MIT MUNC

United Nations Environmental Programme (UNEP)

Background Guide

On the Question of Carbon Capture and Sequestration

UNEP

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1. Why Carbon Capture and Sequestration?

Carbon dioxide levels in the atmosphere are currently at 386ppm, up from 280 ppm during the pre-industrial era, and increasing at a rate of approximately 1.9 ppm per year, with 700 ppm being a projected level for 2100. This increased level has various consequences, beginning with increased temperatures. The average global surface temperature has increased by 0.9°F since 1880, with a rate of 0.29°F per decade, and Arctic temperatures increased at twice the rate of global temperatures. Rising sea levels is another effect of increased CO2 levels, as the polar ice caps melt and the water expands from the increased temperatures. More evaporation leads to more precipitation in coastal areas and more droughts occur inland. Tropical storms occur with greater frequency and intensity, and the ocean becomes more acidic. **(figure 1)**

These effects of increased carbon dioxide levels affect both humans and other life on Earth. As sea levels rise, millions of humans and creatures are displaced. Even slight changes in temperature can make it too hot for an organism to live in an area, which can cause migration and starvation of other species as food sources disappear.

To deal with rising levels of carbon dioxide, we consider carbon capture and sequestration. **(figure 2)**

2. What is it?

Carbon capture and sequestration (CCS) is the removal of carbon from the atmosphere and storage in the lithosphere (ground) or hydrosphere (water), a method to lower the total carbon parts per million. The major focus of carbon capture and sequestration tends to be in industrial settings, with methods of point source capture: pre-combustion, post-combustion, and oxy-fuel technologies. The other way to remove carbon from the atmosphere is direct air capture after emission has already occurred. Once the carbon is captured, it must be transported to sequestration sites, whether it is via pipeline or trucks, at which point it is buried underground. Locations for sequestration include (but aren't limited to) depleted gas and oil fields, sedimentary rocks, and the ocean. **(figure 3)**

3. Implementations

Four industrial projects are currently in effect, Sleipner, Weyburn-Midale CO2 Project, Snøhvit, and In Salah.

The Sleipner Vest is located in the middle of the North Sea, and has been operational since August 1996. At Sleipner carbon dioxide is removed from gas streams with absorption towers, and injected into a saline aquifer, the Utsira Formation. Approximately one million metric tons are stored each year from this project, decreasing Norway's carbon dioxide emissions by 3%, and making the carbon footprint of the natural gas production of the offshore platform nearly zero. **(figure 4)**

Weyburn-Midale CO2 Project transports carbon captured from North Dakota's Dakota Gasification Company's Synfuels Plant to Weyburn and Midale's depleted oil fields in Saskatchewan, Canada via pipeline. The idea is to use the carbon dioxide to recover more oil from the depleted sites, as well as record oil reservoirs' abilities to store carbon dioxide, and the economic feasibility of this action. It began in 2000, and the final phase is to be completed in 2011.

The Snøhvit project began on April 22nd, 2008, removing carbon dioxide from natural gas before liquefying the natural gas. A pipeline transports the carbon dioxide from Hammerfest Liquefied Natural Gas plant to the sandstone Tubåen formation, located in the Barents Sea, 2500 meters beneath the seabed. One million metric tons have already been stored using this project, with a 700,000 metric tons per year storage capacity. The EU partially financed a monitoring program to determine carbon dioxide's behavior after storage.

The In Salah field is located in Algeria, and uses the same method of carbon dioxide separation as Sleipner and Snøhvit, an amine process in which the amine binds to the carbon dioxide. This project removed 186,000 metric tons in 2004, with an increase to 687,000 metric tons in 2007, and is expected to be able to sequester 1.2 million metric tons per year.

Germany has created the first CCS coal plant in Schwarze Pumpe, Germany, operational since September, 2008. Using oxyfuel technology, this plant captures approximately 100,000 metric tons of carbon dioxide a year. The sequestration site is located 200 km away, at the Altmark gas field. The EU plans to have 12 similar plants operating by 2015. **(figure 5)**

4. What to Consider

Your goal as delegates is to decide whether it's feasible to implement CCS technologies as a way to lower carbon levels and prevent global climate change effects, and if so, which technologies should be used. What are the advantages and disadvantages of the technologies? What is your country willing to do in terms of carbon capture and sequestration? Keep in mind economic, environmental, and social costs of both implementing CCS technologies and the costs of inaction as you research. **(figure 6)**

5. Resources

- http://www.epa.gov/climatechange/science/recentac.html
- http://www.epa.gov/climatechange/science/recenttc.html
- http://www.epa.gov/climatechange/science/recentslc.html
- http://www.epa.gov/climatechange/science/recentpsc.html
- http://www.epa.gov/climatechange/science/recentoa.html
- http://www.umich.edu/~gs265/society/greenhouse.htm
- http://www.statoil.com/en/TechnologyInnovation/ProtectingTheEnvironment/CarboncaptureAndStorage/Pages/CarbonDioxideInjectionSleipnerVest.aspx
- http://www.co2captureandstorage.info/project_specific.php?project_id=26
- http://www.ptrc.ca/weyburn_overview.php
- http://www.zeroemissionsplatform.eu/projects/7:weyburn-midale-co2-project.html
- http://www.statoil.com/en/NewsAndMedia/News/2008/Pages/CarbonStorageStartedOnSn%C3%B8hvit.aspx
- http://www.statoil.com/en/technologyinnovation/newenergy/co2management/pages/insalah.aspx
- http://www.guardian.co.uk/environment/2008/sep/05/carboncapturestorage.carbonemissions1
- http://www.guardian.co.uk/environment/2008/sep/05/carboncapturestorage.carbonemissions
- http://news.bbc.co.uk/2/hi/science/nature/7584151.stm
- http://www.engineeringchallenges.org/cms/8996/9077.aspx
- http://www.mongabay.com/images/2006/graphs/ipcc-lag.jpg
- http://eesl.kaist.ac.kr/img/main_54.png

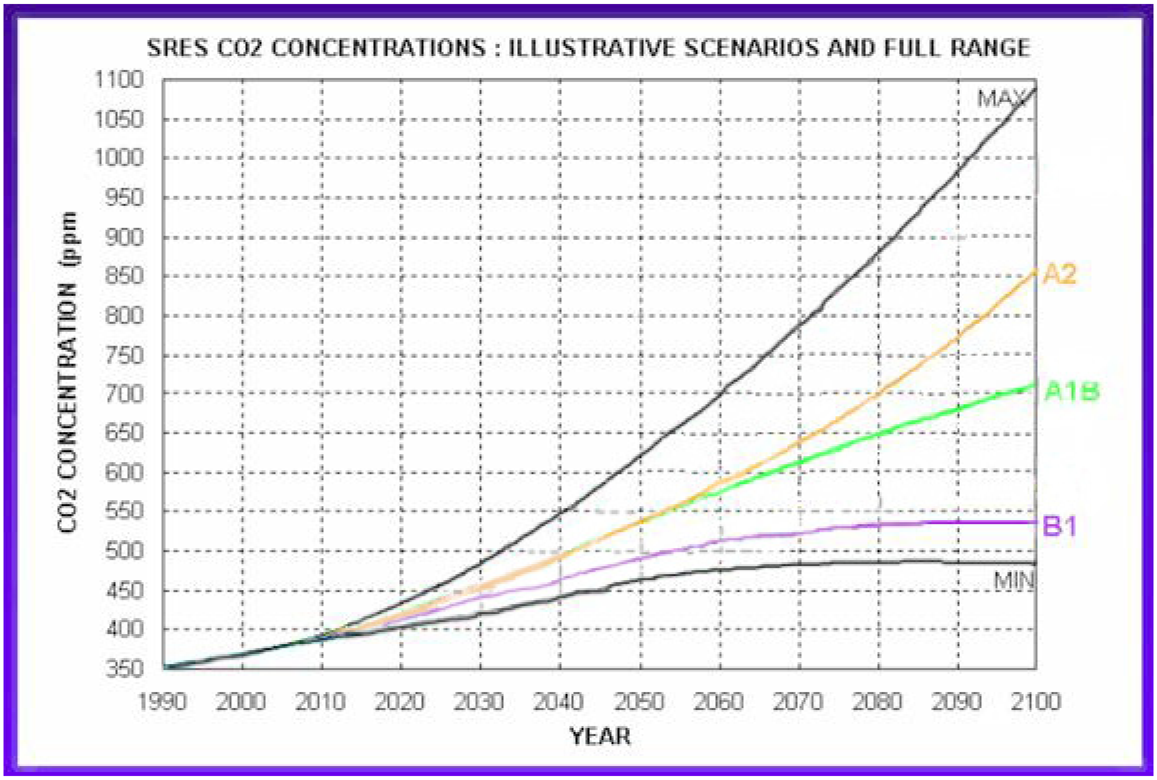

Figure 1. Different models demonstrate possible carbon dioxide concentrations.

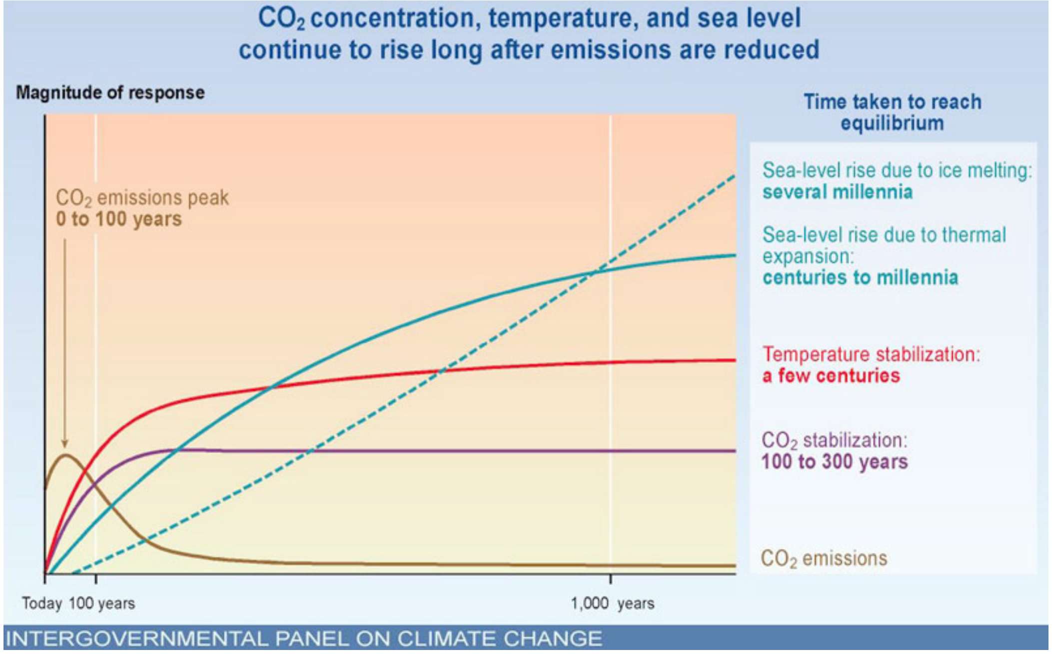

Figure 2. Cutting emissions may not be enough to prevent further effects of climate change; carbon capture and sequestration may be a solution.

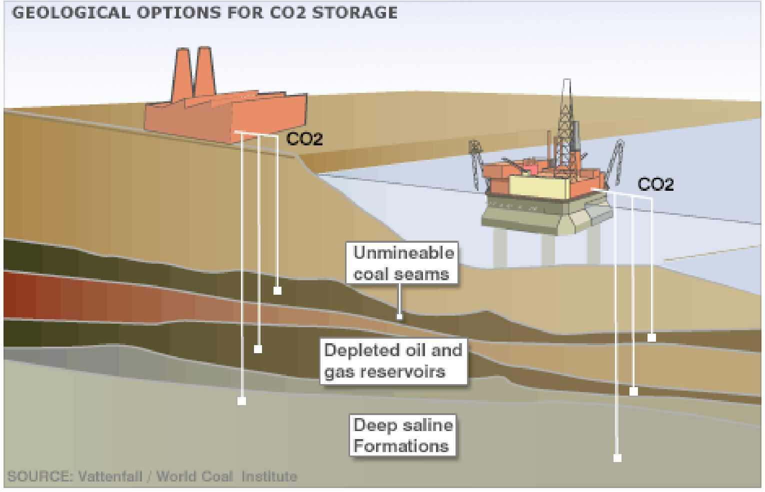

Figure 3. Geological options for carbon dioxide storage.

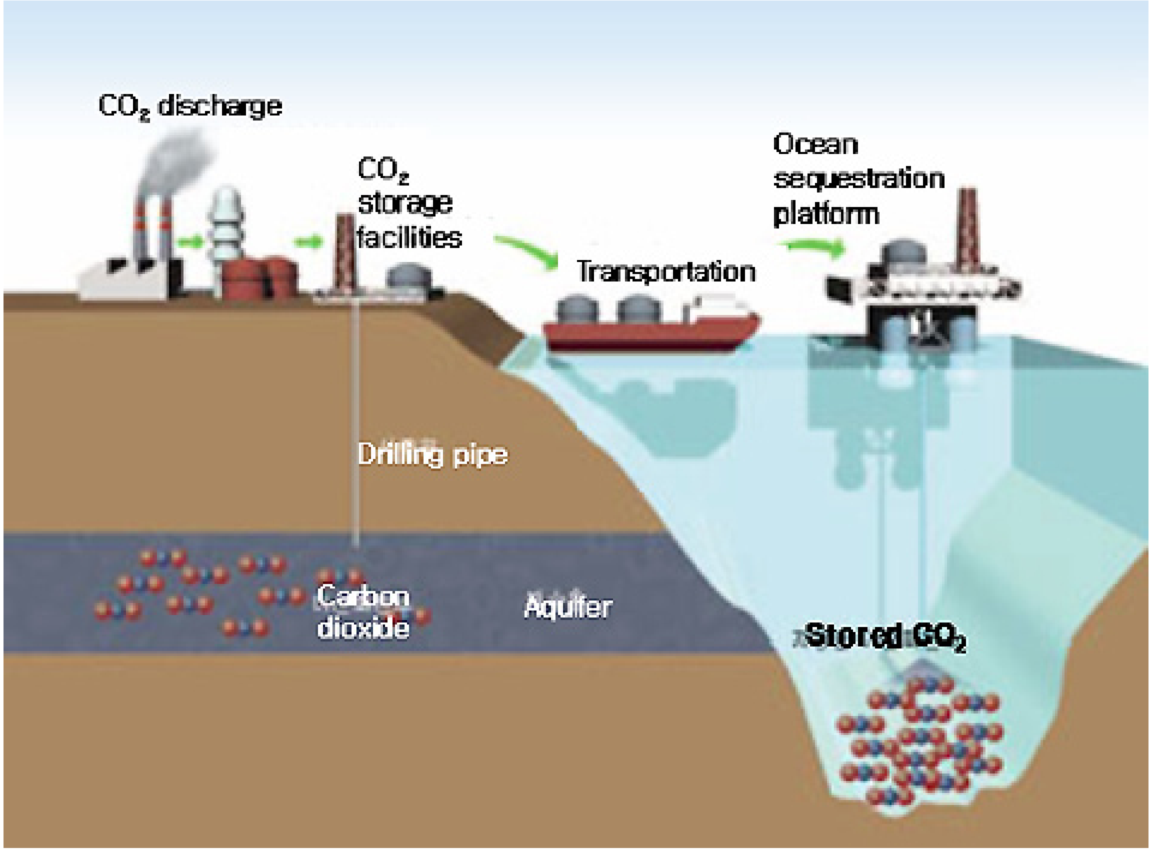

Figure 4. Saline aquifer and ocean sequestration.

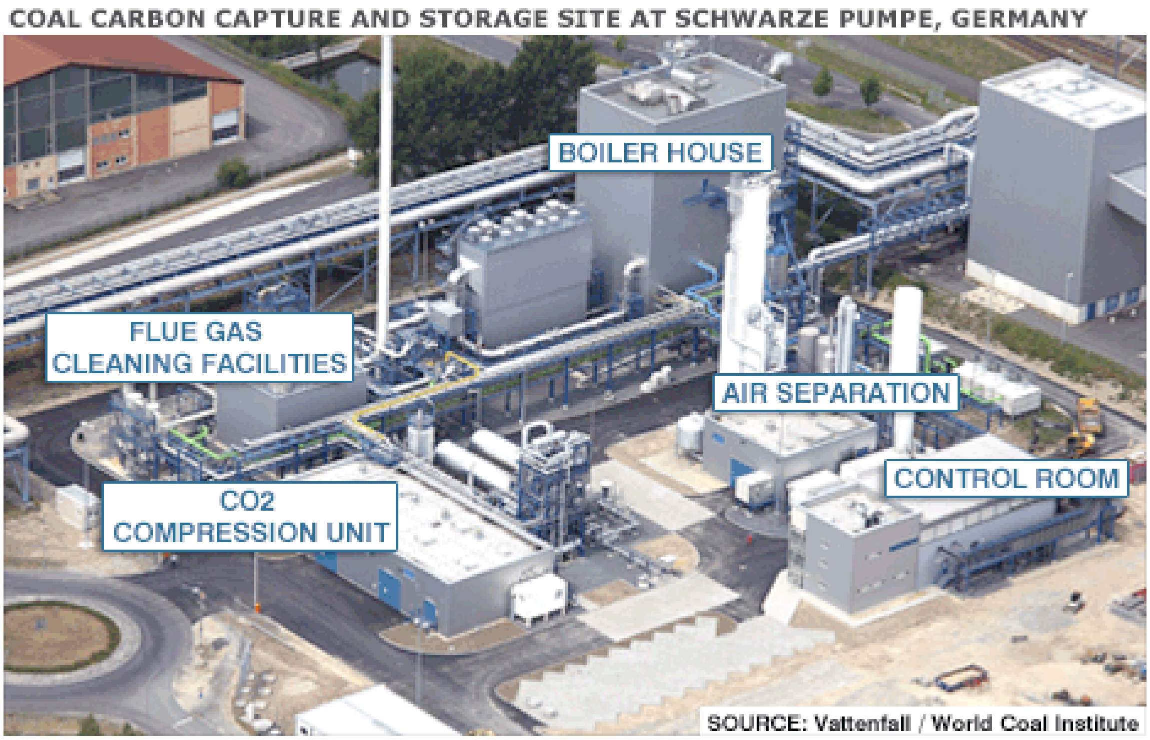

Figure 5. Schwarze Pumpe, Germany.

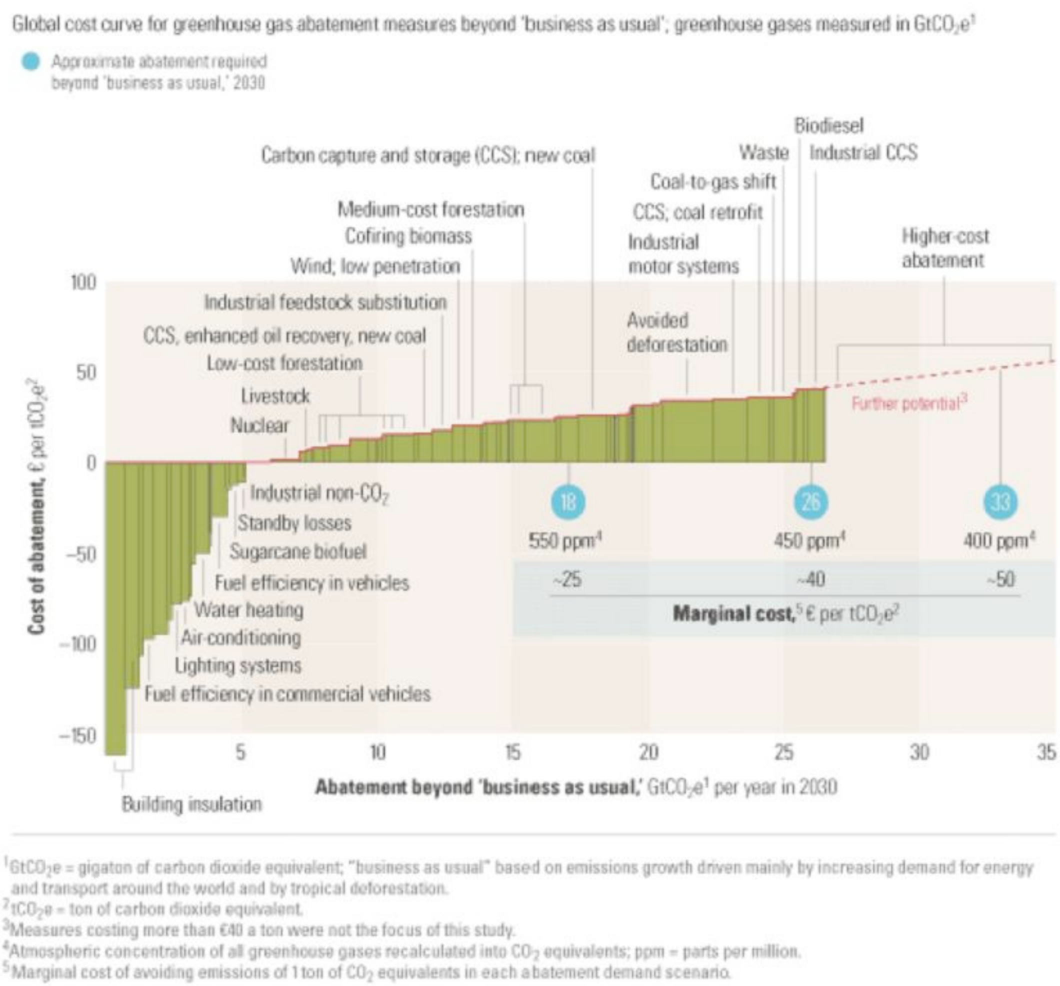

Figure 6. Costs for different methods of reducing carbon dioxide levels.