Global Energy Solutions e.V.

For Prosperity and Climate Neutrality

Carbon Capture and Storage / Usage (CCS / CCU)

Factsheet

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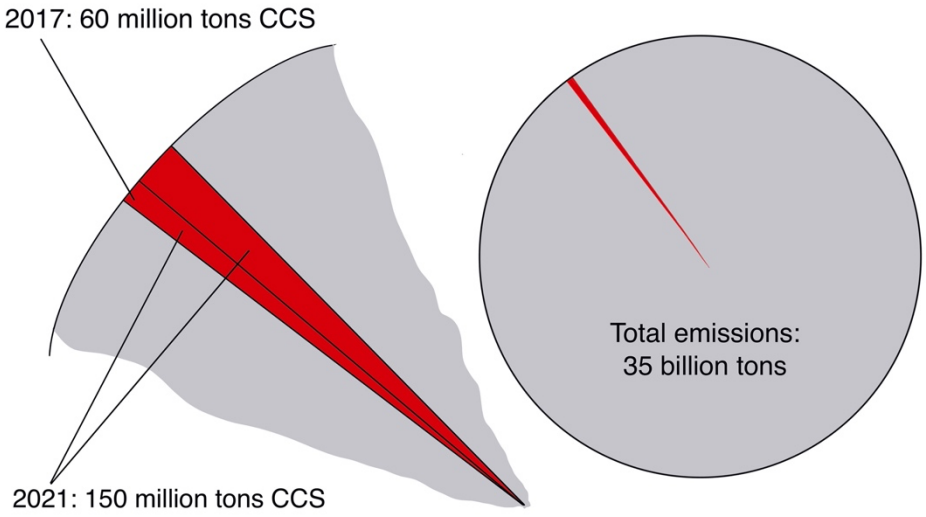
The Intergovernmental Panel on Climate Change (IPPC) recommends it, as does the International Energy Agency (IEA), and the German think tank Agora Energiewende also advocates CCS, especially in cement production. In the political landscape in Germany, however, the topic is very difficult.



Source: IEA 2022, own illustration

CCS is experiencing a rapid boom. Compared to annual global CO_2 emissions, the share is nevertheless small, well below one per mille.

What is it about?

Carbon capture and storage (CCS) can be used to capture CO_2 and store it underground. If climate gas is used further, for example to produce synthetic fuels, this is called carbon capture and use (CCU). CO_2 can either be captured from polluters, for example coal-fired power plants, or extracted from the air by means of Direct Air Capture (DAC). However, the amount of CO_2 in the atmosphere is small, about 0.04%. Therefore, DAC is significantly more expensive than CO_2 extraction from exhaust gases, where the concentration is usually more than 10%.

What´s the status quo?

By far the most CCS projects are in the USA. For a long time now, CO_2 has been extracted in large quantities and injected into oil and gas deposits to make better use of them (EOR/EGR Enhanced Oil/Gas Recovery). CCS is in many respects a mature technology. The number of CCS projects worldwide is increasing significantly. In 2017, 60 million tons of CO_2 were injected, and by 2021 this figure had risen to 150 million tons. However, in relation to the annual CO_2 emissions of about 35 billion tons, the share of CCS has so far been negligible.

How to transport CO_2?

By pipeline, truck, rail, or ship. With distances from approximately 1,800 kilometres, transport by ship is more cost-effective, mainly because laying pipelines is expensive.

How CO_2 can be stored?

Injecting CO_2 into gas and oil fields and caverns is considered sensible and ready for the market. Storage in oil and gas fields under the sea is being planned. Mineralisation, as is being successfully tested in Iceland, is promising. In this process, CO_2 dissolved in water is injected into basalt rock - and thus becomes stone within a few months. The technique is considered very safe. Volcanic basaltic rocks are common all over the world. Therefore, theoretically, there are no capacity problems for storing CO_2.

What are the costs?

Capturing CO_2 in industry currently costs between $40 and $120 per ton. According to Chinese figures, the costs could drop to a third by 2050. Direct air capture, on the other hand, is much more expensive. Currently, the price is between 600 and 800 dollars per ton, but it could drop to 100 dollars over the next 20 years. This does not include the cost of storage.

Conventional power plants have efficiencies between 35 and 55 per cent. Capturing CO_2 reduces it by 5 to 10 percentage points, which lowers profitability.

New business models are currently emerging around CCS. The Langskip project in Norway, for example, plans a price of 30 to 55 euros for the disposal of one ton of CO_2 in gas fields under the North Sea. This includes transport from German ports.

This contrasts with the costs for CO_2 certificates that must be paid in the EU if the CO_2 is released into the atmosphere. In 2022, the price for one ton of CO_2 in the EU will be 30 euros, in 2025 it will be 55 euros.

What do critics say?

Today's CCS plants eliminate between 80 % and 90 % of the CO_2 in the flue gas stream. (Lower capture rates are possible and correspondingly cheaper, higher ones significantly more expensive). Critics in particular point to the efficiency losses caused by CCS and the associated larger fuel volumes. In addition, there are doubts about the safety of CO_2 storage. However, technical storage is much safer and faster than using natural sinks, for example through reforestation. If a forest catches fire, the CO_2 stored in the wood is released again. Finally, there is still a considerable need for regulation of CCS in terms of certification, accounting, and verification.

Conclusion

CCS and CCU are important tools in the fight against the climate crisis and represent opportunities that should be seized. Currently, 150 million tons of CO_2 are removed from the atmosphere every year. In 2050, it will have to be many times that amount if - as is to be expected - fossil fuels are to continue being used and at the same time CO_2 pollution of the atmosphere is not to increase any further. Many questions are still open, for example transport and final storage of these huge quantities. Not surprisingly, the technology is currently being used primarily in oil and gas production - because it serves to increase yields and is immediately profitable. In general, financing CCS or CCU is the biggest current challenge, especially in developing and emerging countries.