SHOWCASE PROJECT: EASTMAN CHEMICAL: ELIMINATING HYDROGEN PLANT NATURAL GAS COMPRESSORS

SOLUTION OVERVIEW

Eastman has hydrogen plants covering 118,000 square feet at its Kingsport, Tennessee facility that use high-pressure natural gas as a raw input to create hydrogen gas for polymer production. The company was using two compressors at the facility to compress the natural gas to high pressure; however, findings from an energy survey led the company to shut down the compressors and instead use a high-pressure header it already possessed to supply natural gas to the hydrogen plants. The switch resulted in an annual energy and cost savings of 8% for the associated hydrogen production process.

Eastman's Tennessee Operations employs approximately 7,000 people and is one of the largest chemical manufacturing sites in North America. The site uses 160 megawatts (MW) of electricity, the majority of which comes from a highly efficient co-generation process. Eastman's Tennessee Operations manufactures hundreds of chemicals, fibers and plastics.

Eastman energy teams regularly perform energy surveys of various production areas at all company sites. During an energy survey at the Kingsport facility, a process engineer in that area pointed out that two compressors were being used to compress natural gas from a low-pressure line that originally provided natural gas to the site, while there was a newer high-pressure natural gas header located nearby. The energy team performed an analysis and estimated costs for using the high-pressure header to run the hydrogen plants instead of the two natural gas compressors. The energy team found that making this switch would reduce production losses and energy use. After reviewing the benefits provided by the energy team, Eastman implemented the project, starting in September 2012 and finishing in November 2013.

SECTOR TYPE

Industrial

LOCATION

Kingsport, Tennessee

PROJECT SIZE

118,000 sq. ft.

FINANCIAL OVERVIEW

Project Cost: $1.7 Million

SOLUTIONS

In 15 months, Eastman shut down the two 260 Brake Horse Power (BHP) natural gas screw compressors and instead arranged for an existing 375 pounds per square inch gauge (psig) natural gas high-pressure header to supply natural gas to the two hydrogen plants. This process required the company to upgrade the header, which included adding piping, tie-in points (for future boiler conversions), pressure-reducing valves, and pressure/flow transmitters, among other enhancements. The new high-pressure delivery system means that Eastman no longer has to perform low-to-high-pressure conversions of natural gas.

The process for upgrading the header included adding approximately 1,500 feet of 12-inch piping to the 375 psig natural gas header, with tie-ins for the future conversion of two coal-fired power plants to natural gas. From the newly expanded 12-inch natural gas header, the company installed approximately 500 feet of branch piping with pressure-reducing valves to supply 315 psig of natural gas to the two hydrogen plants, eliminating the need for the screw compressors. The additional costs associated with expanding the header and adding tie-ins for the future conversion of the two coal-fired power plants to natural gas were too high to justify implementing this project based solely on the energy saved by shutting down the compressors. However, Eastman knew that within one year, one of the coal-fired boiler natural gas conversion projects would require the header to be extended. Because Eastman was going to spend capital to upgrade the header in the near future anyway, the company decided to initiate this project so that it could realize energy savings now from shutting down the compressors while also positioning itself for the future conversion projects.

Although successful, Eastman’s replacement project was not without technical challenges and barriers. Eastman had to determine how to safely and effectively clean the upgraded natural gas header. The project team researched how to clean the natural gas piping and sought advice from several other companies. Additionally, Eastman had to determine how much to expand the header to meet the requirements of the future coal-fired boiler natural gas conversion projects, as well as to supply the two hydrogen plants. The project team utilized hydraulic models of the natural gas header to help determine the correct header size.

OTHER BENEFITS

In addition to the energy savings, the project has helped the company reduce maintenance costs and prevent waste of natural gas. Historically, the compressors had frequent operational issues that shut down the hydrogen production process, resulting in maintenance costs and the consumption of significant amounts of natural gas to warm up the hydrogen reformer for each start-up. Maintenance costs in 2011 were $38,000 for the two operating compressors and two backup units. The project is also receiving significant recognition for its success.

This project was awarded the 2014 American Chemistry Council’s (ACC) Significant Improvement in Manufacturing award which is one of five categories of the ACC’s Responsible Care Energy Efficiency Awards program. The compressor elimination project also was recognized with the 2014 Tennessee Chamber of Commerce and Industry Energy Award. The project was also presented at the 2013 Eastman Worldwide Utilities and Energy Forum to encourage other entities to consider pursuing similar opportunities for energy savings.

Annual Energy Use

Baseline(2012)

1

Actual(2014)

0.92

Energy Savings

8%

Annual Energy Cost

Baseline(2012)

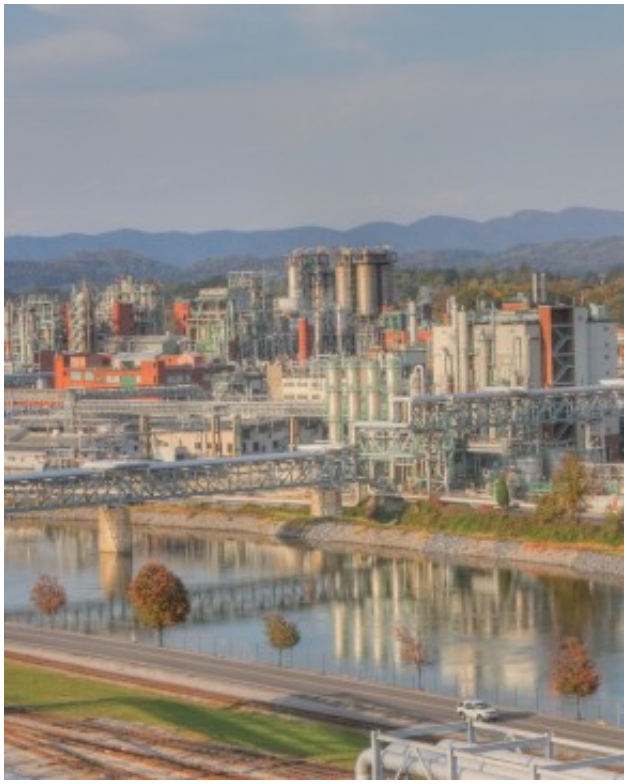
1

Actual(2014)

0.92

Cost Savings

8%



Eastman’s Kingsport, TN facility

New Natural Gas header (dark yellow)