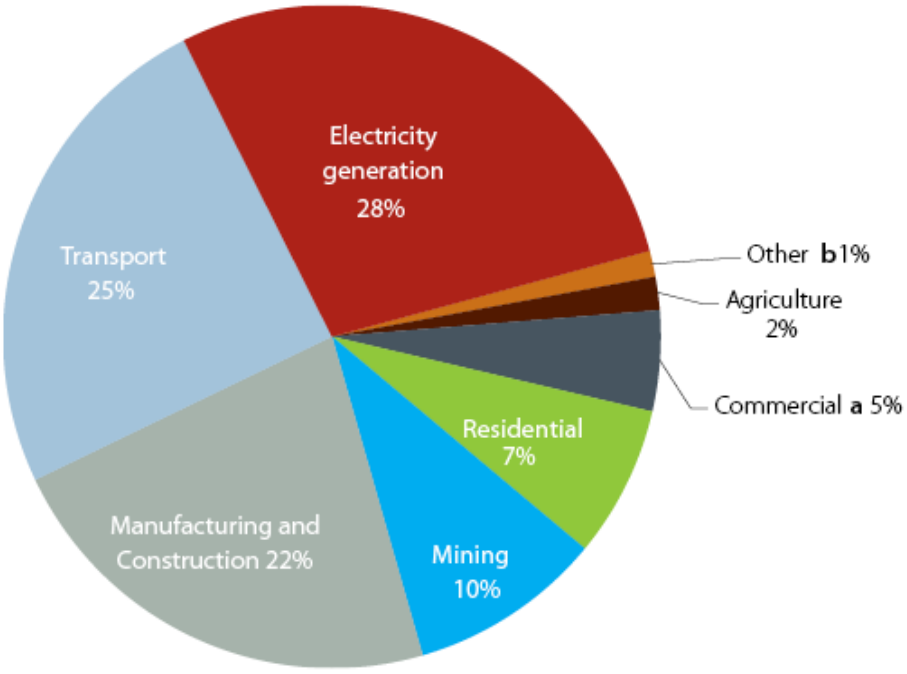

Figure 1 - Australia's total energy consumption by sector, 2010 - 11 [iii]

Figure 1 shows that to make any meaningful reductions we need to be synthesising transport fuels and changing the ways we process metals or manufacture cement. Importantly we need to drive carbon out of our electricity generation. It's no good claiming that we need to de-industrialise or have large cut backs on consumption. The scale of the industrial transition required to achieve a low carbon economy will dwarf our current production. Meaningful reductions will for example result in the hydrogen replacing coal in the smelting of steel with the result that steam rather than carbon dioxide is expelled. Likewise aluminium, known as "canned electricity" has to be smelted using massive amounts of reliable clean low carbon electricity. Our heavy road transport needs to move to electrified rail and our light car fleet converted to electricity. It's obvious that we have not even started the process of real carbon reductions and all this needs to be done with speed and with massive energy density.

We will only get one go at transforming our energy base and any system that is unproven or has massive redundancy and does not stand up to analytical rigor must be excluded. No nation has yet made any significant greenhouse gas reductions using wind or solar power and certainly not with expensive storage systems.

France and Sweden are two standout examples whose nuclear powered electricity generation meets the levels required by 2050. This has resulted in electricity being generated with carbon emissions of 77 and 22 grams of CO_2 per kilowatt hour versus our 847[iv]. France achieved their transition in 22 years with almost double Australia's generating capacity.

We have on this planet enough uranium to power the globe for tens of thousands of years. Nuclear power stations utilise materials some 20 times more efficiently than wind or solar power and in nations that embrace the technology, 1200 megawatt reactors are now built in around 4 years.

In five future papers I will explore the issues of radiation, reactor safety, used fuel deployment, proliferation resistance and the massive environmental and industrial benefits of nuclear energy. Much of this will come from my studies into nuclear physics at ANU and I hope you stay around for all of them.

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[i] http://www.monbiot.com/2014/03/14/the-biogas-disaster/, http://www.crikey.com.au/2009/04/17/how-much-co2-makes-a-manildra-biofuel/,

[ii] http://www.columbia.edu/~jeh1/mailings/2014/20140221_DraftOpinion.pdf

[iii] Energy in Australia 2013, Bureau of Resources and Energy Economics, Figure 10: Australia's total energy consumption, by sector, 2010–11, Page 24.

a includes ANZSIC Divisions F, G, H, J, K, L, M, N, O, P, Q and the water, sewerage and drainage industries.

b includes consumption of lubricants and greases, bitumen and solvents, as well as energy consumption in the gas production and distribution industries and statistical discrepancies. Totals may not add due to rounding.

Source: BREE 2012, Australian Energy Statistics.

[iv] International Energy Agency, CO2 EMISSIONS FROM FUEL COMBUSTION *Highlights* (2012 Edition), p111