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" Accelerating Industrial Decarbonization: Digital-AI and Energy Transformation "

Presenter's Biodata & Abstract

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Title of Presentation : Hybrid Catalyst loading of regenerated and fresh catalyst for reducing carbon (CO2) footprint/ GHG emission and promoting circular economy/sustainability

Presentation Abstract:

Catalysts are typically one of the largest controllable costs for a refiner. After ULSD implementation, catalyst requirement has gone up in Refineries worldwide. Increased catalyst requirement not only results in increase in cost to but also increase in carbon footprint due to higher metal mining and extraction and consequent higher landfill disposal at its end of life.

Industries are a major sector/source of GHG emission. While Everyone is looking for various options/technologies at individual or community level, industries have major responsibilities in cutting down the emissions.

There is one aspect of reducing emissions in industries i.e., promoting a circular economy.

Catalysts are one of the biggest assets for the refinery. Catalysts are manufactured for re-utilization after first use. Major global refineries utilize full cycle of catalyst by reusing it. However, this concept is reusing catalysts is not being practiced in many refineries.

There are four ways by which spent catalyst disposal/utilization occurs.

1. **Disposal**. Spent catalysts are sent for disposal by land filling. This is one of the worst options because not only does it denies usage of any part of spent catalyst but it also harms the environment significantly.

2. **Component Recycling (Metal Recovery).** Another method to use spent catalyst is to send it for metal reclamation. By this method, precious metals are recovered in the form of chemicals, which are again sent for making fresh catalyst. Commonly this method is known as recycling. This method helps reduce CO2 partly because raw materials are recovered from spent catalyst.

3. **Indirect use (Co-ingredient Recycling).** In this method, spent catalyst is taken into manufacturing process without altering its form (No metal recovery).

4. **Direct Reuse (Regeneration & Rejuvenation).** The best way to utilize spent catalyst is to reuse the catalyst in refinery again after doing required treatment so that catalysts gain its activity back. This is called catalyst regeneration. Catalyst use reduces CO2 footprint significantly and it also reduces the cost. This promotes the circular economy in a true way.

Reusing properly regenerated catalysts avoids unnecessary spending and complements environmental sustainability. A pool of reusable catalysts is a valuable resource for refiners to manage their fill costs and precious foreign exchange. Hybrid loading of fresh and regenerated catalyst renders almost similar performance with significant cost saving and very negligible/no performance comprise. The idea of hybrid loading is to combine regenerated catalyst at the top of the reactor and fresh catalyst at bottom of the reactor. In the top bed, no complex reactions occurs and hence catalyst activity does not hamper the performance of the unit. The highly reactive sulphur species with high reaction rates of removal at the top of the reactor are not limited by catalyst activity. Hence Regenerated catalysts are good enough

to provide needed activity at top of the reactor. Higher activity is required, as feed progresses through the unit and hence in bottom beds, fresh catalyst is loaded. Hybrid loading is well proven practice through years of experience by many refiners which costeffectively maximizes the performance of the unit.

Hybrid loading is also supported/guaranteed by catalyst manufacturers. Usage of regenerated catalyst not only results in cost reduction, but also CO2 footprint is significantly lowered as compared to using fresh. Reusing catalysts minimizes landfill disposal, reduces CO2 emissions from metals reclamation, reduces CO2 emissions from metals mining and extraction thus promoting environmental circularity and sustainability goals of the refiners in a great way. CO2 generation for Regeneration/Reuse is ~ 60% lower than fresh. This is a significant difference, and one should encourage reuse of catalyst to support circular economy.

In addition to regeneration and rejuvenation, the fully preactivated technology of of Eurecat (TOTSUCAT) would reduce carbon footprint by 80% (Scope 1 emissions) during the start-up.