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## **CHALLENGES and OPPORTUNITIES for INDUSTRY and GOVERNMENT in achieving ENERGY SECURITY – Greening Brown Coal**

I want to make a few down to earth points - and I want to stress that I am not claiming to have proven or peer reviewed science to back up all my suggestions. But I believe that our experience on the ground will be validated by implementation and subsequent scientific monitoring and analysis:

- Australia does not have an energy security issue, but we do have a greenhouse gas emissions policy problem
- I want to argue that a predominant cause of climate change is worldwide vegetation clearing and degradation of soil carbon – perhaps it is a more significant cause than fossil fuel burning, historically speaking
- This presents great opportunity for Australia - We have some of the most degraded agricultural lands, per capita, in the world, so our opportunity to sequester CO<sub>2</sub> as terrestrial carbon, using modified farming techniques, is vast – potentially sufficient to offset all our fossil fuel emissions for many decades, even centuries, with appropriate policy settings

### **To my 1<sup>st</sup> point:**

That Australia doesn't have an **Energy Security** issue - We have extensive coal and gas reserves, abundant low-cost uranium and vast renewable energy potential. But Australia does have a shortage of transport fuels and a greenhouse gas emissions problem - and therefore we do face energy policy challenges.

There is, however, an immediate opportunity to help resolve Australia's CO<sub>2</sub> issue – that will allow us to continue to utilise Australia's abundant coal and other fossil fuels, until alternative low-emissions and renewable energy infrastructure can be established over the next 30 to 50 years.

It is worth noting that Australia has some of the world's largest brown coal reserves. These can be referred to as lignite, as they are from lignin in trees and are, geologically very young - just past being peat. Victoria's lignite is some of the 'cleanest' coal in the world – low in sulphur, ash and heavy metals – but it is up to two-thirds water. So, with the advent of Climate Change, it is seen as unacceptable to burn wet lignite for electricity, as it is low in thermal efficiency and emits two to three times the CO<sub>2</sub> of black coal or gas, at the power station flue-stack.

Victoria has 430 billion tonnes of lignite, with about 40 billion tonnes mineable at \$5 - \$10 per tonne. This is several times the energy reserve of the North West Shelf and equivalent to Saudi Arabia's oil fields. This could power south-eastern Australia for several centuries.

Victoria's lignite always be much cleaner and cheaper than Australian east coast black coal. But I do not believe that electricity is the highest value use for this rich clean lignite material.

New Australian technologies show real prospect to convert lignite at low cost and with low emissions into clean, low sulphur thermal/coking coal equivalent, transport fuels and fertilisers.

### **But how can the CO<sub>2</sub> emissions from lignite-use be managed?**

An answer, remarkably, might be to use the same peat-like lignite to make a biological, carbon-based, humic and fulvic rich fertiliser, to catalyse Australia's vast cropping and grazing lands to photosynthesise CO<sub>2</sub> from the atmosphere and store it productively, through the plant roots, as soil carbon.

This is a form of biological carbon capture and storage, or **Bio-CCS** as I call it.

A report made public by the European Environment Commission in March, 2009 underlines the crucial role that soils can play in mitigating climate change. **"Soils contain around twice the amount of**

carbon in the atmosphere and three times the amount to be found in vegetation. Soils are an enormous carbon reservoir”, containing around 1600 billion tonnes, and “poor management can have serious consequences”. The report underlines the need to sequester carbon in soils – “the technique is cost competitive and immediately available, requires no new or unproven technologies, and has a mitigation potential comparable to that of any other sector of the economy.”

**So, to my 2<sup>nd</sup> point** - A major cause of Climate Change has been the clearing of vegetation and forest, and the degradation of agricultural lands of vegetation coverage and soil carbon.

At this point, I want to make it clear that it is my firm view that humans are causing Climate Change – and it will have extreme consequences for human life on Earth. Planet-Earth will survive this climate change event, as it has previous ones in the geological record, but humans may not fare so well. So we should do everything that is useful and efficient, quickly, to reduce the various possible causes of Climate Change and to suck-down CO<sub>2</sub> from the atmosphere, as a precautionary measure.

An estimate of the total carbon lost from soils worldwide, by human activity over the last 10,000 years, is around 6,000 billion tonnes - which could be fifteen to twenty times the total fossil fuel emissions since the Industrial Revolution - being around 360 billion tonnes.

In addition, the altered surface albedo effect of vegetation & forest clearance has a major impact on surface/atmospheric temperatures and local precipitation & evaporation – which sounds like Climate Change!

So the focus on fossil fuel emissions as the predominant cause of Climate Change, and therefore the main cure, is, I suggest, arguably misplaced.

**I want to give a civil engineer’s view of climate change:**

The Earth’s biomass has been photosynthesising CO<sub>2</sub> from the atmosphere and thus converting it to organic/carbon matter in the soils and oceans for around a billion years – to form the peat/coal/oil/gas that humans have dug up and burned a significant percentage of, mainly over the last few generations.

It should not surprise us that destroying a major means of bio-sequestration, namely vegetation coverage, and burning a significant portion of a billion years of sequestered carbon, in the form of fossil fuels in just a few decades, could have a significant effect on the dynamics in the atmosphere.

It then seems obvious to me that if we wish to reverse this impact, we should seek to harness the Earth’s natural CO<sub>2</sub> pumps, the plants and biology, to re-establish, and even accelerate, the photosynthesis of CO<sub>2</sub> back into the soils via the plants’ root structures - noting that healthy plants need carbon and biology rich soils, and then they generally have as much mass below ground as above ground.

**Turning to the opportunity for Australia** - Scientists have estimated that soil carbon lost since European settlement from the 500 million hectares of Australian rangelands and farmlands, by traditional grazing and cropping, could be as much as 150 – 200 billion tonnes of CO<sub>2</sub> sequestered in the soils. The average soil carbon contents of these farm-lands have gone from three to four percent down to around one percent.

This is the equivalent of around 300 years of Australia’s current annual greenhouse gas emissions.

So if Australia could remediate its vast agricultural soils just part way back to pre-European soil carbon levels (without using excessive synthetic chemical fertilisers and fungicides that destroy soil carbon and biology and emit nitrous oxide), soils scientists like Dr Christine Jones suggest that we would be sequestering approximately 50 billion tonnes of CO<sub>2</sub> for each 1% increase in soil carbon (down to 30cm depth).

Note that global greenhouse gas emissions are approximately 45 billion tonnes per annum.

Putting it another way: **a 0.2% increase in soil carbon on just 5% of Australia’s cropping and grazing lands, each year, would offset all of Australia’s current annual greenhouse gas emissions**

Soils would then be more fertile and drought and salinity resistant – providing enhanced food security and quality.

This is a WIN-WIN for farmers, the community, big emitters and the environment.

Increasing soil carbon is one of the few proven, large-scale possibilities - and arguably the best and most sustainable way - to remove existing atmospheric CO<sub>2</sub> in the short-term. Australia's landscape and farms are so degraded and vast that they can suck up fossil fuel emissions at positive-value and at low-cost for hundreds of years.

**This process converts CO<sub>2</sub> from a waste and pollutant into a useful feedstock**

I know Australian companies who over the last 15 years have developed biological fertilisers blended from carbon-based materials, lignite particularly, and other nutrients, minerals and micro-biology, that reduce the need for synthetic chemical fertilisers and pesticides, at lower cost and using the same distribution rates and machinery, on-farms. As part of a biological cropping and grazing system, which avoids deep-tillage, burning-stubble and over-grazing, biological fertiliser is now used on over hundreds of farms across Australia – It increases soil carbon year-on-year, sustainably, by rebuilding the biology and humic substances in the soils, so that plants can grow deeper roots and exude carbon photosynthesised from atmospheric CO<sub>2</sub> into the soils.

This is bio-sequestration of CO<sub>2</sub>.

It is a low-risk, low-cost system that Government should recognise and encourage, with equivalent support as is being provided for geological carbon capture and storage – **Geo-CCS** – a technology which may not be available at-scale for many decades.

**So to conclude:** Technology can now convert Climate Change from being a threat into a massive opportunity for Australia. Biological farming and other Bio-CCS technologies, such as algal sequestration of flue-gas CO<sub>2</sub>, can form a '**carbon bridge**' – to a low emissions and renewable energy future, sustainably – **delivering energy security and food security, whilst protecting our economy from high costs of CO<sub>2</sub> mitigation.**

This is not to say that the reduction of fossil fuel emissions is not also necessary going forward, but rebuilding terrestrial carbon levels is arguably the only immediately available, large-scale system for reducing the legacy CO<sub>2</sub> levels in the atmosphere.

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