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INNOVATIVE OILFIELD GTL SOLUTION FOR ASSOCIATED GAS

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So what becomes of the next generation of smaller oil fields, where there will not be sufficient gas volumes to justify these large investments? Ironically, the smaller the gas volumes, the more difficult the problem they present. This counterintuitive fact has led to the idea of "distressed gas," where an oil field cannot be developed because no economic means exist to dispose of the small quantities of associated gas.

The associated gas that accompanies oil to the surface in a producing well can be a great advantage and valuable revenue stream, if your oil field is near a pipeline that feeds into a gas market. However, as oil fields move into deeper and more remote areas, away from population centers and gas infrastructure, the options for handling associated gas have become restricted and the question of what to do with it often difficult. The industry is crying out for a solution.

Historically, where there was no local market or available pipeline, associated gas was flared. However, this is now both environmentally and politically unacceptable, and in many countries banned. The alternative of gas reinjection is expensive and can cause reservoir damage, which adversely affects production and reserves.

Seeking a solution that avoids either of these alternatives, the industry for years has experimented with a variety of technologies.

For example, in areas with large associated gas volumes, the gas can be commingled into gathering systems and supply nearby specially constructed liquefied natural gas (LNG), methanol, or ammonia plants. However, this solution comes with a couple of major requirements.

1) High gas volumes must be committed in advance to justify the substantial plant-building cost.

2) Commonly, supplementary nonassociated gas also must be available to offset supply fluctuations, including the eventual decline of field production. One example of how this supply-balancing requirement can work is the Bonny Island LNG plant in Nigeria, which ran on nonassociated gas until gathering systems were built that allowed associated gas to replace part of the original supply stream.

Without both of these prerequisites, commingling is not an option. With oil fields getting smaller and more remote, there will commonly not be sufficient reserves of associated gas to justify installing gas infrastructure or gas-processing plants. Even in areas such as the North Sea, where extensive gas infrastructure and a ready local market exist, small fields with short lives of 4 years or so cannot justify the expense of installing a gas export pipeline.

Other solutions proposed for dealing with associated gas that cannot be exported by pipeline have involved locating a gas-processing plant adjacent to the oil field and using technologies such as floating LNG, gas-to-liquids (GTL), methanol production, or gas-to-wire electrical power generation. These too tend to require large supplies of gas and considerable investment. For example, a standalone facility capable of consuming 100 to 150 MMscf/D of gas would have a capital expenditure of more than USD 1 billion. In addition, a facility would need a steady nondeclining gas stream, which often can only be achieved by combining associated gas with nonassociated gas from other fields. As such, this has led to these large facilities focusing on stranded gas with reserves of 0.5 Tcf or greater, rather than associated gas.

The technology is based on a coupled process, (Fig. 1), where the associated gas first is converted to synthetic gas (syngas) - a combination of hydrogen and carbon monoxide by means of a steam methane reformer (SMR). This syngas then is compressed and fed into a Fischer-Tropsch (UT) reactor, which converts the syngas into syncrude (Fig. 2). The process also involves gas pretreatment upstream of the SMR where contaminants such as sulfur are removed and higher hydroc are converted to methane. However, unlike conventional GTL technology the process does no employ a hydro cracker downstream of the FT reactor to convert the syncrude to diesel fuel and naphtha. However, this technology easily could be added, if there were a market for these products, as might be the case if the plant were onshore.

Both the SMR and FT reactors are similar in design and consist of a series of mini-channels (0.39 inxO.20 in.) into which fecraloy foils coated in catalyst are inserted. In each reactor, there ate two sets of channels, and the design is analogous to a plate-and-fin heat exchanger.

For the SMR, one set of channels is used to combust gas to provide heat, while the other set hosts the SMR reaction. This reaction requires a tempera ture of more than 1,292°1E which is provided by heat from the combustion channels. The channels are in layers within the reactor, with a layer of combustion channels alternating with a layer of SMR channels. This close coupling of the channels improves heat transfer to provide process intensification and enable a reduction in reactor size.

For the FT reactor, one set of channels is used for the FT reaction. However unlike the SPAR reaction - which is endothermic - the FT reaction thermic. Thus, the second set of channels is used to circulate cooling water to remove heat. Again, the alternating laers of channels improve heat transfer and enable a reduced reactor size.

The UK pilot plant has demonstrated that the technology works. Parallel with this technology program, a commercial-development program is in progress to ensure an orderly transition from the laboratory to the field (Fig. 3).

Part of this program focused on how to scale up the technology From its UK pilot-plant dimensions to full commercial requirements. It was concluded that trying to scale up from a 0.2-B/D to a 200-B/D reactor design was the wrong approach because the manufacturing techniques appropriate to a small reac tor could not be used to manufacture large reactors in volume. Consequently. strategic alliances with world-class manufacturing companies were established to develop reactors that incorporated the CGTL technology but could he manufactured economically at full commercial scale and in the volumes necessary to support the market.

With the industry move to smaller and more remote oil fields, the issue of distressed associated gas is becoming an increasing problem. The use of flaring is no longer acceptable for both environmental and economic reasons, which has left limited options available. These gas-handling and -marketing solutions tend to be expensive, and many are not suitable for the declining gas profiles of associated gas. The solution to distressed associated gas described herein consists of converting it to syncrude by means of a modular reactor system that can be matched to the gas profile. The syncrude can be commingled with the produced crude oil for transportation and sale, eliminating the need to market the product and allowing additional reserves to be booked.

Аннотация

В статье дано кратное описание инновационной технологии использования нефтяного попутного газа, которая позволяет использовать газ в качестве ценного сырья и не сжигать его на нефтепромысловых факелах. Технология позволяет преобразовывать попутный газ в синтезгаз, который далее преобразовывается в синтетическую нефть, которую можно смешивать с обычной нефтью, или же

получать дизельное либо керосин.