Atmospheric Carbon Dioxide

How technology can help reduce atmospheric carbon dioxide. By ***Suzanne Hall***

Some people argue that technology offers options to reduce atmospheric carbon, and that there is, therefore, no need to dramatically change our lifestyles and the direction of economic and social development.

Atmospheric carbon can only be reduced in the following ways:

- By reducing emissions of carbon dioxide.
- By removing carbon from the atmosphere.

In this article, we provide an overview of just how much technology can help in reducing atmospheric carbon dioxide.

Reducing emissions of carbon dioxide

One way to reduce atmospheric carbon dioxide (CO2) is to put less into the atmosphere. From a technology perspective, this can be achieved in two ways. First, by using energy efficiently. This means improving the yield from carbon-based energy sources. The energy sources cannot be engineered for a better yield. So the technology that uses such sources must be made more efficient. There is scope for such improvement. The second way in which less CO2 can be put into the atmosphere is by using less carbon-intensive energy sources and more alternative energy sources. The technology for using alternative energy sources exists and can be developed. But neither is existing technology being promoted by government and industry, nor is research into further technologies being supported at the rate it should be.

Carbon sequestration

Carbon sequestration is the permanent removal of CO2 from the atmosphere. There are two types of sequestration: biological and geological.

Biological sequestration is the process by which young, growing trees and plants use CO2 for their growth. Carbon from the atmosphere is absorbed by trees and vegetation, and locked away into their molecular structure. Currently, forests, soils, and other vegetation absorb 40% of manmade emissions. Part of this absorption is driven by the increased CO2 level in the atmosphere, but there is a limit to the capacity of forests and vegetation to respond to increasing CO2 levels. Planting trees and plants is a way to help absorb atmospheric CO2. But the overall process is currently not well understood. For example, it is known that trees and vegetation absorb CO2 while growing. That absorption decreases in maturity. And when a tree or plant dies, it will add carbon dioxide back into the system unless it is taken out of the carbon cycle—by, say, being used as building material. Where trees are planted, in what quantities, and what type of tree, are issues that are not yet fully understood. Tree planting, however, remains one of the best known and most practised methods to reduce CO2.

Biological sequestration in oceans has also been investigated by some researchers. One idea is to add iron sulphate to ocean water to increase the growth of marine algae. The algae absorb CO2 from the atmosphere when growing. When they die, they sink to the bottom of the ocean as carbon. Again, the effect of the process on overall marine life is not understood. Many scientists believe that the risks far outweigh the benefits. So this option is currently not safely practicable.

Geological sequestration is the capture, compression, and permanent storage of CO2 in underground reservoirs. CO2 capture makes sense only at points where large quantities of CO2 are produced, such as power stations. At these points, the process is estimated to reduce emissions by about 80%. The captured CO2 must then be compressed and transported to underwater storage reservoirs—it is considered too dangerous to store on land—such as saline aquifers and hydrocarbon fields. The risk of CO2 escaping via natural faults or oil-drilling

activity, however, is considered very high. The benefits of the process and the availability of the technology makes geological sequestration feasible. Its only industrial-scale implementation below the bed of the Norwegian Sleipner gasfield is therefore being carefully monitored. It should be noted, however, that the one million tonnes of CO2 that has been sequestered under the Sleipner field represents about 3% of Norway's CO2 emissions for one year.

Conclusions

There is a limit to the efficiency that technology can bring, and carbon sequestration provides small and unreliable benefits. Most certainly, technology can reduce atmospheric CO2. Such a reduction could only be measured relative to total atmospheric CO2. If we continue with the growth-driven business-as-usual economic model, the reduction that technology can bring will not have any impact on atmospheric CO2 that will halt global warming. Technology will, however, have a significant impact if there are limits placed on countries' carbon emissions. Alternative energy sources, such as solar energy, can also have a significant effect and should be promoted.

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8 November 2004. References: 'How We Can Save the Planet' by Mayer Hillman, Penguin, 2004.

SIDEBARS

Carbon Sequestration

Visit CLSF, the Carbon Sequestration Leadership Forum, for a more detailed overview of the process.