

The Refiners Challenge: Growing Capacity Coupled with a Lower Quality Feedstock

Larry G. Chorn, Platts Analytics, (720) 548-5524, larry_chorn@platts.com

Overview

According to most crude oil demand forecasts, refining capacity must increase to meet an additional daily demand of 35 MMBOPD by 2025. Additionally, the quality of the global crude oil supply will be decreasing. New volumes entering the market are forecast to have poorer quality characteristics (gravity, sulfur, acid number) than what they are replacing or supplementing. Lower gravity crude oils require additional treating to remove heavy metals and catalytic upgrading to produce high-value refined products like jet fuel and reformulated blendstock for oxygenate blending (RBOB) gasoline. Crude oils with high sulfur content, also known as “sour” crude, require additional treating to produce the ultra-low sulfur transportation fuels required in Europe and North America.

Methods

We consider the combined impact of investments for upgrading capabilities and capacity expansion on the existing global refinery complex. The article begins with a review of the 2007 refining industry capabilities and the recent trend of declining crude supply quality. Estimates are developed for capital required by 2025 to expand the complex from 95 MMBOPD of atmospheric distillation capacity to 135 MMBOPD, where both values incorporate an obligatory ten percent spare capacity. The analysis then incorporates upgrading (vacuum distillation, catalytic cracking and hydrotreating) requirements for the existing complex to accommodate the declining supply quality forecast. Estimates of incremental upgrading-associated capital required for both improvements to the existing complex and the projected 2025 complex are developed using recent Nelson refining index cost trends and construction timelines.

Results

Refining capacity must increase, in turn, to handle the larger throughput requirements. However, Platts anticipates that the quality of the global crude oil supply will be decreasing because new crude will have poorer quality characteristics (gravity, sulfur, acid number) than what it is replacing. And that poses major problems for refiners. Lower gravity crude oils often require additional treating to remove heavy metals and complex upgrading to produce high-value refined products like jet fuel and reformulated blendstock for oxygenate blending (RBOB) gasoline. Crude oils with high sulfur content, also known as “sour” crude, require additional treating to produce low-sulfur transportation fuels required in Europe and North America. Acidic crude will corrode refinery components, leading to higher frequency turnaround cycles (can we say “leading to greater maintenance downtime and costs”?) unless refiners use expensive corrosion-resistant alloys in equipment fabrication and piping.

Among the challenges facing the global refining industry are:

- To expand capacity to meet demand,
- To upgrade existing refining capacity to produce higher quality, less polluting fuels, and
- To increase the complexity of refineries to process poorer quality crude oils.

Two financial issues will become concerns as a result of these challenges:

- The availability of risk capital to fund these enormous construction demands must be addressed.

The growing price differential between light and heavy crudes will make it harder for refiners trying to process the increasing quantity of lower quality crude while still producing fuel that meets quality regulations.

Conclusions

The global refining industry is concentrated in a few countries, mostly OECD consuming nations. Local resistance to construction in these countries foreshadows delays and rising costs. Industry consensus reflected in announced construction plans indicates that the majority of capacity growth, about 70%, will occur in producing countries and in China. International Agency Agency (IEA) and Purvin & Gertz estimates, reported at the 2006 OPEC seminar, show planned capacity additions through 2011 will total about 14 million barrels per day. Superimposing the IEA and OPEC forecast for global demand in 2011 of 94 million barrels per day, or a 10 million barrel per day increase over 2006, it appears the distillation capacity will marginally exceed requirements, but upgrade capacity will continue to lag, even if construction schedules are maintained.

The aggregate (2007 through 2025) nominal capital for upgrading and expansion approaches five trillion dollars. The majority of expansion and upgrade capacity is scheduled for start-up in 2010-2011, so construction schedules should be closely monitored for slippage as their impact on quality-induced price differentials will be negative and significant. These analyses suggest the present light-heavy price differential will be sustained through an optimistic refinery capacity planning horizon.