

Oil Refinery Assets Reliability Catalyst Replacement Optimization Tool

The Situation

Hydrotreating is a process in an oil refinery for reducing sulphur, nitrogen and aromatics in the crude. A catalyst which enables this process has limited lifetime, which varies, depending on several factors, such as crude quality, production volume and speed, etc. A catalyst that isn't replaced prior to end of its effectiveness puts this process in jeopardy, as crude load not properly cleaned must be discarded, causing downstream production to stop for the duration of the unplanned replacement. Losses due to such disruption are estimated at \$5 M per incident.

Increasingly stringent regulations, heavier crude, and growing energy demand have complex, and sometimes conflicting, challenges for refiners operating hydroprocessing units.

The Need

A refinery operations manager needs to ensure timely replacement of catalysts, while balancing their remaining life with the upcoming production needs.

To meet these objectives and ensure optimal production flow and crude quality, refinery needed a predictive maintenance solution that can estimate catalyst remaining lifetime based on upcoming production needs.

A cost-benefit analysis tool is then needed to drive profitable operations decisions and support a pre-planned, timely replacement.

The Solution

Utilizing trending reaction characteristics and product quality analysis data, we deployed Machine Learning to develop a **Catalyst's Aging Model**.

This model was then used in a Dynamic Programming based Catalyst Replacement Optimization Tool. Using "what-if" scenarios based on the potential production needs, the system recommends optimal usage and timely replacement schedule, well in advance.

The Benefit

- ✓ Our Dynamic Catalyst Replacement Optimization tool prevents future catalytic process failures, saving a refinery upwards of \$5M per incident in lost production costs.
- ✓ Our 'what-if' scenarios can align with the production optimization systems enabling profitable operations decisions that support refinery's P&L objectives