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12.085 HW 5

For many geoengineering solutions, the cost of capturing and transporting CO₂ is a major limitation. Lackner et al. (1995) proposed using CO₂ to synthesize solid carbonates; their proposal would be much more feasible if the geoengineering site locations were not constrained by their proximity to fossil fuel-burning plants. To solve this problem, Lackner et al. (2001) showed that capturing CO₂ directly from the air could be cheaper and more efficient (in terms of overall CO₂ mitigation) than using windmills. The design of these CO₂-collectors is based on cooling towers used for wind power in dry climates (Bishop, 1993): water is pumped up the tower where it cools the air. The cooler air falls, generating much more energy than was needed for pumping the water up in the first place. In CO₂-capture, the falling air would flow over CO₂ sorbents instead of wind turbines. The capacity of each tower is 9,500 tons of CO₂/day, or the total emissions from vehicles in a city of 700,000 people. The major challenge is to find the most optimal sorbent (Ca(OH)₂ has been suggested) and develop a way to recycle the sorbent when extracting the CO₂ from the sorbent (Lackner et al., 2001).

Prototypes were created by Lackner and Global Research Technologies, LLC. The news release doesn't have many technical details, but each completed tower could extract 1,000 tons of CO₂/year, so millions would be needed to remove the estimated 25 billion tons that would stabilize CO₂ levels at twice that of pre-industrial times (The Earth Institute at Columbia University, 2007).

I think this approach to CO₂ extraction is both appealing and ominous—the advantage is that extraction could be done anywhere, so that emissions from small,

scattered sources (cars, for example) can be accounted for. The extracted CO₂ can be re-used for enhanced oil recovery, sequestered underground, or used to synthesize carbonates. The danger is that it takes away any incentive for reducing emissions—people will no longer be responsible for their emissions, since the CO₂ extracted originates from a variety of sources from all around the world.

References:

Bishop, J.E. (1993), Wind power may yield cheap power, *The Wall Street Journal*, June 9, 1993.

The Earth Institute at Columbia University (2007), First Successful Demonstration of Carbon Dioxide Air Capture Technology Achieved by Columbia University Scientist and Private Company, April 24, 2007.

Lackner et al. (1995), Carbon dioxide disposal in carbonate materials, *Energy* 20:11, 1153-1170.

Lackner et al. (2001), 1st National Conference on Carbon Sequestration, Washington, DC, 2001 - 198.99.247.24,
http://www.netl.doe.gov/publications/proceedings/01/carbon_seq/7b1.pdf