

PLAYING A *pivotal role*

Klaus Reischl, SERO PumpSystems GmbH, Germany, highlights the important role played by side channel pumps in carbon capture and storage (CCS) processes.

Carbon capture and storage (CCS) is a technology designed to help reduce greenhouse gas (GHG) emissions. The process involves the capture of carbon dioxide (CO₂) from exhaust gases from industrial processes and power plants and its subsequent storage in geological formations. Due to their special





Figure 1. CCS plants are currently being built primarily where GHGs are produced in large quantities in industrial processes.

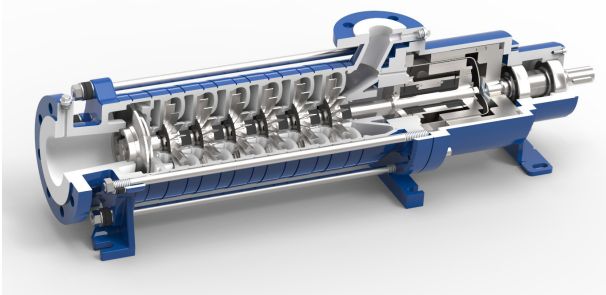


Figure 2. The wide speed range of side channel pumps makes it possible to variably adjust the delivery volume and therefore to pump liquid CO₂ or ammonia as a hydrogen carrier without pulsation.

features, including very low NPSH values, large delivery heads, low-temperature resistance down to -60°C, and the tear-free delivery of two-phase flows with up to 50% gas content, CCS plant builders rely on side channel pumps when implementing CCS technology.

Technologies for the capture and storage of CO₂ make an important contribution to the decarbonisation of industrial processes. CCS plants are therefore currently being built primarily where GHGs are produced in large quantities in industrial processes, e.g. in power plants operated with fossil, substitute or residual fuels, in the chemical industry, in oil and gas refineries, in the cement industry, in iron and steel mills, and in the maritime industry. Another effect of capturing and storing CO₂ is the generation of environmentally neutral energy, e.g. in the production of blue hydrogen or the provision of liquefied CO₂ for heating purposes, for process engineering or in the

shipping industry. After the capture process, the CO₂ is fed into a compression stage where it is compressed under high pressure to around 100 bar so that it can be transported as a liquid phase to the point of use or storage. Pumps play an important role in the entire CCS process. Side channel pumps meet the necessary technical requirements to be used at several points along CCS infrastructure chains, from capture to transport, to permanent sequestration under the seabed in rock strata or in empty oil and gas fields.

Principle of the side channel pump

Side channel pumps have a number of features that provide benefits when used in CCS plants. Due to their self-priming operating principle and their holding pressure head – the lowest NPSH value is just 0.2 m – side channel pumps offer optimum integration possibilities. Extremely low inlet heads can be realised when taking off from a tank, which avoids special structural or design measures on the system. The wide speed range of the pumps makes it possible to adjust the delivery volume variably and, therefore, to pump liquid CO₂ or ammonia as a CO₂ carrier without pulsation. Another characteristic of side channel pumps is their large delivery head and very steep characteristic curve. Depending on the series and design, it can extend up to 1100 m.

Designed for high pressures and a wide temperature range

Side channel pumps operate under demanding process conditions in CCS plants. For example, they are designed and specified for high pressures of up to 100 bar – far more than the 15 bar that must be mastered in the transport and storage of compressed, liquefied CO₂.

They are also suitable for a wide range of media temperatures from -60°C to 220°C. Low-temperature fluids such as CO₂ and ammonia, which change from a gaseous to a liquid state at temperatures of approximately -57°C and -33°C respectively, can therefore be reliably transported because the side channel pumps are specially designed for this in several respects. Spring assemblies configured for this purpose compensate for thermal expansion, as well as contraction of the hydraulics, which occurs when the pump is filled by the pumped medium, or at standstill. Additional elongation inserts prevent temperature-related stresses in the pump body. The plain bearing is designed with a dimensionally optimised fit. Finally, special thrust washers minimise possible wear effects and ensure increased operational reliability.

Reliable performance in two-phase conveying

Another advantage offered by side channel pumps is their ability to maintain uninterrupted pumping performance even when gas components occur in the liquid CO₂. If the pressurisation changes and media temperatures reach their boiling points, liquid CO₂ and ammonia tend to successively change to the gaseous state. In such a case, side channel pumps operate very reliably for a long period of time because they keep the flow rate largely constant even in the event of pressure

fluctuations. They can even pump two-phase flows with up to 50% gas content without cracking. Problems due to possible vapour bubble formation and consequent effects on the delivery or metering rate are therefore reliably excluded.

CCS plant projects with side channel pumps

The advantages offered by side channel pumps in the capture and storage of CO₂ are already being used in various CCS projects and pilot plants. Among them is Wärtsilä Marine Systems, which is developing the industry's first on-board CCS technology. As such, CCS presents an immediate opportunity for sustainable shipping. Through its collaboration with AxFlow AS, SERO PumpSystems has supplied pumps for the Wärtsilä test facilities.

Contributing to CO₂-neutral processes

CCS helps to reduce CO₂ emissions and therefore actively contributes to sustainability. To this end, side channel pumps can play a significant role in the capture, transport and storage of CO₂ – and therefore in climate-neutral processes – as an important component in CCS plants. The advantages offered by side channel pumps in the capture and storage of CO₂ are hence already being used in various CCS projects and pilot plants. 