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Process Summary—Natural Gas Liquids Separation and Recovery

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Abstract

Natural gas liquids (NGLs) are the C_2+ liquefied hydrocarbons that are recovered above ground in natural gas field facilities or in gas processing plants. Refineries are a secondary source of some NGLs. The principal NGL products are liquefied petroleum gas, or LPG (a mixture of propane and butane), propane, isobutane, n-butane, ethane, and C_5+ natural gasoline. Besides the growing demand for these NGLs, some NGLs are also extracted from natural gas in order to be able to market the gas by reducing its dew point to below pipeline specification. Some natural gases contain impurities such as hydrogen sulfide that are removed in treaters prior to NGL separation.

Supply of NGLs has grown considerably in North America with the rapid development and application of shale fracking. Recovery of NGLs has provided additional revenue. The United States has switched from a net importer of NGLs to an exporter. US demand for NGLs has lagged behind supply growth, but will significantly increase when ethane steam crackers now under construction or planned for start-up come online. Excess NGL production will be exported.

Worldwide demand for NGLs totaled 410 million metric tons in 2015, about 93.6% of total production of over 438 million metric tons that year. Demand grew an average of 3.43%/yr over 2010 to 2015 from 364 million metric tons. The 3.22%/yr global growth rate of LPG, the NGL product most in demand, over that period exceeded the growth rate of total petroleum demand (about 1.6%/yr). The largest producing regions are North America (about 31% of total production) and the Middle East (about 30% of total production). These two regions account for about 88% of regional surplus NGLs available for export to importing regions. Europe and the Far East have the largest regional deficits of NGLs, accounting for about 37% each of the total regional deficit.

This PEP Review summarizes the process economics and technology of NGL recovery from treated natural gas. Recovering ethane or rejecting ethane (leaving ethane in the natural gas) is presented for each recovery process. Turboexpansion processes are the most prevalent type of recovery processes. Economics are determined for three types of turboexpander processes—the conventional process, a simplified gas subcooled process, and a simplified recycle split vapor process. Economics of a generic NGL fractionation process used to determine the product value of mixed NGL product of the gas separation are also presented.

This process summary highlights the new iPEPSpectra interactive data module with which our clients can quickly compare historical production economics of competing processes in several major global regions. The interactive module, written as an Excel pivot table, is attached with the electronic version of this review. The module provides a powerful interactive tool to compare production economics at various levels, such as variable cost, cash cost, and full production cost. An iPEPSpectra historical economic comparison provides a more comprehensive way of assessing competing technologies, leading to a more valid investment decision.

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