

Evaluation of LNG Technologies

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Abstract

Due to the increasing demand for natural gas in the world today, transportation of natural gas from different parts of the world has become a necessity. Liquefying the natural gas provides a safer and cheaper alternative for transportation and also increases its storage capabilities. There are numerous documented methods for the liquefaction of natural gas but only a handful of methods are actually implemented in industry today. The liquefaction process requires the natural gas to be cooled using various methods of cryogenic processes and also be depressurized to atmospheric conditions for easier and safer storage. With the most popular processes taking advantage of their huge market share, smaller and newer processes are being developed to operate more efficiently and with less utility costs involved. The analysis of eleven processes based on capacity, fixed costs and operating efficiency is discussed in this paper. Seven out of the eleven processes are currently established in various parts of the world. The remaining four processes are in developmental stages and each patent description is used to simulate each process and determine its feasibility in industry.

At the reported maximum capacities of each process, the capital and utility costs are determined. These prices are then related along a possible range of annual capacities. The total price per max capacity for each process is also determined. The total price includes capital and operating cost. These results are analyzed to determine the most economical process. All cost analysis is based on current utility and equipment costs in United States as of 2007.

The results show that the most economical processes at virtually any capacity chosen are the Axen's Liquefin process and the Prico Process by Black and Veatch. Both companies take advantage of simple and cheaper technology like the plate-fin heat exchangers which are extremely efficient based on their design. They both are the processes with the lowest comparable amount of equipment and utility cost. With a lower amount of capital needed to start up these processes, it makes them more favorable in intermediate sized operations ranging from 4 to 6 million tons per year (MTPA). Larger designed processes, like APCI's C3MR process, are currently employed by almost 81% of the industry around the world. Its low utility cost has been well documented and it is even comparable to the newer processes which operate at significantly lower maximum capacities. The C3MR process has maximum capacities around 5 MTPA and can also be easily modified to achieve higher capacities. This makes the C3MR the process of choice for larger operations around the world.

Using our model of analysis and simulation to determine the most economical process used widely today, the Liquefin process would be an ideal candidate. It is capable of producing liquefied natural gas at capacities close to 6 MTPA and it yields the lowest cost per ton in its operation. Axen's reports a growth in the popularity of the process and its cost-effective nature could be the reason.