Capturing Industrial Carbon

Examining Potential Air Quality Benefits

Area of concern in the Great Lakes, Detroit. Photo by U.S. Environmental Protection Agency.

Capturing carbon from industrial processes before it enters the atmosphere has the potential to make a significant impact on the climate crisis, helping safeguard people and wildlife. But what if we could also capture the other pollutants that more directly contribute to poor air quality and health conditions? We have an opportunity to reduce carbon emissions, improve air quality, and do it all with community input.

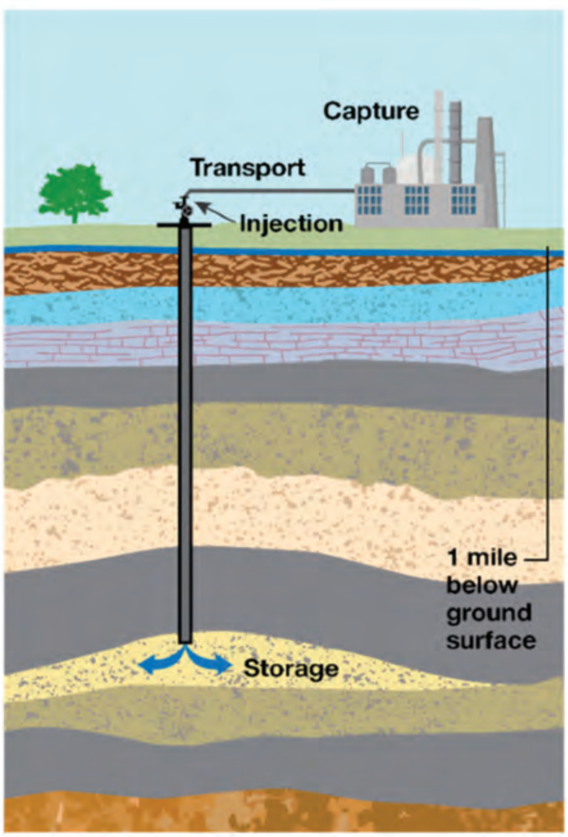
What is Carbon Capture, Utilization, and Storage?

Carbon capture, utilization, and storage (CCUS) is a technological process that separates carbon dioxide (CO_2) from other air emissions released from burning fossil fuels at an industrial source, such as a cement or chemical factory, and captures it before it can enter the atmosphere. CO_2 is a planet-warming gas. As more is emitted by industrial sources, it creates a greenhouse effect that traps heat in our atmosphere and contributes to climate change. When CO_2 is captured at an industrial source it can then either be stored deep underground for permanent storage or can be used to create products such as low-carbon cement, textiles, or other goods that require carbon-based inputs.

How Can CCUS Improve Air Quality?

The benefits of capturing carbon and reusing it or locking it away are clear—we reduce the emissions being pumped into the atmosphere and offer vital industries needed pathways to cut climate emissions that are otherwise very difficult to eliminate. However, CO_2 is not the only pollutant that industrial processes emit. Additional pollutants such as nitrogen oxides (NO_x), sulfur dioxide (SO_2), and particulate matter (PM) are also emitted by industrial processes and have negative effects on air quality and therefore the health of people and wildlife.

The emissions of harmful pollutants from heavy industry have had a disproportionate impact on communities of color due to historic practices of redlining and other policies that enable environmental racism. Breathing in air with a high concentration of NO_x can lead to respiratory diseases such as asthma, and breathing in SO_2 can aggravate existing respiratory conditions, while both can lead to haze, smog, and acid rain. According to a Sierra Club report, compared to the US average, fence-line communities that are near industrial facilities face greater socioeconomic and environmental harm.



Class VI injection well. Graphic by U.S. Environmental Protection Agency.

The same report said that eliminating emissions of PM from the iron, steel, cement, aluminum, and metallurgical coke industries could avoid thousands of deaths annually.

Recent research from the Great Plains Institute (GPI) has found that retrofitting industrial facilities with carbon capture technology can reduce these harmful pollutants that have caused increased instances of asthma and certain types of cancer, particularly in minority and low-income communities, in addition to achieving the intended CO_2 reduction.

Economic and Health Benefits

Because non-CO_2 gases can erode the CO_2-attracting filter in carbon capture technology, it is standard practice to remove such co-pollutants before capturing the carbon. The GPI study examined scenarios across seven industrial sectors in ten regions where carbon capture could be deployed. Carbon capture technology in these sectors would first remove co-pollutants from the industrial waste streams, making CO_2 capture more efficient and cost-effective. One can then measure "the economic value of health benefits" that would follow from reduced air pollution as a positive side effect.

The study found that in addition to the climate benefit of cutting CO_2 emissions, co-pollutant removal—a part of the engineering process for carbon capture—also improves air quality and public health. The total economic value of the health benefits varied regionally, from \$6.8 million in the Northeast to up to \$481.2 million in the Mid-Atlantic per year. It is important to note that measuring health benefits this way means that the dirtier the industry, the more there is to gain in health benefits when capturing that industry's co-pollutants.

Certain manufacturers and industries will continue to be necessary, even as society deploys climate change strategies. Carbon capture, by pre-treating industrial waste streams to remove co-pollutants, can play an important role in improving air quality and repairing health outcomes previously caused by industrial pollution. Another necessary step for industry during the energy transition will be to move away from fossil fuel-driven operations—e.g., utilizing electric arc furnaces instead of fossil-run blast furnaces and electrifying where possible–to further lower industrial pollution in the long run. To avoid energy-associated lifecycle carbon emissions, a more robust zero-carbon grid is also needed to provide power to electrified industries. When considering the air quality improvement and public health benefits of capture technology, CCUS can make a compelling case for being part of the transition toward industrial production that is safer for the planet and public health.

Considerations

The Inflation Reduction Act (IRA) and Bipartisan Infrastructure Law (BIL) have invested billions into American CCUS research and development, offering economic pathways towards the deployment of the technology for some facilities, but not all. There is a lot of room for interpretation as to whether CCUS will provide meaningful benefits for a given facility and the surrounding community. For example, the GPI study found that, because contaminants in natural gas waste streams are relatively dilute, burning natural gas and capturing the associated co-pollutants does not deliver sufficient air quality gains to alone make CCUS a cost-effective investment; the value to society of capturing climate-altering carbon pollution would also have to be factored in. Additionally, it is important to note that the GPI study did not consider potential upstream or downstream emissions such as those resulting from transportation, nor did the report consider other barriers such as the social license of an industry in a particular locality to operate.

Community Engagement

Communities should be given ample opportunity to be involved in proposed CCUS projects in their area. If developers bring a CCUS project to a community, even if it has high potential to address pollution, it is vital to understand a community's lived experience with industry and the harms that industry might have caused. Due to the historic disenfranchisement minority and low-income communities have faced as a result of industrialization, community members might be reasonably skeptical of claims of reduced harm and potential benefits to their communities. Thus it is increasingly important to validate potential risks and fears before addressing strategies to limit air pollution and other potential socioeconomic benefits.

Given the new Department of Energy (DOE) requirement to include a Community Benefits Plan (CBP) in any project applying for DOE funding, communities could use this opportunity to enshrine co-pollutant removal targets in their project agreements. For example, developers could create an agreement where regular third-party monitoring of air pollutants is conducted and share results with community members in public forums at regular intervals. Another option is for developers to work with communities to help them access technical assistance opportunities or funding for community science, which can then serve as a baseline to compare to transparent reporting done by the company. Examples like these provide opportunities for transparency, which has the potential to aid communities seeking accountability and harm reduction commitments. Transparency throughout the development process will not just be important

Energy Secretary Jennifer Granholm meet with Shirley Watts Payne, a resident of the El Vista neighborhood of Port Arthur, Texas, to learn about her experience as a fence-line resident and the impacts of living adjacent to industry. Photo by U.S. Department of Energy.

for community buy-in, but also to create lasting and equitable relationships between projects and community members. Bolstered efforts for transparency could include things like site tours, insight into company structure and future plans, and demonstrating how community input has been incorporated into ongoing development.

While the lived history of overburdened communities makes the continuation of industries that are difficult to decarbonize particularly complex, co-pollutant reduction may be one way to reduce harm and avoid exacerbating historic inequities in the interim until alternatives to carbon-intensive products or less polluting methods of production arise. Capitalizing on this, there are real opportunities for developers and communities to be innovative in the development of CBPs to create a project that can meaningfully benefit communities, especially if community members are involved in the discussion of potential benefits. Finally, federal policies should incentivize industry to prevent harm and provide benefits to communities as a restorative practice that repairs historic harm and crafts a pathway toward a healthier, more equitable transition.

For more information, please visit NWF's Reducing Greenhouse Gas Pollution webpage or contact Dr. Simone H. Stewart, senior industrial policy specialist, at StewartS@nwf.org, Sarah Kallgren, carbon management coordinator, at KallgrenS@nwf.org, or Jacob Ferrell, carbon removal justice fellow, at Ferrellj@nwf.org.