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## **Question 44: What strategies have you utilized to balance available catalyst life in hydroprocessing units with scheduled turnaround times, and how can this be optimized to increase profitability?**

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Two scenarios exist when looking to balance hydroprocessing catalyst life with turnaround timing: instances where excess activity is present and instances where there is not enough activity to meet the projected TA schedule.

In instances where there is excess activity and to minimize leaving activity on the table, refiners often increase unit severity to use up the excess activity and provide economic benefits.

In an ULSD unit this can be accomplished in several ways – processing more barrels of a difficult feed stream like LCO or coker gas oil, a combination of processing more difficult feed and increasing the distillation endpoint of these streams. The maximum benefit is derived from units processing high % of cracked stock (LCO, LCGO) at high pressure (> 1000 psi) and low LHSV.

Similarly, in a FCCPT unit, catalyst activity can be used up by processing more challenging barrels which could also include a higher metal containing feed or depending on where the unit is in its cycle and the capabilities of the unit, changing operating mode from HDS/HDN to maximum PNA saturation to improve FCC feed quality and target higher FCC conversion and more profitable yield profile. The higher severity operation requires more MU H<sub>2</sub> and wash water and higher FCC feed H<sub>2</sub> content can lead to heat balance issues in the regenerator so need to work closely with downstream units.

In instances where there is not enough activity to meet the projected TA schedule, several options exist to extend cycle life. These options may have economic penalties that need to be weighed against the costs of moving the TA date.

- If unit is heat constrained, switch to an ascending profile to achieve higher WABT without change in furnace duty.
- If pressure drop or metals contamination is a constraint, cycle can be extended by taking a pit stop and replacing the top bed or if only need to extend the cycle for a very short time, the feedrate and/or gas circulation rates can be reduced to stay within the dP limits.
- If possible, divert difficult feeds (Cracked stocks, high end point feeds with high metals) to a different unit or process lighter feeds by changing cutpoints in upstream distillation columns.
- Reduce product targets and overtreat on other units to ensure final blended products are on-spec (for e.g., two ULSD units - one which is at end of life and other with fresh catalyst can be operated at different sulfur targets.)

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- For FCCPT units, determine a constraint that has to be met for the refinery to keep operating (FCC regenerator SOx emission, FCC gasoline sulfur, etc.) and reduce severity of the hydroprocessing unit to satisfy this minimum constraint for the remaining cycle.

In short, there are many options for both scenarios and the best solution will be different for each particular instance depending on refinery configuration, capabilities and economics.

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