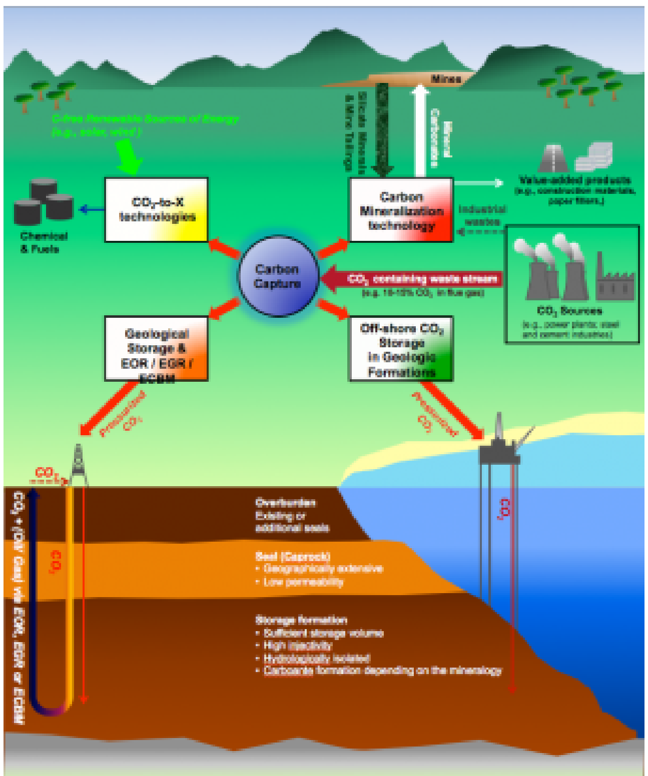
From theory to reality: Carbon capture utilization and storage

April 9 2014, by Christophe Jospe, Earth Institute, Columbia University



The many processes that involve carbon capture utilization and storage.

In spite of calls for urgent action to reduce carbon dioxide emissions to mitigate the effects of climate change, little attention and funding has been given to a technological solution that can take this greenhouse gas from a concentrated source or directly from the atmosphere, and use or sequester it.

In theory, carbon capture, utilization and storage can be considered a viable option to reduce the amount of anthropogenic greenhouse gas emissions. In reality, there are significant technological, political, economic and practical hurdles for the technology to work on an effective scale. As collective action to tackle climate change stalls, and the global consumption of carbon-intensive energy sources increases, it is imperative to have a thorough assessment of such hurdles from an interdisciplinary perspective.

To assess what is being done, what can be done, and what should be done, the Lenfest Center for Sustainable Energy is bringing together experts from an array of fields for a conference and annual meeting of the Research Coordination Network on Carbon Capture, Utilization and Storage from April 14-16.

Discussions will range from business and policy implications of the technology, to the current and future state of large-scale projects, to state-of-the-art technological advancements. (Click here for an agenda with speakers, topics, abstracts and a link to register.)

Carbon capture can be separated into two categories: point source capture—capturing the CO2 from a concentrated source such as a coal or cement plant; and direct air capture, which removes carbon dioxide directly from ambient air, independent of where the emissions came from. The Monday, April 14, workshop, "Air Capture and Its Applications in Closing the Carbon Cycle," considers the latter, and will discuss direct air capture's opportunity to become a backstop technology that could ultimately allow us to clean up after ourselves.

The artificial tree is able to absorb carbon dioxide when dry, and release it when moist.

As presented in an article recently published by Lenfest Director Klaus Lackner, "The urgency of the development of CO2 capture from ambient air" (pdf), there are three major benefits to air capture technology. First, air capture and carbon sequestration would allow for continued use of liquid fossil fuels while we transition to a carbonneutral economy. For instance, flying an airplane or driving a car releases greenhouse gases that cannot be directly captured from the source, but in this case can be offset from direct air capture.

Secondly, air capture provides a scalable option for reducing atmospheric concentration of CO2. Technologies such as Lackner's "artificial tree" on a larger scale can theoretically remove up to 1 ton of CO2 per day per unit from the atmosphere. For reference, our global CO2 emission is 80 million tons daily.

Lastly, pairing up the air-captured CO2 streams with a renewable energy source could provide an option for converting captured CO2 into liquid hydrocarbon fuels. This could provide a route for closing the carbon loop in the transportation sector, which due to the need for high energy density fuels, has proven to be one of the most difficult sectors to decarbonize. Under this scenario, synthetic fuels would displace fossil-derived hydrocarbons, thereby reducing the emissions associated with this sector.

The meeting of the Research Coordination Network on Carbon Capture, Utilization and Storage on April 15 and 16 considers the entire range of the technologies in three parts. Part 1 provides essential background, motivation and context. As the calls for putting a global price on carbon increase, it is crucial to have an accurate view of how much it costs to capture a ton of it to determine scalability of the technology. Likewise, it is important to build public trust in the ability to safely and responsibly store it.

Part 2 looks at global large-scale projects to bring participants up to date on current technologies and provide outlooks for near-term developments. Aside from CO2-intensive energy sources, there are a range of industrial applications (pdf) that can implement this technology.

Part 3 takes into account the current status and challenges in CO_2 capture and conversion. This addresses the critical issues of research and development goals, where we need to be in the future and how to get there.

Carbon capture, utilization and storage has been dismissed by some critics as too expensive, too risky and too enabling of the continued use of fossil fuels. However, theoretically, they have the potential to become a major player in climate change mitigation, both as a backstop technology and as a way to more responsibly reduce the amount of carbon dioxide emitted from point sources. A goal of the April 14-16 conference is to bring together expertise that covers the range of technological, political, economic and practical know-how to most strategically and pragmatically find a way forward.

More information: The paper titled "The urgency of the development of CO_2 capture from ambient air" is available online: energy.columbia.edu/files/2013 … -CO2-air-capture.pdf

Source: Columbia University