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Excellence in Plant Performance
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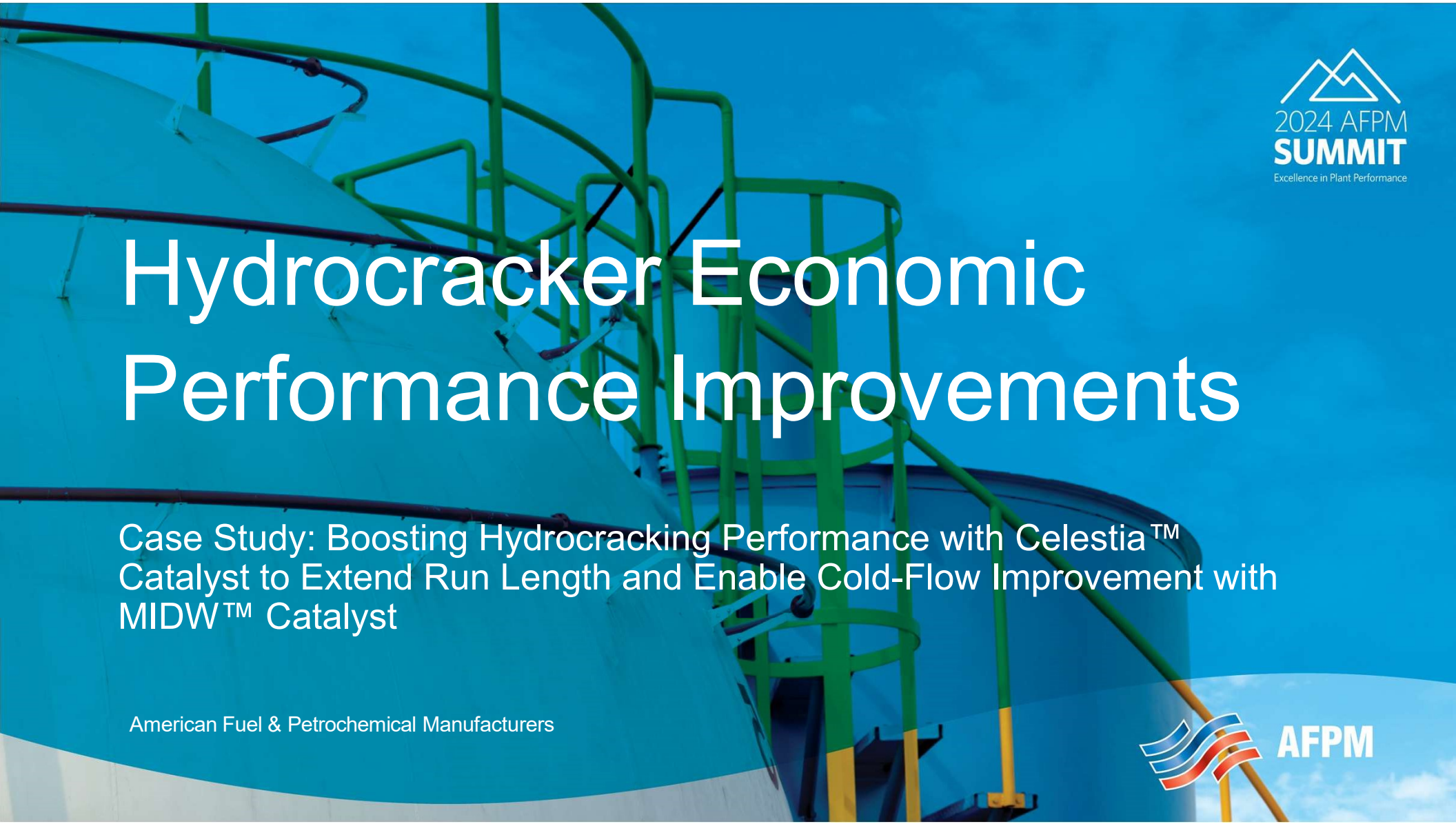

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Hydrocracker Economic Performance Improvements

Case Study: Boosting Hydrocracking Performance with Celestia™ Catalyst to Extend Run Length and Enable Cold-Flow Improvement with MIDW™ Catalyst

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Speakers

ExxonMobil Ketjen

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Speaker
Mitchell E Loescher, PhD PE
Technical Sales Manager
ExxonMobil Product Solutions

Speaker
Christy Anderson
Technical Services Manager
Ketjen Corporation

Moderator
Oscar Brown
SME Hydroprocessing
Valero Energy

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Case Study: Unlocking value from a constrained hydrocracker within an existing asset

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Processing Parameter	
Pressure	150 barg / 2175 psig
Feed Quality	
API Gravity	20
Sulfur	1.7 wt%
Nitrogen	880 wppm
FBP	520°C / 970°F
Feed Blend	
HAGO / VGO / HKGO / SRGO	

Unit Pain Points

- Severe performance degradation at EOR
- Maxed-out temperatures
- Reduced HC activity
- Need to run an existing separate dewaxing unit

Improvement Goals

- Meet run length objectives without feed tailoring and minimizing product downgrade
- Less performance drop-off at EOR
- Enable MIDW™ catalyst in hydrocracking reactor
- Improve yield profile

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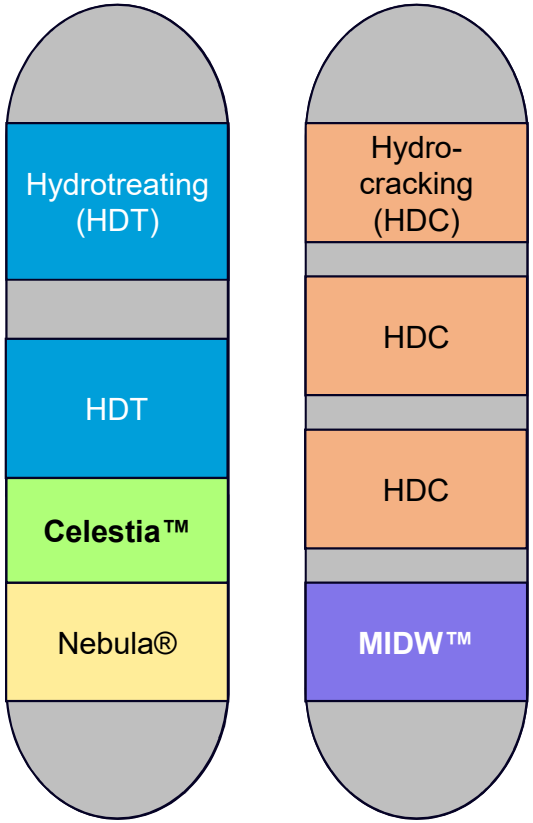
Case Study: Applying Celestia™ catalyst to optimize hydrocracking catalyst function



Approach

- Unit already using Nebula® bulk metal catalyst
- Replaced ~25% of pretreat reactor with Celestia catalyst
- Reduced Nebula catalyst by ~33%
- Expected 1.35x pretreat activity increase versus prior cycle
- Improved pretreat enabled reduction of cracking catalyst volume
- MIDW™ catalyst employed in remaining volume

What is Celestia™ catalyst?

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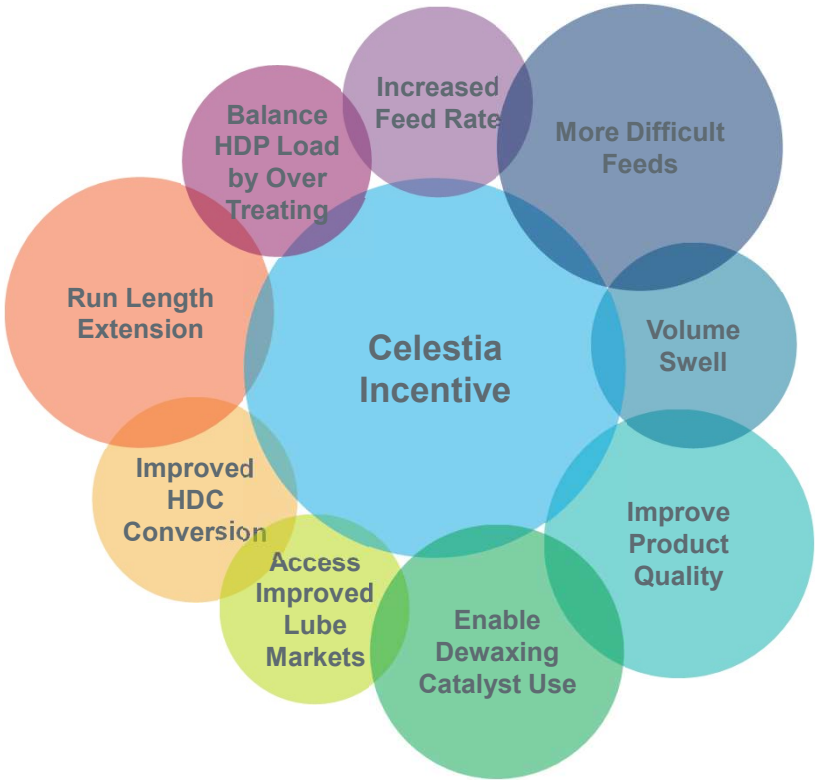

- **A bulk metal hydrotreating catalyst**
  - Composed of hydrotreating metals and proprietary organic
  - No inert Al support → more active metals in equal reactor volume
- **Highest activity hydrotreating catalyst**
  - Step-out aromatic saturation (volume swell) and HDN activity
  - Enables higher performance of non-BMC reactor beds
- **Incentives extend beyond the individual unit:**
  - Meet lower sulfur targets without capital
  - Rebalance internal feeds to improve utilization
  - Widen the available crude diet
  - Product blending opportunity to relax a constraint
  - Coordinate HDT turnaround schedules
  - Improve energy efficiency

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ExxonMobil & Ketjen: A long history of collaboration & specialty hydroprocessing catalyst innovation

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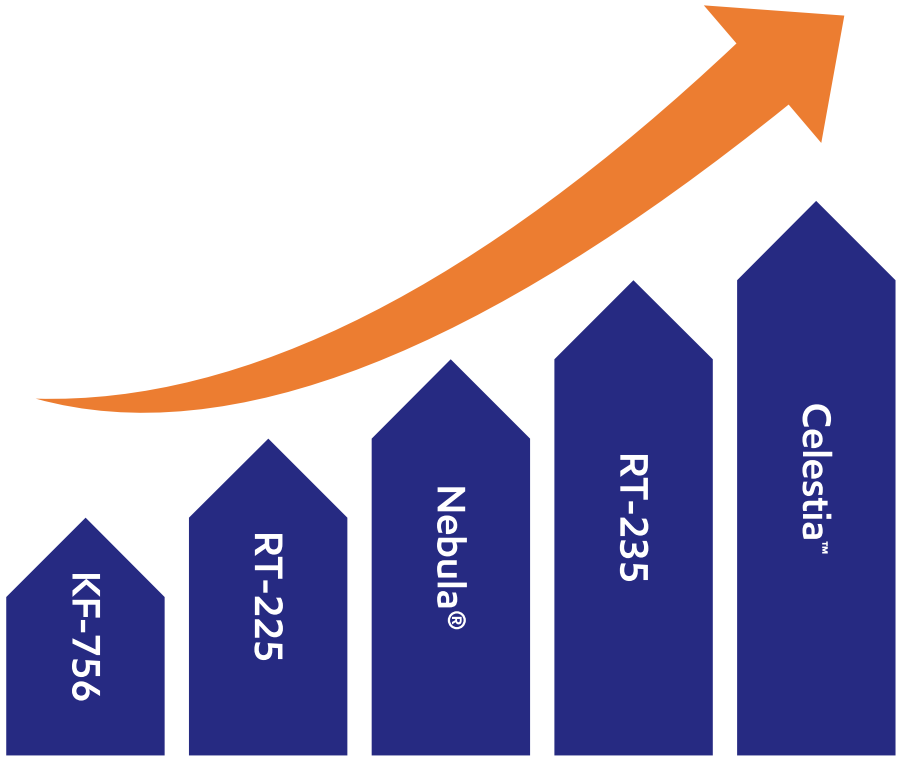

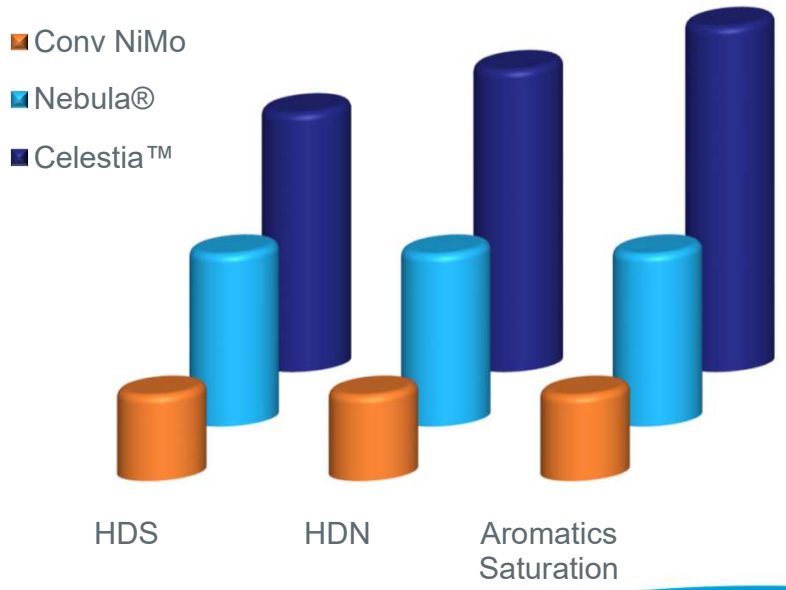

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Case Study: Celestia™ catalyst in action

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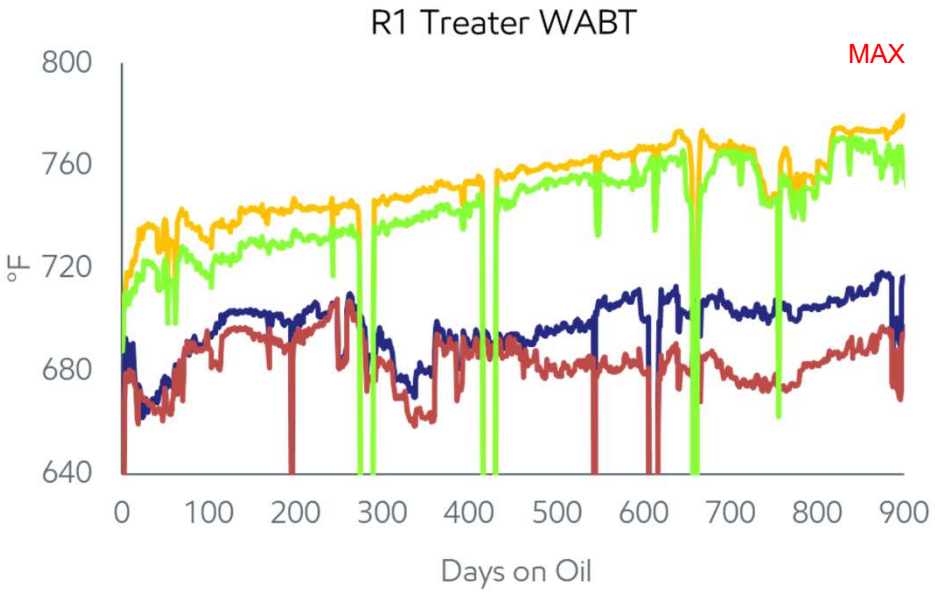

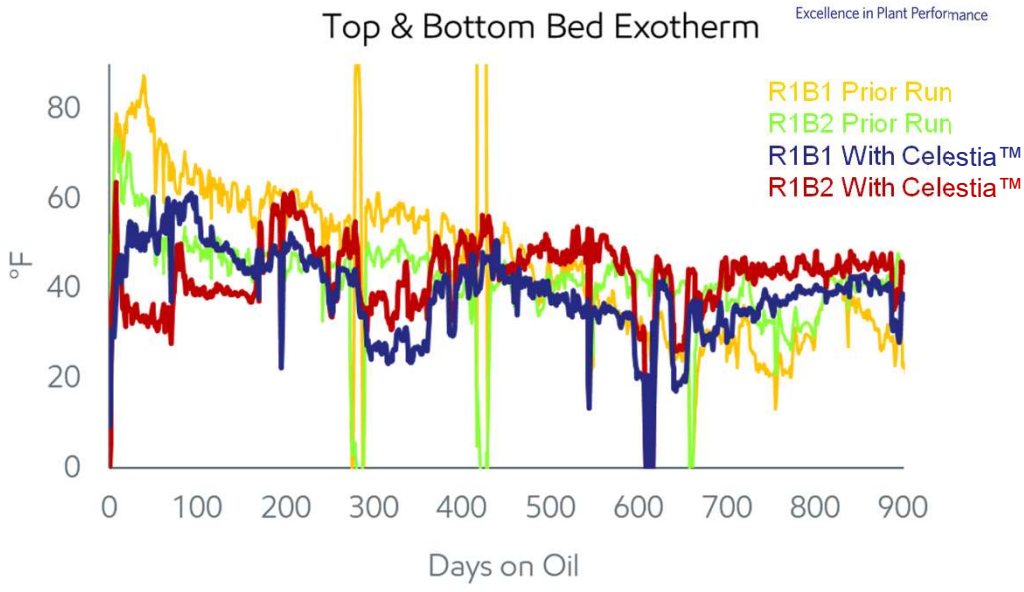

Significant Improvement in SOR Activity

- 40°F lower SOR temperatures
- Exceeded expected 1.35x RVA
- Low temperatures drive stable aromatic saturation, low deactivation

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Case Study: Harnessing unparalleled HDN

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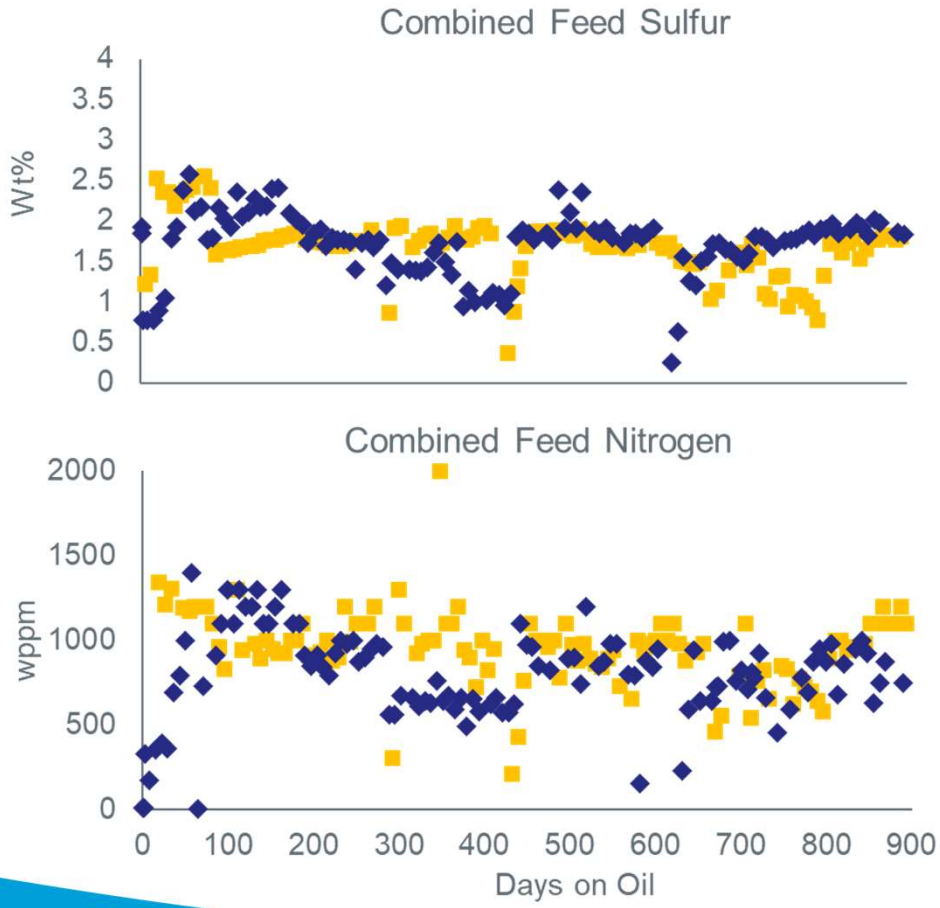

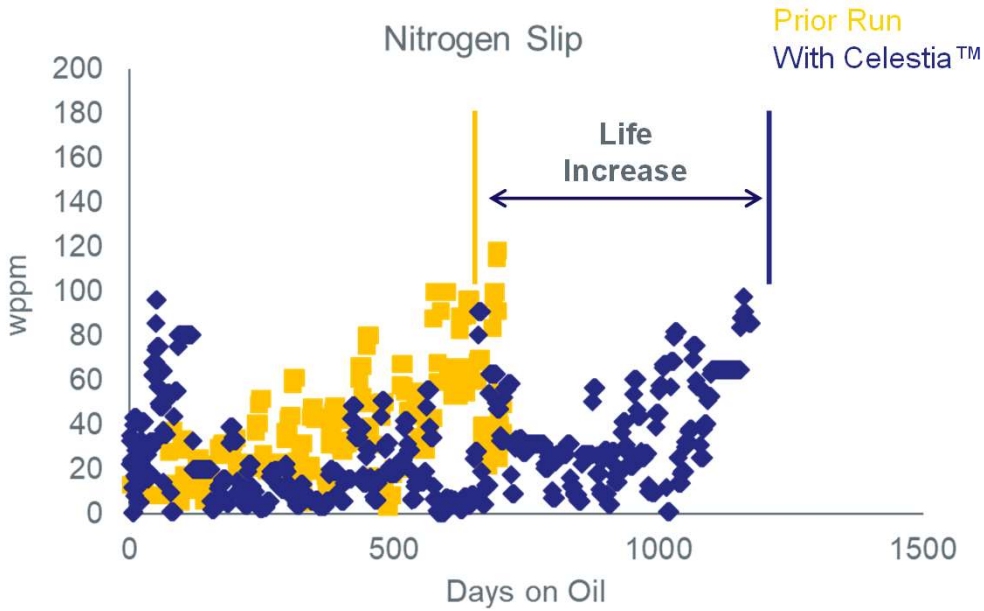

Improved N-Slip & Arosat
Key to Unlocking Cracking

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Case Study: Benefits work synergistically

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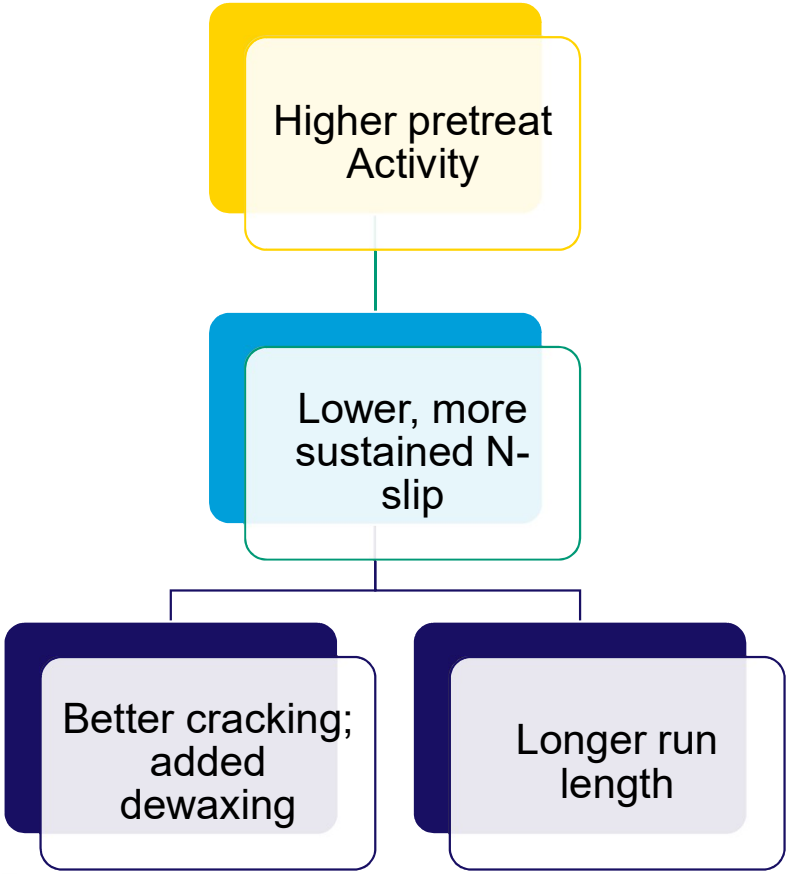

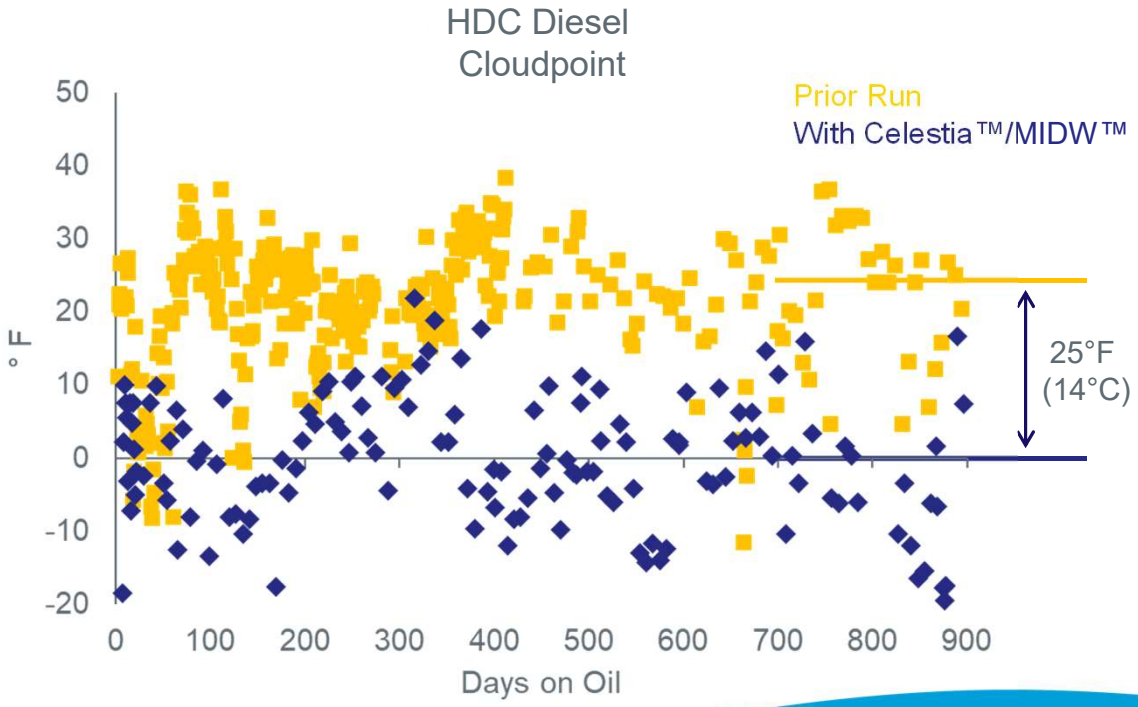

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Case Study: Improving refinery economics

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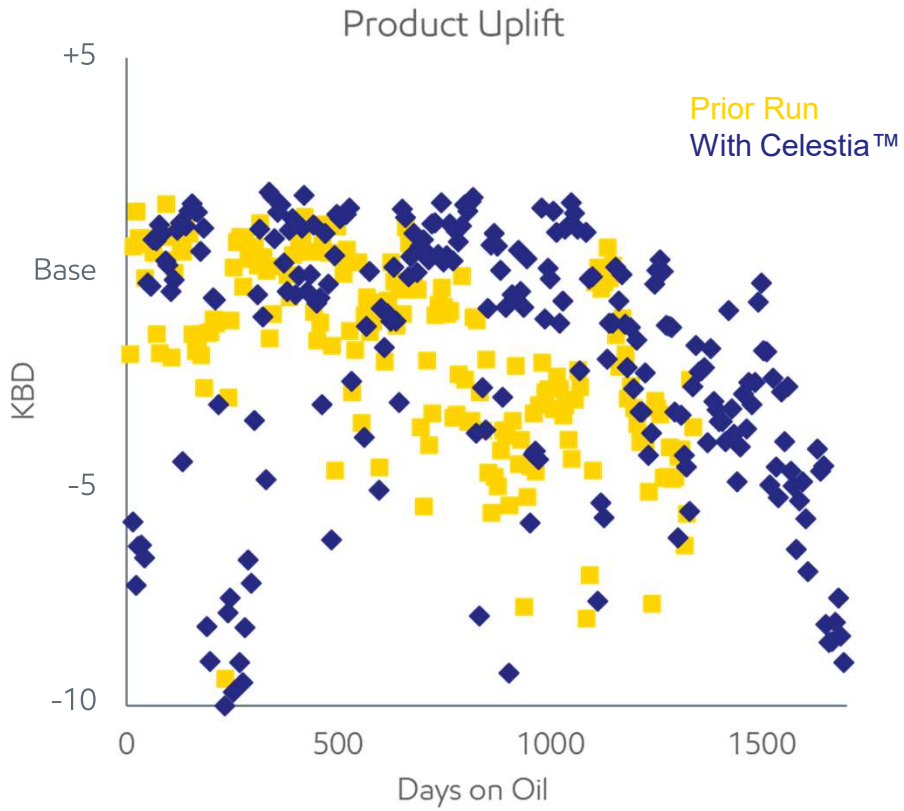

Values Captured

- HDC yields and performance*
- Increased product uplift throughout cycle
- HDC diesel product quality
- Reoptimization & repurposing of downstream assets
- Additional OPEX savings

$15-25M / yr*

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Assuming conservative $10-15/bbl uplift vs next best disposition

Celestia™ Catalyst: Proven value for you

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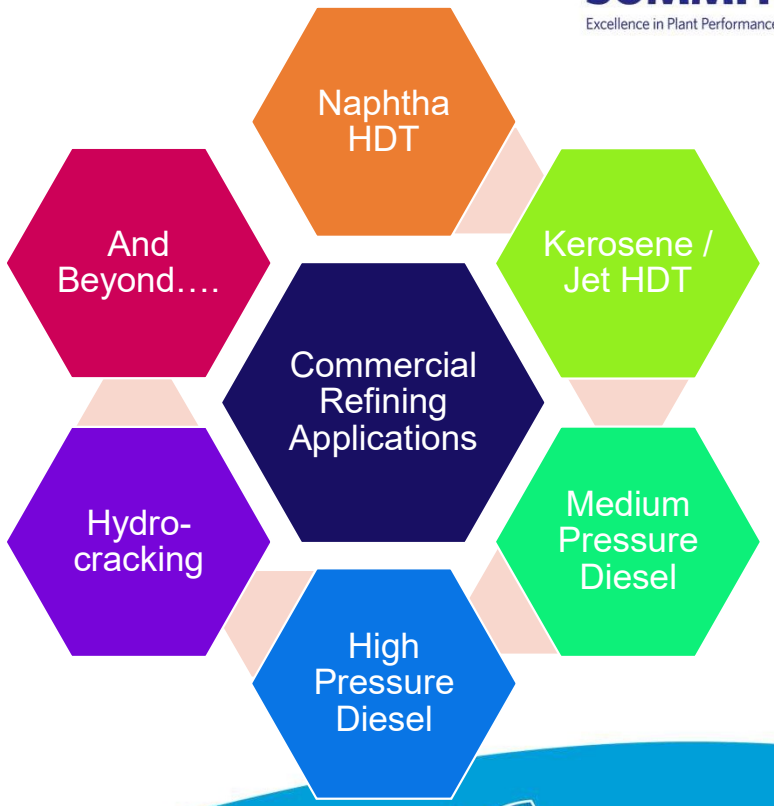
Exceptional hydrocracker pre-treat activity maximized this unit's profitability via:

Superior Activity	Unlocked Cracking	Optimized Investment
Sustained Arosat & N-Slip	Improved Product Properties	Improved OPEX and CAPEX
Extended Run Length	Improved Uplift & Yields	

What can Celestia catalyst bring to your refinery?



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Questions?

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AFPM Reference Material

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This presentation will be available to all conference attendees post conference.

Other material relevant to this content can be found:

- ExxonMobil Catalysts & Licensing
- Ketjen Clean Fuels Technology

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