



# CLEAN AIR TECHNOLOGIES CARBON CAPTURE SOLUTIONS

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ANDRITZ provides you with tailor-made clean air technology solutions focusing on reduced emissions and improved performance and efficiency to meet changing market conditions and comply with asset strategies. Our offering covers the entire flue gas line, ranging from particulate control, dry

and wet scrubbers, multi-pollutant equipment to CO<sub>2</sub> capture systems for various industrial plants (P&P, biomass, WtE/S2E, I&S, cement, chemicals and others). Thanks to our broad portfolio of best available technologies, innovative engineering, partnerships with renowned companies, and

excellence in project execution, ANDRITZ can meet your needs for your pretreatment as well as post-treatment CO<sub>2</sub> capture requirements. From feasibility studies, FEEDs, mobile test units to full-scale plants, ANDRITZ is the right partner to implement your decarbonization roadmap.

## ANDRITZ



# Delivering end-to-end solutions

ANDRITZ carbon capture solutions range from feasibility studies (Basic Technical Study, FEL1, FEL2, ...), Front-End Engineering Design (FEED), Engineering and Procurement with Supervision (EPS) to full Engineering, Procurement and Construction (EPC).

In the early phase of your CO<sub>2</sub> capture project, our feasibility studies provide valuable analysis of project costs, key consumable demands, and land requirements.

ANDRITZ FEED studies include the early engineering design, specifications, drawings and data sheets required to develop a firm price estimate and schedule for your future CO<sub>2</sub> capture system. The detailed design and execution planning will accurately and reliably define the cost and execution schedule for your Final Investment Decision (FID).

Depending on your erection and commissioning preference, ANDRITZ will supply your CO<sub>2</sub> capture system on an EP, EPS, or EPC/turnkey base.

Such an integrated EPC approach is particularly relevant for a CO<sub>2</sub> capture system where many technologies are involved including flue gas pretreatment and CO<sub>2</sub> conditioning (compression and/or liquefaction). With ANDRITZ providing the full scope, you can be assured of proper energy integration for the overall solution, which will

contribute significantly to the operational efficiency and economics of your future CO<sub>2</sub> capture system. ANDRITZ experts will support you with the design of each of these important technologies.

## FLUE GASES PRETREATMENT

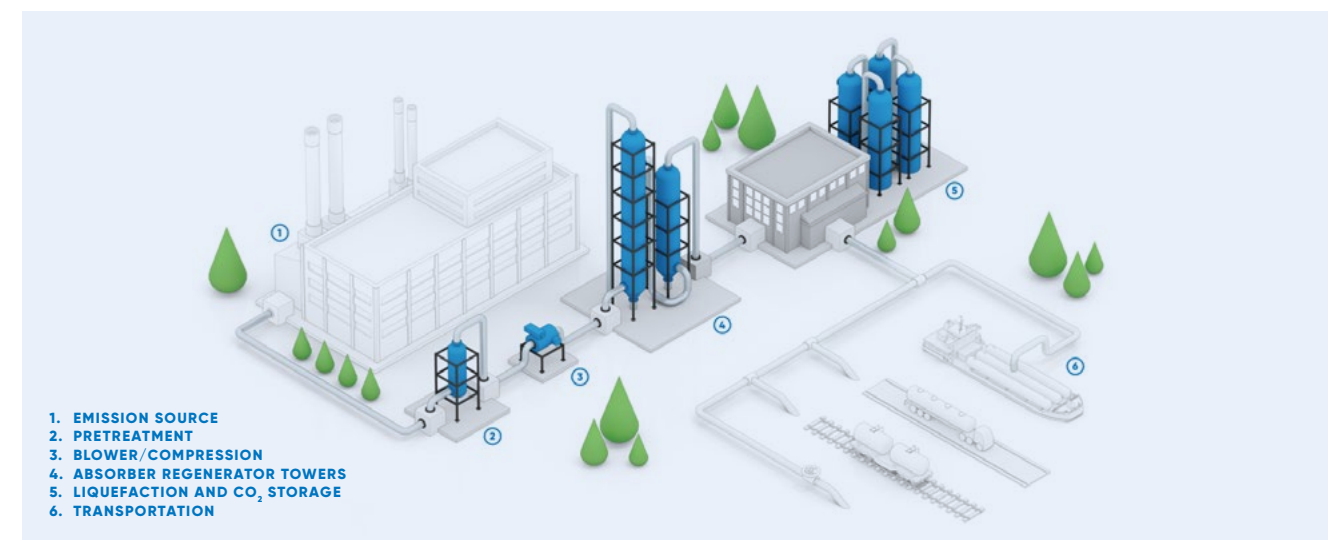
Post-combustion carbon capture technologies require reductions of selected pollutants (SO<sub>2</sub>, SO<sub>3</sub>, NO<sub>2</sub>, ...) present in the incoming flue gas. With over 100 years of experience in designing conventional flue gas treatment systems to meet ultra-low emission standards, ANDRITZ is best positioned to provide you with the right flue gas pretreatment equipment to optimize the operational efficiency and economics of your CO<sub>2</sub> capture system.

## POST CAPTURE CO<sub>2</sub> CONDITIONING:

purification, compression, or liquefaction

Depending on the requirements for the captured CO<sub>2</sub> (chemical use, local storage or transportation), ANDRITZ, in partnership with renowned companies, provides CO<sub>2</sub> purification and compression or liquefaction systems.

In each case, ANDRITZ will ensure optimal energy integration of the post-capture CO<sub>2</sub> conditioning systems into the overall CO<sub>2</sub> capture system, so that the solution is flexible enough to adapt to variations of the incoming flue gas and CO<sub>2</sub> supply requirements.



# ANDRITZ Carbon Capture Solutions

Since more than 15 years ANDRITZ has been active in the field of flue gas decarbonization in various industries. Carbon capture and utilization and storage solutions were tested in cooperation with universities and other scientific institutions. The first approach was to develop solutions for the fossil-fueled power sector, where ANDRITZ has installed and tested pilot plants for nearly 10 years. This real-world experience gave us the confidence and know-how to develop solutions for other industries.

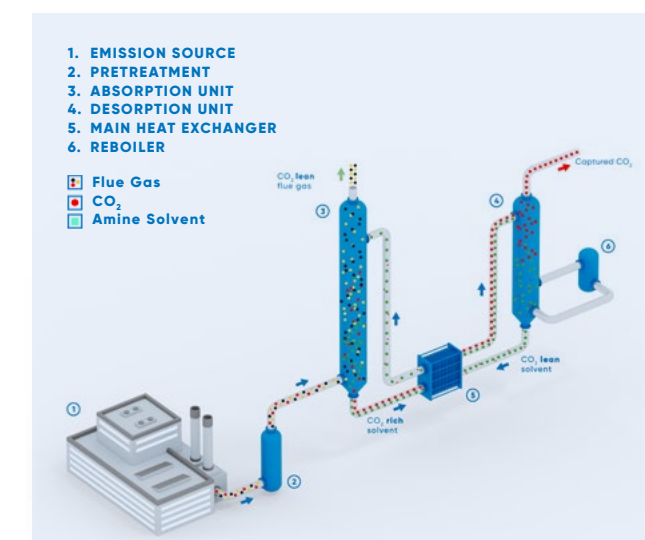
Today, ANDRITZ offers 3 solutions for the capture of CO<sub>2</sub> with highly efficient and well-integrated energy cycles as well as the delivery of CO<sub>2</sub> with the required purity and pressure.

## CHEMICAL ABSORPTION/DESORPTION PROCESS

Several solvents are available for CO<sub>2</sub> capture by chemical absorption. Depending on our customer's preferences, ANDRITZ offers two main solvents.

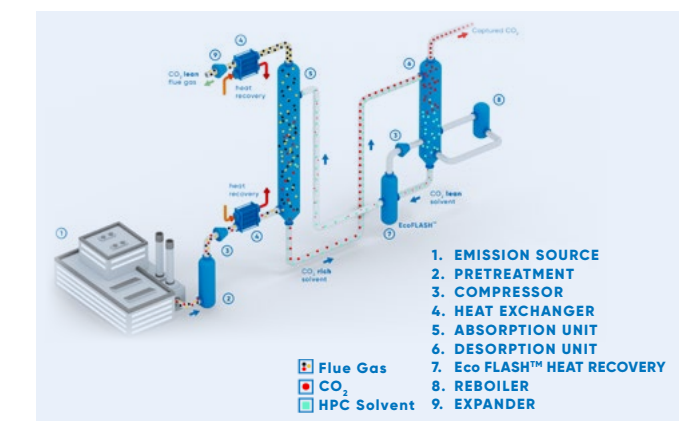
## AMINE

The most used solvent is based on the primary amine monoethanolamine (MEA) and/or mixtures of secondary/tertiary amines, usually with the addition of promoters such as piperazine. Based on its previous experience with CO<sub>2</sub> capture plants and its expertise with gas-liquid absorbers, ANDRITZ will recommend the most suitable amine blend for a given CO<sub>2</sub> concentration in the flue gas and a targeted capture rate.



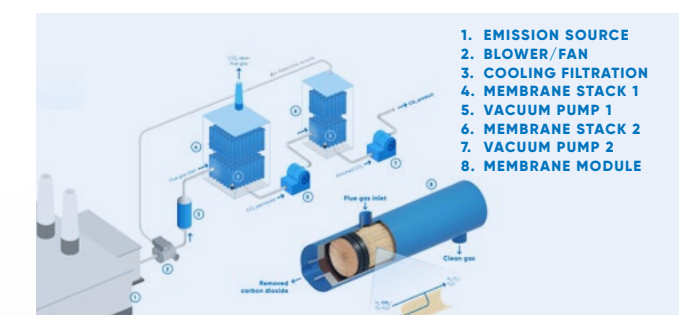
## HOT POTASSIUM CARBONATE (HPC)

If the use of an inorganic solvent is preferred or required, ANDRITZ offers solutions under a licensing agreement with Eickmeyer & Associates, Inc., using the CATACARB® HPC process, including the EcoFLASH™ device ensuring maximum energy efficiency.



## MEMBRANE SEPARATION

CO<sub>2</sub> capture by gas separation membranes is relevant for ANDRITZ customers with limited heat or steam sources and limited space. Today, several types and classes of membranes are available and ANDRITZ, together with its partners, offers polymer-based membranes with or without carriers facilitating the transport of CO<sub>2</sub>. The proposed solutions offer high selectivity, a compact footprint, and the lowest operating costs for the removal of CO<sub>2</sub> from flue gas.



## MOBILE TEST UNIT (MTU)

If you wish to test any of the above mentioned solutions, ANDRITZ can easily transport a fully assembled MTU for amines or membranes in standard industrial containers to any of your plants. The tests can be performed by ANDRITZ experts according to your test plan.



## ANDRITZ – FOR THE CHANGE

In the face of the current climate crisis, ANDRITZ recognizes the urgency of the fight against global warming and is firmly committed to reducing its own carbon footprint and actively developing solutions to help its customers minimize theirs.

Even if carbon capture is one of the technologies of the hour, ANDRITZ has already taken things one step further by offering solutions for hydrogen production and the synthesis of green hydrogen with captured CO<sub>2</sub> to produce e-fuels and valuable chemicals. Additionally, ANDRITZ has a wide range of renewable energy technologies, from biomass pelleting and gasification plants, and waste-to-energy plants, to power and recovery boilers, where the biogenic fraction of the captured CO<sub>2</sub> can be valued as net zero and, in certain jurisdictions, as a CO<sub>2</sub> sink.

All of these solutions help ANDRITZ's customers to reduce their carbon footprint while keeping their plants in operation. ANDRITZ remains committed to helping its customers achieve their decarbonization roadmaps.

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