Addressing sour gas processing challenges

Up to a third of the world's natural gas reserves contain high concentrations of sour gas, with the Middle East a region where such fields are prevalent. John Young, CEO, Twister BV, discusses a new technology that can help to make the development of sour gas fields safe and commercially viable.

AS OIL AND gas reserves worldwide continue to dwindle and many Middle East countries struggle to produce enough natural gas to meet domestic requirements, sour gas fields that were previously left under-developed due to high costs and technical and safety challenges, have come to the fore as an important energy source.

Examples include the Shah gas field in the UAE, the world's largest sour gas project, as well as the Bab gas field – also in the UAE; Kuwait, where operators are looking into the challenges of developing HP/HT Jurassic sour gas fields; and Qatar, where the North Field has up to seven per cent CO_2 and six per cent H_2S by volume.

However, sour gas and its extraction and processing come with significant challenges.

H_2S in the gas stream is highly toxic and flammable with significant HSE implications, the dangers of toxic gas releases or leaks; and threats to both production and transportation infrastructure, with H_2S's highly corrosive nature requiring special handling.

There is also a need to remove CO_2 from the gas stream due to the fact that its presence represents a non-value added gas transport cost. CO_2 can also cause problems for the transportation of LNG.

Furthermore, the need to remove water to allow cost-effective gas transportation also adds complexity, cost and safety implications to gas separation projects.

Traditional technology limitations

The corrosive nature of sour gas fields and processing and separation challenges have subsequently led to pressures on existing technologies and infrastructures.

For example, fully manned glycol-based or amine gas treating production platforms come with the dangers of the potential venting of toxic H_2S, contamination of the glycol regenerator with H_2S, high H_2S gas inventories, intensive personnel and maintenance requirements, and logistical and safety challenges in operating from remote offshore locations. There are accompanying technology challenges as well.

Twister's most recent installation of its supersonic separators

Image Credit : Twister BV

Turbo expanders are often used to dew point natural gas to meet export specifications and recover condensate. In a sour gas environment, however, there are significant pressures on the gas seals of turbo expanders, sometimes leading to availability of only 50 per cent.

Other technologies used to pre-empt corrosion in sour gas fields include Kinetic Hydrate Inhibitors (KHI) that are very popular in Saudi Arabia and are used to mitigate hydrate formation through injection into the natural gas pipelines system.

However, concerns over the performance of KHIs, and in many cases their significant costs, are obstacles to their more widespread usage. In a paper at the 9th North American Conference on Multiphase Technology in 2015, Saudi Aramco discussed the challenges of qualifying a compatible KHI in the Karan sour gas field.

It is against this context of both safety and the need to make sour gas fields commercially viable that operators are looking to alternative gas separation and processing technologies. One such alternative comes from Twister.

Safe, sustainable and profitable gas processing and separation

Based in the Netherlands, Twister BV delivers reliable, high-yield and robust solutions in natural gas processing and separation to the upstream and midstream oil and gas sectors. The Twister technologies are particularly suited to sour gas fields through the Twister Supersonic Separator, a robust, compact gas conditioning solution characterised by condensation and separation taking place at supersonic velocity; and the Twister Hydrate Separator that isolates hydrates and liquids from natural gas without using chemicals through heating coil and cyclonic separation melting hydrates.

The combination of the two technologies results in low maintenance, a low sour hydrocarbon inventory and reduced equipment count. There is also no chemical degradation due to H_2S, no emissions and very limited operator intervention – always a significant benefit in sour gas fields.

Furthermore, the fact that Twister's supersonic gas solution dehydrates gas on the basis of expansion cooling instead of glycol absorption, as well as being a closed system, means that it is the safest means of dehydrating sour gas on the market today.

The reduced weight and plot space on offshore platforms of the Twister Supersonic Separator and Twister Hydrate Separator can also result in cost savings. There are also significant cost savings compared to Kinetic Hydrate Inhibitors, due to the removal of the need for a corrosion resistant alloy pipeline and the ongoing cost of KHI replacement.

A sour gas application, offshore Malaysia

The Twister technologies have also been put to the test in challenging sour gas environments, one such example being the Shell operated B11 600mn standard cubic feet per day (MMSCFD) production platform in Malaysia with higher than normal sour gas contaminant levels of up to 20 per cent CO_2 and 3500 ppm H_2S.

Here, the Twister technologies were a key element of the overall sour gas management risk mitigation strategy and – as a closed system – provided an inherently safer system over traditional dehydration solutions.

Other benefits included no shutdowns and >99 per cent availability; weight savings of 25 per cent compared to alternative platforms and estimated CAPEX savings of 23 per cent; the ability to handle varying feed gas compositions and multiple wells: no pipeline integrity issues; and safe operations.

A new approach to CO_2

As mentioned, another challenge faced in gas separation today in the Middle East is the removal of carbon dioxide (CO_2).

CO_2 is commonly found in natural gas streams and must be removed in order to meet specifications before the gas can be delivered to the pipeline. In combination with water, it can also be highly corrosive.

Traditionally, polymer membranes – semipermeable barriers – were used for the separation of CO_2 (they are less effective with H_2S) but come with significant size, weight and costs on offshore structures and are also often responsible for large methane losses.

With this in mind, Twister is focusing on not only improving the processing but also the profitability of acid gas fields containing large amounts of CO_2 through a cryogenic approach.

The main feature of the cryogenic approach is the production of liquid CO_2 for ease of reinjection. Using an adaptation of Twister's Hydrate Separator called the Crystallizer – designed to operate in low temperature cryogenic environments – the solid CO_2 is melted in order to enable reinjection of CO_2 into the reservoir through pumps, which is much more cost effective than compression.

In advancing this technology, Twister has entered into a joint development programme with Malaysian operator Petronas that will see the fabrication, testing and qualification of a skid-mounted Crystallizer Vessel. The qualification test is scheduled for Q2 2018 in PETRONAS' UTP facilities in Malaysia and is a key component of the joint technology programme. ■