

## Hydrogen Management

*BREAK the reaction chains that bind you*

**Hydrogen** is becoming an increasingly valuable asset the refiner must manage to meet today's clean fuels hydrotreating requirements. Mismanagement of this resource can lead to poor unit performance or even plant closure due to lack of hydrogen supply. Criterion Catalysts & Technologies can help refiners explore their hydrogen management options and avoid costly mistakes.



**N**ew specifications for transportation fuels have necessitated the addition of new "hydrogen-consuming" units and now the demand for hydrogen is in many cases exceeding production. In these cases, Criterion offers hydrogen management advice and forms a technical consultancy with the refiner with a scope that ranges from catalyst recommendations, to detailed optimized catalyst bed loading diagrams, to operating scenario unit performance modeling, to unit data tracking and periodic process documentation. With support from our industry-leading catalyst research and development and close supplier relationships, Criterion has developed and delivered refiners with incremental margin gains from \$0.10 - \$0.25/Bbl.

With recent oil prices in the 40-50 \$/Bbl range, there is even more to gain by understanding the value impact differentials of the cheaper heavier, more sour crudes. Today's new refinery asset engineer defines VI as Value Impact rather than Viscosity Index. Attacking modern refining issues with Carbon Rejection is a longer term and more complex processing strategy than simply adding hydrogen. Criterion can provide detailed pilot plant studies and computer based modeling applications to develop catalyst options and accurately measure unit performance. Additionally, we can refer refiners to Shell Global Solutions that can provide refiners with a comprehensive refinery hydrocarbon management review.

Value Impact

Complex Processing Strategy

Hydrogen Management Advice

## Adding Hydrogen

There can be several options to get additional hydrogen, for example, a steam reforming unit, or third party hydrogen pipelines. The incremental value of hydrogen is then the cost of getting the hydrogen from one of those sources. If however, you are evaluating the value of increasing reformer hydrogen capacity, then the relative throughput of the unit has to be considered to determine the relative impact to the refinery's economics.

### The following are five steps for organizing a hydrogen management study:

1. Optimize each hydrogen consuming unit
2. Eliminate or recognize giveaway value from over treating operations
3. Determine losses to fuel or flare
4. Calculate the net hydrogen value
5. Determine the incremental value of hydrogen to each consumer

### Getting More Hydrogen from the Reformer

Criterion supplies high performance catalysts for both CCRs and Fixed Bed Reformers.

The new generation catalysts squeeze more hydrogen and reformat yield from the reformer unit. Refiners that have switched to our newer generation of reforming catalysts have enjoyed significant operation credits to lower their costs and improve their margins.

PS-40 series has increased CCR hydrogen output globally in more than 25 units. The 15 series and unique PR-11 Fixed Bed Reformer catalysts provide more yield over a longer cycle with greater stability. Switching to these high purity alumina supported catalysts provides the refiner with rapid payback and they are designed for long service. To take it a step further, refiners should select a catalyst supplier who has the expertise to assist their profit improvement team to not only optimize the current unit operation, but also to identify and attack the prevailing constraints in the refinery. Criterion's experience has demonstrated many times that the cost of relieving a constraint requires minimal capital investment

# Where can You add 100 SCF hydrogen per Barrel of feed processed in the Reformer?

## NHT

- Increase feed S content
- Increase olefin content
- Process more cracked naphtha
- Extend the cycle length (H<sub>2</sub> partial pressure shift dependent)

## DHT

- Upgrade LCO to on-road diesel

## HC

- Increase conversion
- Process more heavy cycle oil or coker gas oil

## CFH

- Achieve greater conversion in the FCC

*For more details on the options and benefits to match your needs contact your Criterion Catalysts & Technologies representative and set up a meeting to explore the possibilities.*



**When you develop your next operation scenario, our teams will prepare customized solutions for you with Speed, Confidence, and Success**

### Important:

All information contained in this document is considered accurate at the time of the testing, based on the equipment, and specific conditions and other limitations during the testing process. It is being furnished upon the express condition that the user will make its own assessment to determine the accuracy and applicability for the user's particular purpose.

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