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MAXIMISING THE VALUE OF GLOBAL GAS RESOURCES

SYLVAIN GERARD NATURAL GAS TREATMENT PRODUCT MANAGER, AIR LIQUIDE ENGINEERING AND CONSTRUCTION, ON ENABLING GAS VALORISATION WITH MEMBRANES TECHNOLOGY

With gas playing an increasingly important role in the transition to a lower-carbon global economy, there is strong incentive to secure maximum economic and environmental value from gas resources. However, our customers often face a combination of technical and economic challenges in securing maximum value from gas. Stranded gas, in particular, can pose particular challenges for valorisation.

Natural gas treatment requirements depend on source and use. For instance, in a small gas field containing CO_2, CO_2 removal from natural gas is required to increase heating value. However, conventional technologies can be too expensive for a small unit: the scale factor is not favourable to amine wash technology, and typical membrane plant would require complex pre-treatment. The valorisation of flared associated gas requires cost-effective approaches to secure the removal of contaminants and the extraction of high-value components.

HIGH PERFORMANCE PRODUCTS

To address these challenges, Air Liquide Engineering & Construction has a suite of high-performance membrane products. These are low-cost and reliable technologies which remove contaminants such as CO_2, H_2S, H_2O, and N_2 and enable the recovery of valuable components such as NGLs, Hydrogen and Helium. The applications range from natural gas sweetening, stranded gas conditioning for gas to power, to pipeline gas production and flared gas or off-gas monetisation.

SMALL CO_2-RICH GAS FIELDS

CO_2 removal from natural gas is often accomplished with amine scrubber technology. Conventional solutions involve a high CO_2/CH_4 selectivity membrane which usually requires complex pre-treatment to remove the heavy hydrocarbons and water. The cost of such pre-treatment can sometimes be prohibitive.

By contrast, the novel Air Liquide's All Membrane Solution™ ('AMS'), for pre-treatment and CO_2 removal is simple, reliable, compact, with a lower overall investment cost. This solution is PEEK-Sep™ membrane technology, for water and heavy hydrocarbons removal, in series with MEDAL™ membrane technology, for CO_2 removal, which is tolerant to a level of impurities compatible with the PEEK-Sep™ pre-treatment stage.

Sylvain Gerard, Natural Gas Treatment Product Manager, Air Liquide Engineering and Construction

> "Shifting to a lower-carbon economy, using natural resources efficiently and sustainably, requires strong technology partners"

The first commercial implementation of this new system has been successfully undertaken in Europe in 2018. The project is delivering up to 4 MMSCFD of pre-treated and sweetened natural gas using a simple, though robust, membrane treatment solution.

FUEL GAS CONDITIONING AND POWER GENERATION

Membrane technology also offers a cost-effective solution for gas conditioning (reducing the inerts content to increase the gas heating value, reducing the H_2S content to meet specifications for power generation equipment, reducing C3+ content to achieve minimum methane number). The PEEK-Sep™ products enable the removal of these components due to the properties of the membrane selective layer.

Membrane technology offers inherent benefits such as compact design, reduced weight and footprint, ease of operation, ability to handle feed composition variations with consistent product specification, ease of dismantling, transportation and relocation, limited rotating element, and the potential for remote operation onshore or offshore.

The versatility of the membrane technology and design enables gas fields operators to use the same standardised designs for membrane systems and power generation units across multiple sites regardless of the quality of the raw gas available.

NGL EXTRACTION FROM ASSOCIATED PETROLEUM GAS

PEEK-Sep™ membranes technology makes possible the recovery of part of the heavier components of associated gas with little or no pre-treatment.

In some applications, low pressure associated gas is first compressed and then fed to the membrane unit, where it is split into a low-pressure NGL-lean gas permeate and a high-pressure, two-phase retentate stream. The condensed fraction can be extracted and routed to a pressurised storage vessel, whereas the low pressure permeate product can be valorised separately. Up to 95 per cent of the C3+ contained in the feed gas can be recovered using this technology, and, due to the high carbon content of the NGLs, a site's CO_2 emissions can be greatly reduced.

This technology can also be used for the optimisation and de-bottlenecking of refinery fuel gas systems by allowing H_2 and NGLs to be extracted from the network and routed to other processes, either as a raw product or after further purification and fractionation.

The extraction of high-value components by means of such a simple membrane system is characterised by low investment and operating costs and typical payback periods of around one to two years.