

Industrial Solutions

CO₂-Recovery

Reducing your
carbon footprint



thyssenkrupp



Climate Change – CO₂ makes a difference

In most industrial production processes CO₂ is produced in some way. That may be in an obvious way, e.g. as byproduct of a chemical reaction or from other, more hidden sources. The amount of CO₂ necessary to produce a certain product is called the carbon footprint.

CO₂ is one of the greenhouse gases with an impact on the ongoing climate change. To reduce global warming, the “Paris Agreement” was signed by 195 states in order to match the limit of a warming of 2 °C in relation to the preindustrial level. Due to that, regulations like the “European Union Emissions Trading System” (EU-ETS), the “Effort Sharing Regulation” (ESR) or the „American Rescue Plan Act“ bind producers of greenhouse gas emissions to pay certain taxes. Aim of these regulations is to reduce the admissible netto emissions of greenhouse gases to zero by the year of 2050. But this development towards sustainability also puts producers under financial pressure.

Recovery as a minimal emission solution

Plants working with CO₂ or other greenhouse gases (following CO₂) most likely can be revamped to reduce their emissions. There are several process steps, where losses in CO₂ may occur. The most obvious of these process steps is during depressurization processes of corresponding vessels of the plant. A recovery system can be a solution to collect the CO₂ during depressurization and save it in a storage vessel. Thereby the potential of the recovery system depends on its operating pressure (Fig. 3). The lower the pressure of the recovery system is, the higher the amount of recovered CO₂. On the other hand, a decrease in recovery pressures causes an increase in the effort and complexity of the design of the recovery system. For example, low recovery pressures may cause a large increase in the necessary vessel and/or compressor sizes, especially with increasing vessel volumes (Fig. 5).

Evidently, developing an optimized solution for the corresponding plant is essential. To find a well-balanced compromise between the presented aspects is a task that requires a great expertise in this matter. Uhde High Pressure Technologies (Uhde HPT) provides a longtime experience in the design of tailor-made recovery solutions and assists its clients in finding the optimal solution for their application.

Possible advantages of CO₂-recovery systems:

- reduced CO₂ emission, carbon footprint
- reduced tax cost
- step towards CO₂ neutrality
- lower CO₂ purchase cost

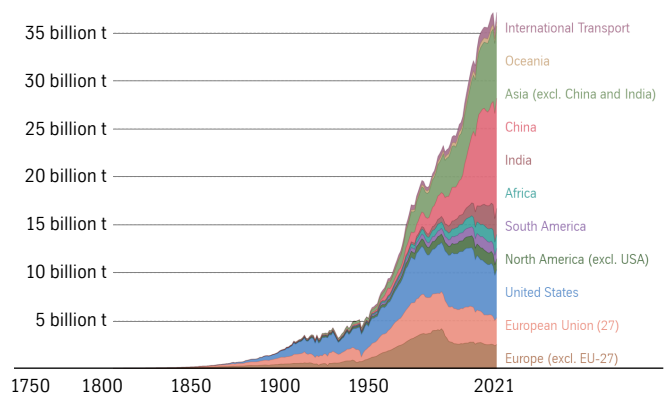


Fig. 1: Annual CO₂ emissions of fossil fuel and industry by world region 2022. (Land use change not included).
Source: Our World in Data based on the Global Carbon Project (2022)
OurWorldInData.org/co2-and-greenhouse-gas-emissions • CC BY

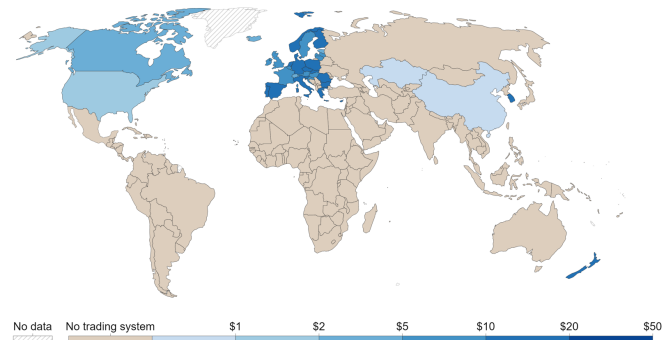


Fig. 2: Emissions-weighted carbon price in emissions trading systems, 2020.
Source: Dolphin, Pollitt and Newbery (2020). Emission-weighted Carbon Price.
Note: Yearly prices are either averages of daily allowances, or allowance-weighted averages of clearing prices in all auctions held within that year.
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Manifold technical options, longstanding know-how

There are several different concepts available for designing a CO₂-recovery system, each with its individual advantages and challenges. To find the optimal solution Uhde HPT can assist clients on their way to implement a suitable solution for their individual requirements.

Concepts of CO₂-recovery

There are different conceptual approaches to CO₂-recovery solutions leading from direct conveying to more sophisticated solutions. Depending on the required/optimal pressure of the recovery system different vessel-types, pressurized or not, can be considered. For certain recovery pressures a combination of concepts may be the most efficient way to maximize the recovery performance. For all recovery concepts a CO₂ collection vessel is useful, not only in order to provide the CO₂ capacity to start up the plant, but also to collect the recovered CO₂ before reuse.

Long term expertise in recovery systems

Uhde HPT can look back to decades of experiences in high pressure CO₂ processes. Since CO₂ is a popular solvent in supercritical fluid processes, a solvent recovery or recycling should always be considered. Uhde HPT implemented a high variety of highly sophisticated CO₂-recovery and recycling systems in the past and can support customers with a most specialized evaluation. Especially customers who think of retrofitting their plants in order to respond to new regulations or climate goals can count on a tailor-made recovery solution for their individual process.

Customized CO₂-recovery systems

Uhde HPT picks up customers where they are and understands, as the case may be, the process they already have. Based on that, Uhde HPT can aid with the adequate engineering/design of recovery components and as a supplier of high-pressure equipment and plants Uhde HPT can also serve customers with a complete solution including development, construction and assembling. A high-pressure specialized service team is responsible for any kind of spare parts and service needed after the system has been installed.

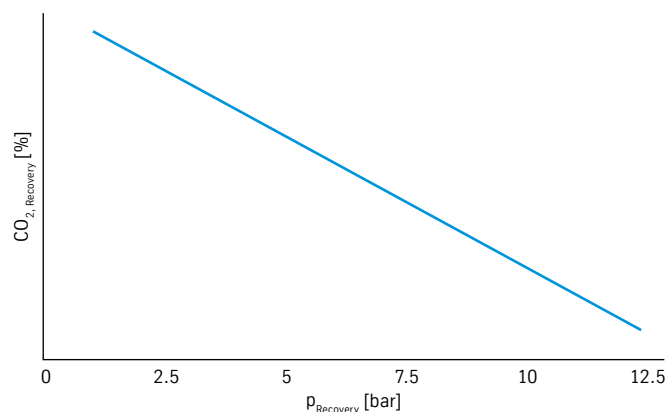


Fig. 3: General dependency of amount of recovered CO₂ on recovery pressure



Fig. 4: Compressor for a CO₂-recovery system.

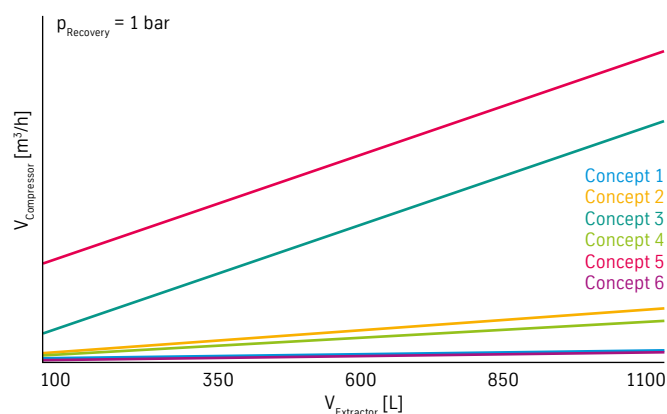


Fig. 5: General dependency of compressor throughputs on extractor vessel size for different CO₂-recovery concepts.

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