# Carbon capture co-benefits report

Reduced pollutants, improved air quality, and health benefits

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## Key takeaways

- The carbon capture co-benefits report describes the economic value of reducing pollutants through amine-based carbon capture at 54 facilities across seven industries and 10 regions for the United States. The report simulates adding carbon capture to facilities with average emissions for their sector in each region. Next, it simulates pollutant removal at facilities and calculates the resulting air quality change and health benefits.
- Adding carbon capture to a facility in each of the seven industries in this report results in between $6.8 to $481.2 million in health benefits per year in each region. The study simulates capture for three to seven facilities per region, depending on the industries present regionally.
- There are health benefits for adding carbon capture to all industries, but the cost of capture and amount of health benefits varies by facility. Further study is needed to calculate $CO_2$ reduction benefits, transport and storage costs, and benefits of adding capture to the 5,000 US facilities eligible for the 45Q tax credit.

**What are co-pollutants?**
Co-pollutants are pollutants that are emitted alongside the primary pollutant from a specific source. For this study, $CO_2$ is the primary pollutant, the specific source is industry or power facilities, and $NO_x$, $SO_2$, and PM are the secondary or co-pollutants.

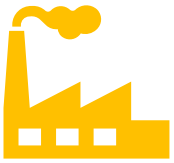
**What are co-benefits?**
Co-benefits are additional, often unintended, benefits that result from actions aimed at addressing a primary issue. Carbon capture is used to reduce $CO_2$ emissions, but pollutants are also removed to keep the system running smoothly. This pollutant reduction improves air quality, a co-benefit.

## Report overview

Amine-based carbon capture can help reduce pollution because pollutants like nitrous oxides ($NO_X$), sulfur oxides ($SO_2$), and particulate matter (PM) must be removed to help keep the carbon capture equipment running smoothly. When these harmful pollutants are reduced, it can lead to better air quality and improve public health. In this carbon capture co-benefits report, seven industries that can use carbon capture are examined to estimate how this process could bring additional benefits to different regions of the United States. The report describes three main steps for this process, 1) select facilities, 2) simulate pollutant removal, and 3) calculate health benefits.

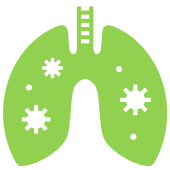
### Step 1: Select facilities

The report uses US EPA data to identify 54 representative facilities in seven industries across 10 regions. These industries included cement, coal power plants, ethanol, fertilizer and ammonia, iron and steel, natural gas power plants, and petroleum refineries. The representative facility for each industry was selected based on the median $CO_2$ emissions in their industry and region.



### Step 2: Simulate pollutant removal

Next, the report examines the process of capturing $CO_2$ emissions at these facilities. Before $CO_2$ can be captured, the emissions must pass through "scrubbing" systems to remove pollutants. The systems used in the report typically remove at least 75.1 percent of $NO_x$ emissions, 98 percent of $SO_2$ emissions, and any condensable PM particles.[1] Next, the report simulates the $CO_2$ passing through a capture system designed to remove 90 percent of $CO_2$ emissions.[2]



### Step 3: Calculate health benefits

To calculate the health benefits of removing $NO_x$, $SO_2$, and PM from the 54 facility's emissions, the report uses EPA's CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool. This tool evaluates how changing pollutant levels affects the local and regional air quality and associated health impacts. The tool also provides the economic value associated with these changes in health impacts. The report shows the number of potential asthma exacerbations and mortality reductions, as well as the amount of total health benefits, in millions of dollars per year for each industry and across each region.

1. The equipment used to remove co-pollutants was designed to meet the EPA's New Source Performance Standards for pulverized coal technology, which provide the most conservative estimates for co-pollutant removal, and thus, health benefits gained.
2. Capture system used is an existing technology (Shell's Cansolv amine-based carbon capture system).

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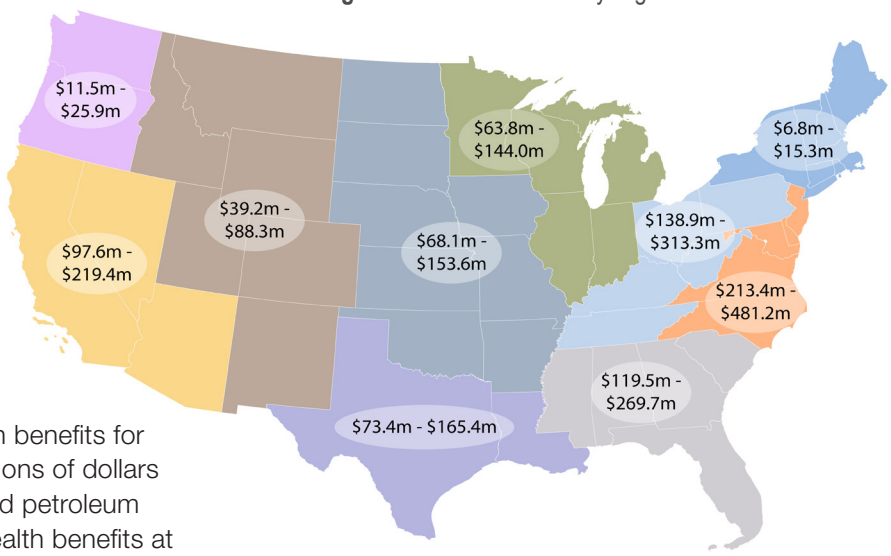
## Health benefits by region

Adding carbon capture to a facility in each of the seven industries in this study results in $6.8 million to $481.2 million in health benefits per year in each region. Not all regions had a facility in each industry. The report simulates capture and associated benefits on between three and seven facilities per region, depending on the industries present regionally.

**Figure 1**: Health benefits by region

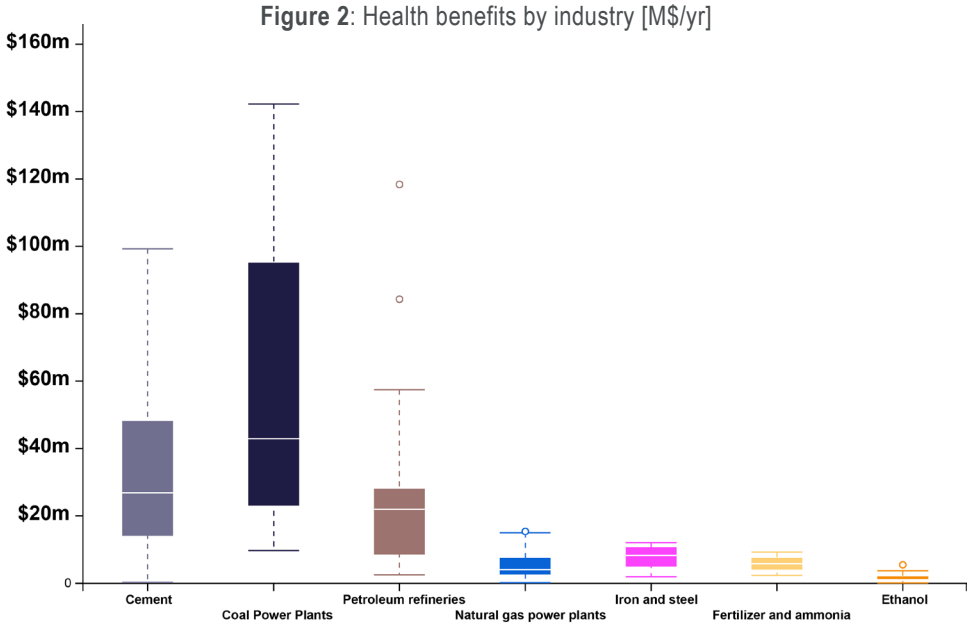



## Health benefits by industry

Installing carbon capture provides annual health benefits for all industries. The largest health benefits, in millions of dollars per year (M$/yr), were seen in cement, coal, and petroleum refineries (figure 2). The report compares the health benefits at each facility to the 45Q tax credit for permanent storage ($85 per metric ton) and cost of capture. Factors like storage and transport costs, as well as climate, jobs, and carbon reuse benefits, were not included in the analysis.

Additionally, only 54 representative facilities eligible for the 45Q tax credit were studied. There are nearly 5,000 other facilities in the United States eligible for the 45Q tax credit that could also provide similar health benefits from carbon capture to those found in this study.

**Figure 2**: Health benefits by industry [M$/yr]




**Tax credit benefits greater than capture costs**

The value of the 45Q tax credit is greater than the cost of capture for some industries, including ethanol, fertilizer and ammonia, iron and steel, and some coal and natural gas power plants.

**Tax credit and health benefits greater than capture costs**

Most cement facilities, most petroleum refineries, and one coal power plant, have a capture cost greater than the 45Q tax credit. However, the combined economic value of the health benefits and the tax credits is greater than the remaining cost of capture.

**Tax credit and health benefits less than capture cost**

Most natural gas facilities, some cement facilities and coal power plants, and one petroleum refinery provide health benefits, but the total economic value is less than the remaining cost of capture after the 45Q tax credit.

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For more carbon management resources related to carbon capture and air quality, visit the Carbon Capture Coalition, Industrial Innovation Initiative, Carbon Action Alliance, or Carbon Capture Ready websites or reach out to Kelley Reierson at kreierson@gpisd.net.

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