Carbon Sequestration: Too little, too late

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ABSTRACT

The growth in emissions of carbon dioxide, implicated as prime contributor to Global warming, is a problem that can no longer be swept under the rug. But perhaps, it can be buried deep underground or beneath the ocean. A grand challenge for 21st century engineers will be developing a system for capturing carbon dioxide produced by burning fossils fuels and sequestering it safely away from the atmosphere. Carbon capture and storage(CCS) is most likely to be applied to large point sources of carbon dioxide, which involves power plants and large industrial processes. This paper presents an overview of carbon sequestration technology, the problems that have to be solved before it can work and what coal industry has been doing so far.
Keywords: carbon sequestration , global warming.

INTRODUCTION

Carbon dioxide is the prime contributor of green house gases in the atmosphere. Emission of carbon dioxide arise from a number of sources like fossil fuel combustion in power generation, industrial , residential and transport sectors. Global emissions of carbon dioxide from fossil fuel use in the year 2000 totaled to about 23.5 GegaTonne CO_2 yr^{-1} (6 Gega Tonne C yr^{-1})[1]. The IRCC special report on emission scenarios (SRES) projects the future emissions of CO_2 on the basis of 6 illustrative scenarios where global CO_2 emissions range from 29 to 44 Gega Tonne CO_2 yr^{-1} in 2020 and from 23 to 84 Gega Tonne CO_2 yr^{-1} in 2050 [2].

Carbon sequestration has been proposed as one of the engineering solutions to global warming. Carbon sequestration is the process of capture and long terms storage of atmospheric CO_2[3] . It has been proposed as a way to mitigate or defer global warming and avoid dangerous climate changes[4]. CO_2 may be captured as a pure by product in process related to petroleum refining or from gases from power generation[5]. There are three main components of the CCS process: capture, transport and storage. The capture step involves separating CO_2 from various gaseous products. The transport step involves carrying captured CO_2 to a suitable storage site located at a distance from CO_2 sources. Potential storage methods include injection into underground geological formations, injection into deep ocean and industrial fixation.

Carbon dioxide capture and storage

- Geological Storage: It is undertaken in a variety of geological settings oil field, depleted gas fields, deep coal seams and saline formations. Sub-surface geological storage is possible both on shore and offshore[6].

- Ocean Storage: Several concepts have been proposed so far in respect to disposal of CO_2 to ocean/sea bed like lake deposits CO_2 directly on to sea floor at depths greater than 3000m or storage of CO_2 in solid clatharate hydrates[7,8], conversion of CO_2 to carbonates. CO_2 is captured, compressed and transported to deep ocean floor for release at or above sea floor[9,10]. CO_2 then dissolves in to surrounding sea water and becomes a part of ocean carbon cycle[11].
- Mineral storage : carbon sequestration by reacting naturally occurring magnesium and calcium containing minerals with carbon dioxide to form carbonates is called mineral sequestration. According to IPCC , power plant equipped with carbon capture and storage (CCS) utilizing mineral storage process would eventually require 60-180% more energy than a power plant without CCS.
- Forest and carbon storage : forests can store much carbon and their growth can be considered as a potential carbon sink. Fossil fuel emissions of carbon currently offset 310 million metric tonnes of U.S[12,13]. A carbon balance of near zero could be achieved by large forested landscape over long period of time[14,15].

Effectiveness of various sequestration options

The stream of carbon dioxide emitted from smokestack is relatively dilute , making carbon dioxide capture unrealistic. Even more energy is lost by compressing carbon dioxide to liquid form and it is necessary to monitor for leaks. Earth crust is not a purpose built vessel for holding carbon dioxide and the storage must last for thousands of years. So risk of leak must be taken seriously. All of this suggest that the best scenario for geosequestration is that it will play a small role (at most perhaps 10% by 2050) in the worlds energy future. Moreover carbon sequestration has the capability of changing the chemical composition and habitable qualities of the oceans. Deep sea life is extremely sensitive to change.

Despite of government assistance very little is happening with geosequestration. The electricity coming from coal gasification plants that do carbon sequestration will be more expensive because a lot of energy is lost in the process of running the plants in the actual sequestration operating and huge cost of building pipelines , maintenance and monitoring will be passed on to the customers. Carbon sequestration is promoting a vision that no one knows what the true cost will be and whether these technologies will succeed on a large scale.

The fastest and cheapest way to close down coal plants soon is probably investments in efficiency. Remember, it is lot cheaper to save a watt of electricity than to produce one. Meanwhile the clean energy industry (solar, wind, geothermal) will keep growing very fast at exponential rates.

CONCLUSION

In order to mitigate adverse effect of climate change we need to adopt a sustainable development approach by making use of environmental friendly technology. Energy efficient technologies in conjugation with sustainable pathway will help to reduce vulnerability of natural as well as other socio-economic system. An amalgamation of both geological and mineral sequestration technology should be promoted and considered for future mitigation of green house gases emissions.

References

1. IEA, *World Energy Outlook 2007: China and India Insights.* International Energy Agency, Paris, France(2007).
2. IPCC Fourth Assessment Report, Summary for Policy Makers , *Climate Change 2007:Impacts, Adaptation and Vulnerability (WGII)* (2007).
3. Sedjo R and Sohngen B, "Carbon Sequestration in Forests and Soils". Annual Review of Resource Economics (Annual Reviews) **4**, 127–144,(2012).
4. "Squaring the circle on carbon capture and storage" , *Claverton Energy Group Conference, Bath,*. October 24, 2008..
5. https://web.archive.org/web/20080506083543/http://www.pointcarbon.com
6. Cook P J and Carleton C M (Eds.), Continental Shelf Limits: The Scientific and Legal Interface. Oxford University Press, New York, 360. (2000)
7. Rehder G, Kirby S H, Durham W B , Stern L A, Peltzer E T, Pinkston J and Brewer P G, *Geochimica et Cosmochimica Acta*, **68(2)**,285-292(2004).
8. Teng H, Yamasaki A and Schindo Y, *International Journal of Energy Research* , **23(4)**,295-302(1999).
9. Bradshaw A, *Limnology and Oceanography* , **18(1)**,95-105(1973).
10. Song Y, Chen B, Nishio M and Akai M., *Energy*, **30(11-12)**,2298-2307(2005).
11. Marchetti C, *Climate Change*, **1(1)**,59-68(1977).
12. Pacala S, Birdsey R A, Bridgham S D, Conant R T, Davis K, Hales B et al, National Oceanic and Atmospheric Administration, National Climatic Data Centre, 29-36(2007)
13. Jackson R B, Schlesinger W H, Proceedings of National Academy of Sciences, **101**,15827-15829(2004).
14. Kashian D M, Romme W H, Tinker D B, Turner M G and Ryan M G, *Bio Science*, **56**,598-606(2006).
15. Jenny H and Raychaudhuri S P, ICAR, New Delhi, 126 (2006)