



1st Post Combustion Capture Conference

Environmentally friendly and economic carbon capture from power plant flue gases: The SIEMENS PostCap technology

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With the PostCap process, Siemens developed a second-generation process for the separation of carbon dioxide from power plant flue gases that is now mature for large-scale demonstration. This absorption-desorption process is based on an amino acid salt solution in water and is characterized by high efficiency and environmental friendliness.

Besides low energy demand and low separation costs, environmental acceptability gets increasing importance for the implementation of carbon capture units of growing sizes –from pilot to demonstration plants up to full-scale units. Therefore Siemens focused from the very first on a solvent that has significant advantages in this regard – thanks to the salt character of the active substance.

Due to the fact that salts and their reaction products are not volatile, gaseous solvent emissions from the absorber in the environment are practically not possible. Extensive scrubbing steps for the reduction of the emissions and the related consumption of fresh water are not necessary, which results in lower costs for installation and operation of the capture plant. At the same time, a high purity of the separated CO₂ is achieved since the product stream cannot contain solvent constituents.

By means of the vaporization characteristics of the amino acid salt in the aqueous solution, the handling of the solvent is significantly simplified in the capture plant. There is no risk of solvent inhalation for the personnel operating the plant; the solvent is not flammable, not explosive and odorless. Amino acids are naturally occurring substances and biodegradable. Moreover, due to the ionic character of the solution, the solvent features a high stability against the oxygen contained in the flue gas. Therefore the Siemens PostCap process can be applied to flue gases from coal-fired as well as from gas-fired power plants, the flue gas of which has particularly high oxygen content. Minor degradation of the solvent takes place through deactivation by side reactions with trace components contained in the flue gas. The deactivated solvent will be regenerated in a specially developed reclaiming process

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that enables a sustainable operation of the plant at minimum operating costs and the extensive recovery of active solvent that can again be used in the capture process.

The presentation will exhibit the features of Siemens' PostCap technology for CO₂ capture from power plant flue gases and will particularly focus on the conditions in the Near Middle East region. The adaptation of the PostCap process to existing requirements like minimization of energy demand and water consumption as well as the adaptation to boundary conditions like steam and cooling water conditions will be explained in detail. For minimization of the overall costs, the capture unit will be optimally integrated into the power plant. At the same time, a good operability of the capture unit in interaction with the power plant is assured – even if the power plant is subject to frequent load changes as a result of increasing dynamics on the international energy market.

With the available know-how within Siemens, resulting from a broad experience as manufacturer of power plants, large compressors, and operating systems as well as from in-house competence in chemical engineering, an integral solution for the economic sequestration of CO₂ can be offered. Advanced process features and heat integration measures secure a low thermal energy demand of the capture process of 2.7 GJ per ton of CO₂ separated. This value corresponds to a coal-fired reference power plant with an electricity production of 800 MW. This energy penalty results in a decrease of the power plant's efficiency by only 6 % points (without compression of the CO₂ stream) compared to a power plant without capture. For a gas-fired power plant (860 MW), an efficiency drop of 5.6 % points is achieved, again without consideration of CO₂ compression.

Thanks to a high thermal and chemical stability of the solvent used, the PostCap process can be flexibly operated in a wide range of operating conditions. For this reason, existing power plants can easily be retrofitted with the technology.

The features of the Siemens PostCap process were validated in a pilot plant in a coal-fired power plant near Frankfurt, Germany. Experience of several thousand operating hours confirms the environmental friendliness and the good economics of the process. A second pilot plant with a capacity to capture 2.5 tons per hour of CO₂ is currently in the planning phase in Florida, USA.