

# Carbon capture and storage—reality or still a dream?

October 17 2014, by Stephen Bygrave

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Could carbon capture and storage be the way to clean up coal power stations, such as this one in Australia's Latrobe Valley? Credit: Monash University/Flickr, CC BY-NC

To have any chance of avoiding dangerous climate change we'll have to reduce the carbon emissions from our energy sectors—currently the largest human source of greenhouse gas emissions globally. And we'll have to do it quickly.

Renewable energy is one solution. But given ongoing debate about supplying enough energy for a growing population, and replacing old fossil fuel energy generators, options such as [carbon capture](#) and storage have been hailed as another.

Recently the largest carbon capture and storage program yet began operation at SaskPower's Boundary Dam project in Saskatchewan, Canada. The project retrofitted a 138 megawatt coal power station into a 110 megawatt station, and is expected to [capture 90% of the carbon emissions](#) produced through burning the coal.

Carbon capture and storage, or CCS, gained attention as far back as 1995, when the Intergovernmental Panel on Climate Change speculated that yet-to-be-developed CCS technology might be applied to large fossil fuel generators.

The Canadian project demonstrates that the technology can be used, but we now know it comes at considerable cost, and may not even reduce overall carbon emissions.

Many of these issues have been presented in a [CCS Information Paper](#) by Beyond Zero Emissions, of which I am the CEO.

## Why CCS?

The rationales supporting CCS include the technical, economic and political obstacles in the transition to a zero carbon energy system such as one reliant on renewable energy.

From a physical construction point of view, replacement of existing emission intensive generation capacity, on top of the additional capacity required in developing economies, is a daunting prospect. Particularly when considering the ever tightening time-frame for change for

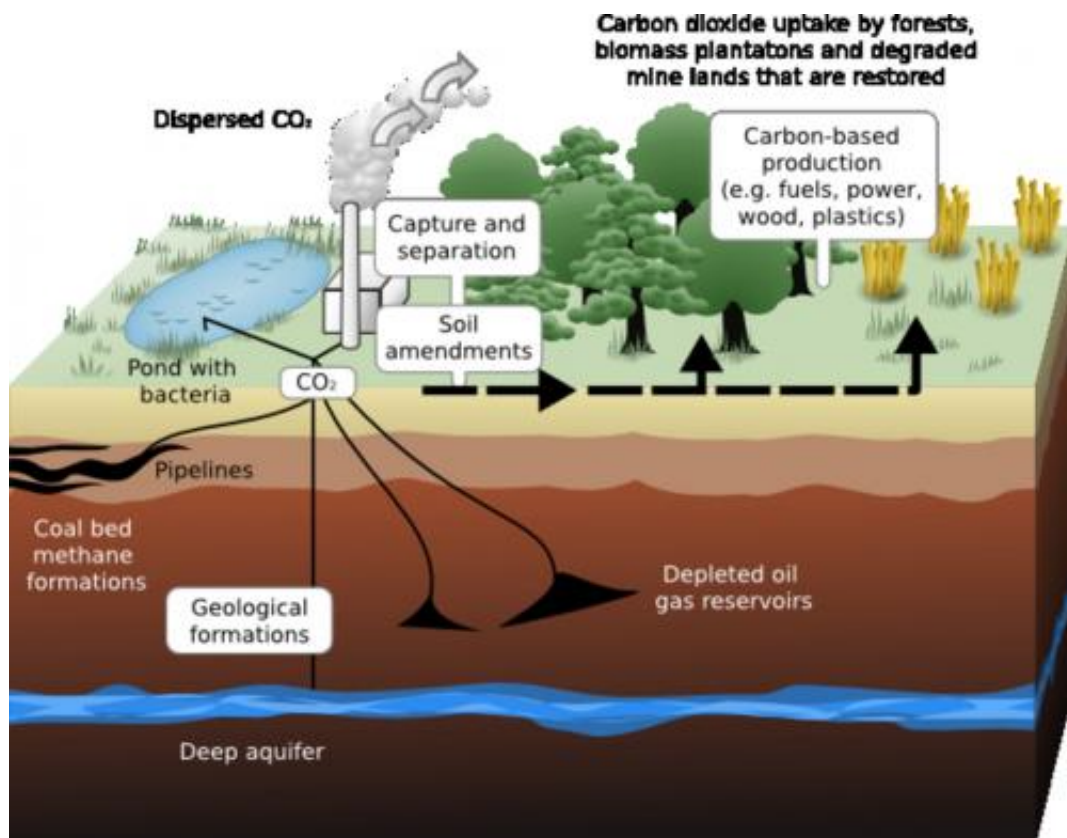
preventing dangerous climate change.

In addition, a political minefield awaits the regulated obsolescence of a large utility asset portfolio of mixed public and private shareholders as greenhouse gas emissions cease to be ignored.

It's no wonder that the possibility to adapt these assets to operate without emitting carbon dioxide invites temptation—a circuit breaker of sorts.

## CCS doesn't work if you're digging up more fossil fuels

The Canadian CCS project will use the captured carbon to help extract crude oil. This is partly to offset the cost of capturing carbon, but what does it mean for carbon emissions?



How CCS works. Credit: LeJean Hardin and Jamie Payne derivative work: Jarl Arntzen/Wikimedia Commons, CC BY-SA

The CO<sub>2</sub> injected into oil-bearing rock mixes with the oil and allows that oil (now mixed with CO<sub>2</sub>) to move to the surface, via wells, for recovery.

After separating the CO<sub>2</sub> from the recovered oil, CO<sub>2</sub> (valued by the industry between US\$25-\$40 per tonne) is cycled back into the ground again and again.

Ultimately some CO<sub>2</sub> will remain permanently stored. But CO<sub>2</sub> enhanced oil recovery can produce between 0.2 and 1.1 tonnes of oil [for every tonne of CO<sub>2</sub> permanently stored](#) (see also [here](#) and [here](#)).

Nearly all of the oil will be burned to produce 0.6 to 3.4 tonnes of CO<sub>2</sub>. Therefore, the ratio of CO<sub>2</sub> stored to CO<sub>2</sub> released due to oil burning ranges from 0.6-to-1 to 3.4-to-1. That's either slightly climate-positive (with an overall storing of carbon) or very climate-damaging (with carbon released overall).

In order to maximise profit, oil producers will inevitably target the most climate-damaging reservoirs where the greatest amount of oil can be recovered by using the least amount of CO<sub>2</sub>.

On top of emissions from oil, in North America where most of the new CO<sub>2</sub> injection activities are planned, any CO<sub>2</sub> permanently stored is not expected to be monitored and verified. No legal mechanisms have been established. So in this case the permanent storage of any CO<sub>2</sub> should be considered incidental.

## High cost—for what gain?

So why use CO<sub>2</sub> to retrieve oil at all? One reason is to offset to considerable costs of retrofitting the coal power station, and countering the 21% drop in power output.

The essential goal behind CCS is to preserve capital assets while transitioning to zero carbon emissions. But this argument doesn't hold up under scrutiny.

We can de-carbonise electricity by replacing fossil fuel power with renewable, or retrofitting fossil fuel power with CCS, or a mix of both. But no matter which path we choose, it will come at the expense of emissions-intensive power generators, and then passed on to society.

This can come through devalued share holder capital from closing power stations early, or through additional investment for CCS.

In the case of the latter, the capital returns of fossil fuel generators renewed by CCS would be clipped by a wholesale electricity market in which renewable generation is already proving competitive. Any room in the wholesale market for price increases would be borne by electricity customers.

Additional investment not generating additional revenue dilutes returns, effectively consuming the pre-existing capital. Any shareholder of a company experiencing an unproductive equity raising is aware of this reality. The only capital preserved therefore would be the balance of existing and new capital – if any.

The Canadian CCS project is the first chance to test this point. A [reported CA\\$1.35 billion](#) (AU\$1.56bn) including a CA\$240 million government grant has been invested to retrofit the coal power station

with CCS—converting 139 megawatts to 110 megawatts.

Compare this with the [recent sale](#) of the NSW owned MacGen to AGL—4,640 megawatts for the sum of AU\$1.5 billion. Clearly any attempt to refit Macquarie Generation with CCS would prove far more costly than foregoing such a sale value.

It is clear that it would be less costly to simply replace emission intensive generators—a cost that would be offset by avoided future fuel expenditure.

## **More cost and less abatement**

Quite aside from [greenhouse gas emissions](#) which CCS seeks to resolve, other problems remain with the continued use of fossil fuels.

Mine site land-use conflict with agricultural production and protected areas of bio-diversity, fire risk of exposed flammable material, combustion waste solids and other pollutants not addressed by [carbon capture](#), as well as water intensity of thermally inefficient generators to name but a few.

It must be questioned why infrastructure which entails such significant external costs would be adhered to so determinedly, even if CCS could be proved as a slightly commercial proposition.

When it's clear that CCS is not even close to a commercial prospect and when net CO<sub>2</sub> emissions may actually increase when combined with oil recovery we must accept reality and swiftly move on to proven and affordable solutions to reducing [carbon emissions](#) such as [renewable energy](#), energy efficiency and reforestation to name but a few.

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