House of Representatives Standing Committee on Science & Innovation
Inquiry Into The Science & Application of Geosequestration Technology

Summary

Encapsulation ocean geosequestration would give the quickest and easiest option to lock away carbon dioxide with no apparent potential problems that require to be solved. Australia has the intellectual property to pursue this route.

1. Introduction

It is assumed that this inquiry is into how to dispose of carbon dioxide collected from exhaust streams and the atmosphere into a suitable permanent repository. My science background is in Chemical Engineering and have done work on how to collect carbon dioxide from exhaust streams and methods of safely disposing of it efficiently.

2 The science underpinning geosequestration technology.

The physical and chemical properties of carbon dioxide (CO_2) are well known. What is often forgotten about CO_2 is that it is a very good solvent. The interaction of weak solutions of CO_2 has caused the dissolution of rocks to form underground caverns, some of which are very extensive.

The amount of further research into the disposal of CO_2 is going to depend on which method is chosen to lock it away. Geosequestration underground appears to have the most question marks as to what will happen to the CO_2, once it is in the repository. One of the main issues revolves around the fact that it is hot at depth underground. Another issue involves the rock present and whether it will dissolve away or allow the liquid or gaseous CO_2 to permeate through the rock. Geosequestration in the ocean suffers from less potential problems that need solving. The main issue is how the CO_2 interacts with the surrounding salt water/silts at the pressures involved at greater than 1000m depth.

If the CO_2 is encapsulated prior to geosequestration in the ocean, the problems virtually disappear. Encapsulation of CO_2 has a further advantage in that if at some time in the future the CO_2 should be required, it can be recovered.

3 The potential environmental and economic benefits and risks of such technology.

Of the three methods outlined above, the process of geosequestration underground would appear to be the most risky. There appears to be no way of minimising this risk from geothermal heat turning the repository into a potential CO_2 volcano. What we have is the equivalent of a boiler with a continuous heat source and no way of turning this heat off, as well as no pressure/temperature relief valve, that is if the CO_2 is put in a supposed sealed rock structure. The question also arises as to how one can ensure that the pressure at depth in the ground can maintain the CO_2 as a liquid, without the CO_2 leaking away and contaminating our large extensive underground aquifer basins with additional dissolved minerals some of which may render the aquifers useless as a future water supply. There is also the question of where are enough suitable underground repositories to keep on storing the CO_2 year after year for perhaps hundreds of years.

Tests done at Frio, USA by Yousif Kharaka and colleagues from the US Geological Survey in Menlo Park, California, where they collected fluid and gas samples before injection began, and at regular intervals afterwards. More recent samples suggest that minerals in the rock walls, including carbonate, are being dissolved by the mixture of CO_2 and saltwater in the reservoir. If enough carbonate is dissolved this could create tunnels in the rock through which the CO_2 gas may seep out into the atmosphere again (*Geology*, vol 34, p 577). While this hasn't happened yet at Frio, Kharaka says that it could be a problem at other sites, particularly where existing cracks in the rocks are filled with carbonate-rich minerals.

Kharaka postulates that if organic compounds and trace metals dissolved in the brine also leak out, they could contaminate groundwater.

Geosequestration in the ocean avoids these problems and Australia is fortunate to have large areas off the coast (and also close to most of the power stations), that are eminently suitable to place the liquid/solid CO_2 that will be secure for many years. Nature has been sequestering CO_2 in the ocean since the oceans appeared so its not as though the CO_2 is being dumped in the ocean. What is not clear however, is whether there will be an increased acidification of the ocean from the liquid CO_2 at depth or whether the sea water will form a clathrate or its equivalent around the CO_2 or that the CO_2 consuming biota will be able to cope with the increased load of CO_2.

Encapsulated geosequestration in the ocean is probably the best method of ensuring that the CO_2 remains where it is placed and that it doesn't interact with the ocean, ocean silts or the marine life.

The potential environmental benefits are the turning of Australian coal fired power stations into "green energy" suppliers. It would make electric vehicles more attractive as they would be truly zero emission vehicles, thus tackling the CO_2 emissions from vehicles at the same time. Australia would no longer be labeled as one of the worst CO_2 emitter per person on the globe. There exists the possibility of a new export income generating stream from Australia collecting and disposing of other countries CO_2 problems.

4 <u>The skill base in Australia to advance the science of geosequestration technology.</u>

Australia does have the expertise to advance geosequestration, which ever route is chosen. There are groups all round the country researching various aspects of geosequestration.

5 <u>Regulatory and approval issues governing geosequestration technology and trials</u>.

My only comment relates to geosequestration in the ocean. Governments need to clarify the issue of whether placing CO_2 in the ocean constitutes dumping or is it just an accelerated natural process. I would contend it is the latter. If the Government backs the encapsulation ocean geosequestration, then the process of CO_2 disposal can begin immediately without having to wait for the outcomes from scientific research and trials with the attendant saving in money.

6 <u>How to best position Australian industry to capture possible market applications</u>.

The Federal Government need to act quickly to decide, assist and champion the most appropriate system of geosequestration that is cost effective, energy efficient and non-threatening to the rest of the environment before Australia looses the lead that it has in capture of carbon dioxide. The funding that is needed to kick start this along is not great when one considers what the costs might be if global warming is not tackled head on quickly. Estimated cost might be in the vicinity of $50M to provide a fully functioning system from capture to final disposal.

If a suitable system is chosen it can be marketed with coal exports to provide other countries with the technology to keep on using Australian coal.