Process Economics Program

Report 148B
Synthesis Gas Production from Natural Gas Reforming

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Abstract

This Process Economics Program (PEP) report presents an update on the subject of synthesis gas production from natural gas. A previous PEP report on this subject (PEP Report 148A) was published in November 1990.

The evaluation scheme selected for this report is based on a broader line of technologies as compared to the previous report which presented comparatively fewer choices of technologies commercially available at that time. The analysis format is also different from the one used in that report. For this report, we categorized the syngas technologies in three main divisions according to the end use of the gas. Three areas of syngas end uses were chosen: 1) hydrogen, 2) methanol, and 3) Fischer-Tropsch products.

Then, another subdivision was made according to the type of reforming used to produce the syngas for the above end-use products. Four types of reforming processes are evaluated. They are: steam methane reforming (syngas for hydrogen and methanol); combined reforming (syngas for methanol); autothermal reforming (syngas for Fischer-Tropsch products); and partial oxidation (syngas for Fischer-Tropsch products). And then in a final classification, for a given combination of reforming methodology and targeted syngas end use, processes are presented according to the technology licensors.

A detailed technical review of the current R&D work on natural gas reforming is also presented in a separate chapter.

In all, eight reforming technologies are presented. Two are for syngas production for hydrogen (Uhde and Praxair), four illustrate syngas production for methanol (Lurgi, Haldor Topsoe, Johnson Matthey/Davy, and Toyo), and two processes show syngas production for the Fischer-Tropsch process (Haldor Topsoe and Shell).

The design and process configurations for the above technologies are of a conceptual nature and basic data for them were extracted from patents, technical articles, and company brochures available within the domain of public information. PEP internal information sources, which are generally based on talks with the licensors/producers, have also been used.

Our analysis indicates that Uhde and Praxair steam methane reforming-based syngas technologies stand very close in terms of capital investment and production costs. In the combined-reforming technologies class, Johnson Matthey/Davy seems to have a significant economic edge over Lurgi and Topsoe. Toyo’s steam methane reforming (SMR) syngas technology (for methanol) has the highest production cost but if extra hydrogen present in the syngas is extracted and an economic credit is taken for it, the process economics for syngas are improved. Shell partial oxidation also shows a sizeable economic advantage over the Topsoe autothermal technology in syngas generation for the Fischer-Tropsch process.

Our report provides insight into syngas plant process economics and can be used as a tool for cost estimation for different syngas plant capacities. The report is highly beneficial for those planners/producers looking at products downstream from the syngas especially now that the focus on chemicals manufacturing is shifting to the United States with the development of cheap shale gas and while China is expanding its chemicals production plans based on coal. Another PEP report (PEP Report 148C, to be published in 2013) covers syngas production from coal.
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