Question 14: In your experience, what operational factors contribute most to utility costs in hydrotreating units?

ROBERT STEINBERG (Motiva Enterprises)

The biggest contributor to utility cost per barrel in a hydrotreater is probably the unit operating pressure. Higher pressure units require more energy to pump up the charge, hydrogen, amine and wash water.

The utility cost that may get the most attention and that operations has control over is heater firing. Use of a hot separator and bringing in hot feeds can substantially reduce heater firing. However, fired duty per barrel of charge is generally much lower for a hydrotreater than for many other refinery units like crude units, cokers and reformers.

Some people like to keep H2 to oil ratios to the minimum required for the catalyst even if they can circulate more. While this will save some energy, it may not be optimal for the catalyst. Using more than the minimum required recycle gas will increase H2 partial pressure and may reduce catalyst aging rates, it can also improve distribution within the catalyst bed. If catalyst life is extended, yields are improved, or product properties are improved the benefits can be much larger than the energy savings from the minimizing H2 to oil ratio. In addition to the catalyst benefits, higher recycle gas rates will increase velocities in exchangers and furnaces and may reduce fouling.

Some hydrotreaters maintain the same charge rate all the time using product recycle to maintain reactor feed if less fresh feed is available. It is necessary to maintain reactor charge rates high enough to be within the operating range of the distributor tray. If there are large amounts of cracked feeds, recycle can be needed to control exotherms. Maintaining the same charge rate can simplify operations, reduce exotherms and improve distribution within the reactor without impacting required reactor temperature or catalyst aging rate. However, it can also substantially increase energy consumption. For a short-term reduction in charge rate, such as for a few days, the simplicity of maintaining operating conditions may justify the recycle. For longer time periods, such as several weeks, the impact should be evaluated more carefully to see if more recycle than needed to maintain minimum charge rates is justified.

Using more than the minimum recycle gas rate can often extend catalyst life at the cost of a marginal increase in energy consumption. Using excess product recycle will often have little benefit and substantially increase energy consumption.

If there are advantages to using more than the minimum recycle gas or product recycle, the benefits such as better catalyst performance and simplicity should be compared to the extra energy cost to maximize profitability.

Tags

Fouling

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Year

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