In downstream oil & gas, improving efficiency and increasing throughput are critical to maximizing profitability. While it can be difficult to identify the specific areas and/or equipment to focus on for optimizing flow and overall capacity of the plant, increasing yields, decreasing costs, and reducing downtime. Often equally as challenging is finding the right solution to the bottleneck as such projects. Companies that successfully deliver on debottlenecking projects will be more competitive in the market. While there is no single approach to undertaking debottlenecking projects, access to accurate and comprehensive engineering and technical information and data can help companies evaluate solutions more effectively and efficiently.

**Summary**

In downstream oil & gas, improving efficiency and increasing throughput are critical to maximizing profitability. While it can be difficult to identify the specific areas and/or equipment to focus on for optimizing flow and overall capacity of the plant, increasing yields, decreasing costs, and reducing downtime. Often equally as challenging is finding the right solution to the bottleneck as such projects. Companies that successfully deliver on debottlenecking projects will be more competitive in the market. While there is no single approach to undertaking debottlenecking projects, access to accurate and comprehensive engineering and technical information and data can help companies evaluate solutions more effectively and efficiently.
A Complex Endeavor

Existing facility debottlenecking is usually an attractive method for increasing petrochemical production, in contrast with a lengthy and permit-driven construction of a new facility from the ground up. A prerequisite for making a reasonable troubleshooting effort or having any hope of a successful revamp is to have a thorough knowledge of the process. Throughput increases, yield alterations, and specification modifications are typical debottlenecking goals. Having ready access to precise information about each process unit, piece of equipment, and input can significantly reduce time spent in a debottleneck assessment. Debottlenecking does not necessarily have to be limited to expansion projects, but now simulation techniques are enabling greater integration of debottlenecking projects into wider plant operations.

The first step in a debottlenecking process generally involves examining the overall operating conditions of a facility. Debottlenecking becomes critical for improving production output that does not meet market demand in terms of quantity or specs. The debottleneck analysis identifies individual processes in a plant that are contributing towards reduced production rates. In many instances this means comparing current operating parameters and system settings (flow rates, temperatures, pressures, heat inputs, etc.) with the design specifications of process equipment. In some situations, eliminating a bottleneck can be as simple as changing system parameters to match recommended design values.

Other times, however, the solution may require a bit more time and effort, such as replacing an entire piece of equipment or retrofitting it to better match the needs of the facility. The most common causes of bottlenecks in refining plants include control valves, choke valves, compressor capacity, pipe size, heat exchangers, and rotating equipment, such as pumps or compressors.

Simulation models can be used and simulate each individual piece of equipment under different conditions as well analyze the entire plant process. Having readily available engineering reference data is critical to run a well-balanced debottleneck assessment. These simulation models can be better calibrated using specific unit performance under a variety of conditions and pressures. Another benefit of having access to a trusted reference engineering data and information is that it increases collaboration among the different process engineers, operations and project personnel. There is no more guessing as to what would be the potential yields if certain operating parameters are selected in the processing model. With up-to-date engineering reference data from Knovel, process engineers can fine-tune their modeling systems to be more precise and to be able to forecast operating conditions.

Plentiful and affordable natural gas liquids (NGLs) in the U.S. from shale formations have provided U.S. petrochemical producers with an inherent feedstock cost advantage. One of the challenges of growing NGL production is feedstock diversity, which makes these assessments more complex because reference operating conditions for each piece of equipment must be modeled for the different options available.

1 From “Debottlenecking Options and Optimization” by Donald F. Scheneider & Stratus Engineering, Inc.
2 http://www.chemicalprocessing.com/articles/2011/debottlenecking-improves-energy-efficiency
Improving efficiency and increasing throughput

Why is having engineering reference data for debottlenecking analysis important? One of the very first items for a successful debottlenecking analysis is having an end-to-end knowledge of process fundamentals of each single unit and how each are interconnected with one another. A successful project can achieve such original design objectives as:

- Achieving more accurate mass and energy balances and process flow diagrams
- Finding a process maximum performance point
- Conducting sensitivity analyses, determining key control variables and degree of operating stability of each process
- Running what-if scenarios more accurately
- Attaining more accurate design information
- Reducing unplanned maintenance and possible shutdown of plant; by definition a debottleneck assessment is challenging, with many different variables
- Preventing build-up of fine particles in piping and instrumentation systems, which can be prevented only by having up-to-date specifications of different operating parameters

How critical is it to have access to up-to-date, relevant and effective engineering reference data before starting any kind of petrochemical debottlenecking project? Very critical. One customer—one of the world’s largest petrochemical companies in the world and the world’s leading licensor of polypropylene manufacturing technology—recently made this discovery.

Our customer evaluated various options to identify a cost effective approach to debottleneck their bulk propylene production facility. After careful evaluation, the increase in throughput through the reactor was identified as the most practical approach. One of the many challenges in debottlenecking is arriving at the right combination of yield and catalyst utilization, which depends on many variables, such as temperature, differential pressures, evaporation capacity, chamber volume and many more. An additional complexity found was that depending on the catalyst selection, different impurities could be produced, further complicating the simulation and increasing the number of input into the model.

By having standardized input from an engineering database, such as Knovel, the company’s engineering team was able to collaborate and arrive at decisions faster, spending the time on decision making instead of data gathering for multiple options. This plant was able to be re-commissioned and placed in operations at a lower cost and less time than competitors.

Conclusion

By using engineering reference data, from a product such as Knovel, chemical companies are able to collaborate better, make the right decisions faster, and allocate their time on making quality decisions instead of specification data for different equipment and inputs. As feedstock availability, especially in the U.S., becomes more diverse, being able to run multiple simulations and analyze expected yields will be critical in terms of achieving a lower cost project and faster commission of debottleneck projects in the petrochemical industry. And with multiple and more complex simulations being run these models are only as good as the data being input into them.

Interested to learn more? Download the Knovel Solution Story, How A Large Polyethylene Plant Used Knovel to Debottleneck Their Operations
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