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Technology and Costs

TECH 2022S7: Carbon Capture and Sequestration Technologies

Carbon Capture and Sequestration Technologies is one in a series of reports published as part of NexantECA's 2022 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

CO_2 or Carbon Capture and Sequestration (CCS) is defined as an integrated system of technologies comprising Capture, Transport and Storage.

CCSs is seen as the most promising route for reducing emissions and achieving net-zero greenhouse gas emissions with the aim of limiting global warming to 1.5 °C to combat climate change.

This TECH report provides an overview of the technological, economical, market aspects, climate landscape in terms of key policies and project status. The following issues are also addressed in this report:

- Technology overview and carbon capture routes as well as the advantages, key challenges and status of their adoption.
- Key players and technology holders / licensors of commercial and developing carbon capture technology.
- Comparison of the different technology and capture routes and typical suitability for different carbon production sources.
- Carbon capture process economics comparison and for different regions
- Commercial applications of carbon dioxide

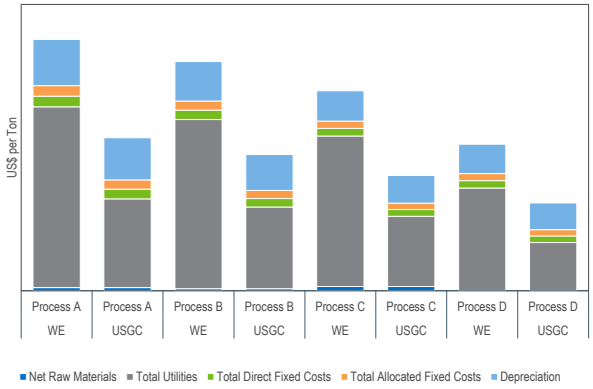
Commercial Technologies

The major commercially available technologies can be generally classified under absorption, adsorption, membranes and cryogenics (though the latter two are not as widely adopted as the former two currently).

- Chemical absorption has been widely used for decades worldwide in power generation, fuel transformation and industrial production. Amine-based processes for CO_2 removal are the most mature chemical absorption technology currently.
- Physical separation which includes absorption, adsorption, cryogenics and dehydration / compression are currently used mainly in natural gas processing and ethanol, methanol and hydrogen production but not as widely used as chemical absorption. The two most common physical solvents are cold methanol (used in Rectisol process) and dimethyl ethers of polyethylene glycol (used in Selexol process).
- Technology readiness for membrane separation varies by application.

Process Economics

Detailed cost of production estimates for carbon capture are presented for MEA, hindered amines and activated amine technologies. Alternative technology such as ammonia-based system was also analyzed. Regional comparison includes Western Europe and USGC.



Commercial Overview

The global consumption of CO_2 in 2021 is estimated at around 233 million tons. The fertilizer industry comprises over half with over 130 million tons being used in urea production. This is followed by the oil and gas industry, with an estimated 74 million tons used in enhanced oil recovery (EOR). Smaller quantities are used in other applications, including F&B production, metal fabrication, cooling, fire suppression and in greenhouses.

CO_2 demand however represents less than one percent of the global carbon emissions and therefore has limited impact on carbon emissions reduction.

An overview of the demand by end use and by region, production sources by sector / country and concentration levels are included in this TECH report.

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The TECH program (formerly known as PERP) is globally recognized as the industry standard source of process evaluations of existing, new and emerging technologies of interest to the energy and chemical industries.

TECH's comprehensive studies include detailed technology analyses, process economics, as well as commercial overviews and industry trends. Reports typically cover:

- Trends in chemical technology
- Strategic/business overviews
- Process Technology
- Chemistry
- Process flow diagrams and descriptions of established/conventional, new and emerging processes
- Process economics – comparative costs of production estimates for different technologies across various geographic regions
- Overview of product applications and markets for new as well as established products
- Regional supply and demand balances for product, including capacity tables of plants in each region
- Regulatory and environmental issues where relevant

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- PDF reports including detailed technology analyses, process economics, as well as commercial overviews and industry trends
- Cost of production tables in spreadsheet format
- Consultation time with the project team

An annual subscription to TECH includes twenty reports published in a given program year. Reports can also be purchased on an individual basis, including reports from previous program years.

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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

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