

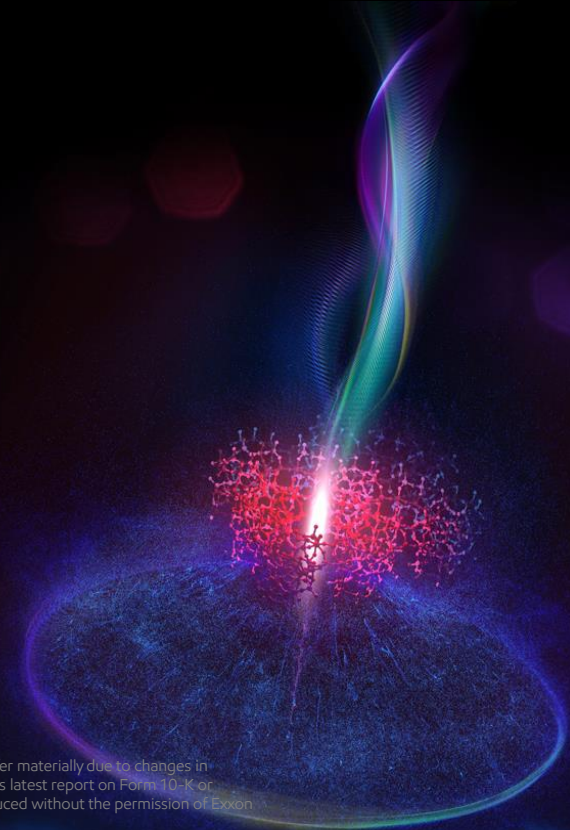
ERTC Virtual Meeting 2020

ExxonMobil dewaxing in bio services



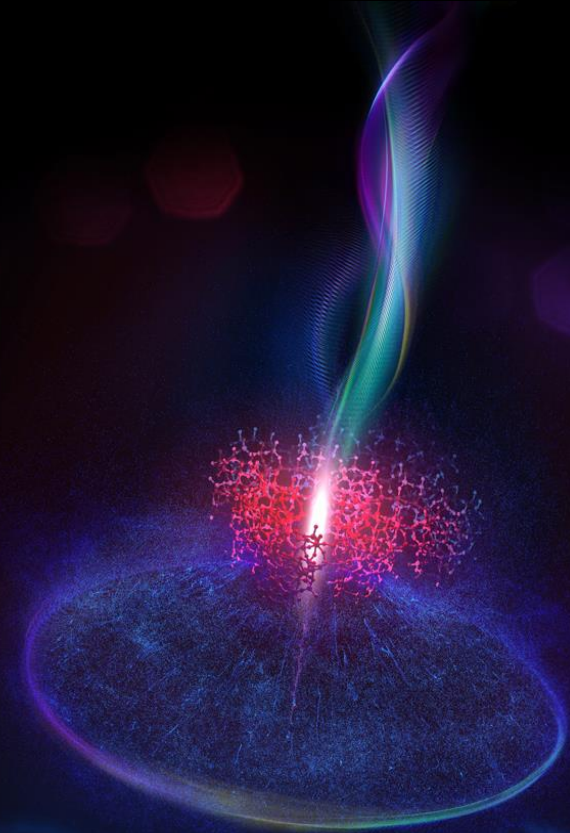
Dean Parker
Technical Sales Manager

This presentation includes forward-looking statements. Actual future conditions (including economic conditions, energy demand, and energy supply) could differ materially due to changes in technology, the development of new supply sources, political events, demographic changes, and other factors discussed herein (and in Item 1A of ExxonMobil's latest report on Form 10-K or information set forth under "factors affecting future results" on the "investors" page of our website at www.exxonmobil.com). This material is not to be reproduced without the permission of Exxon Mobil Corporation.

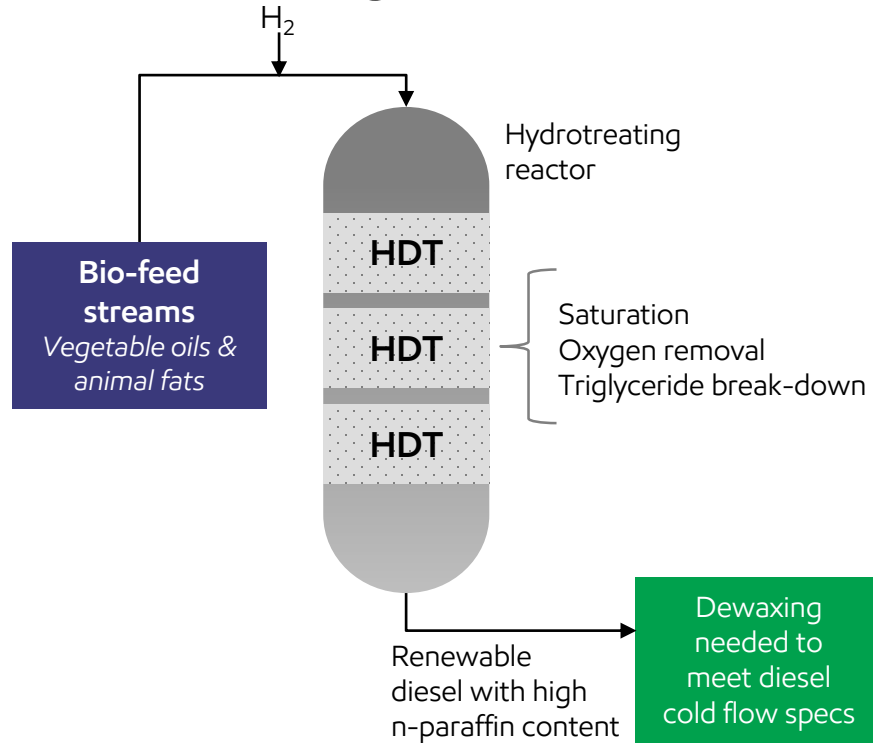


Content

- How bio processing drives the need for dewaxing technology
- Brief intro to ExxonMobil dewaxing catalysts
- Dewaxing catalyst deployment options
- Why ExxonMobil dewaxing meets renewable diesel needs



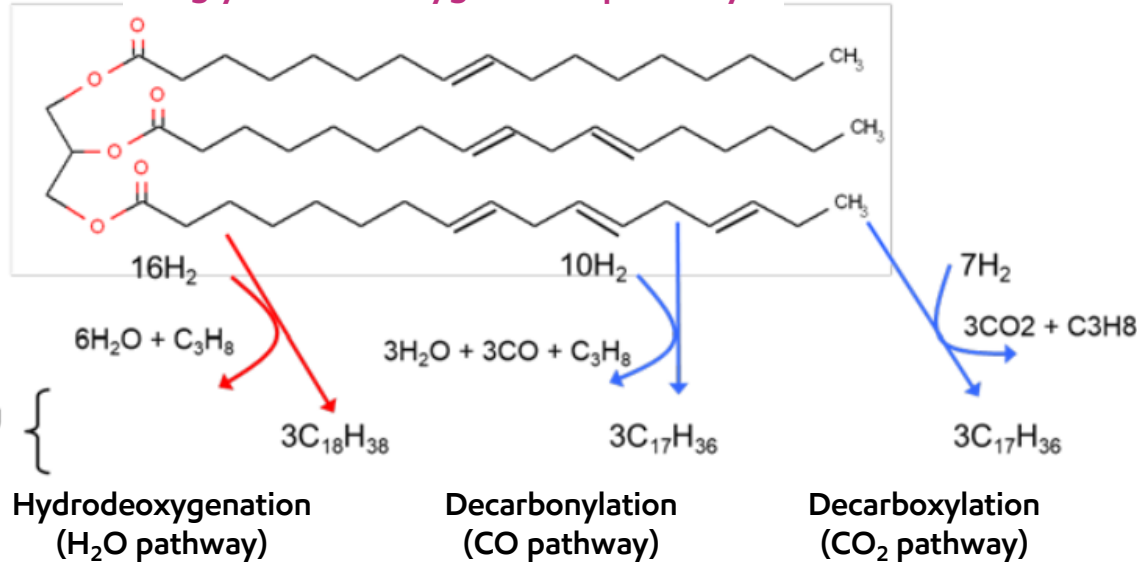
Bio processing drives need for dewaxing



- Vegetable oils and animal fats convert to n-paraffins during hydrotreating
- Carbon numbers range from 12 to 24 depending on the bio source
- Most bio feeds result in C17 to C18 carbon number n-paraffins

Bio reaction pathways

Triglyceride deoxygenation pathways



Major reactions steps:

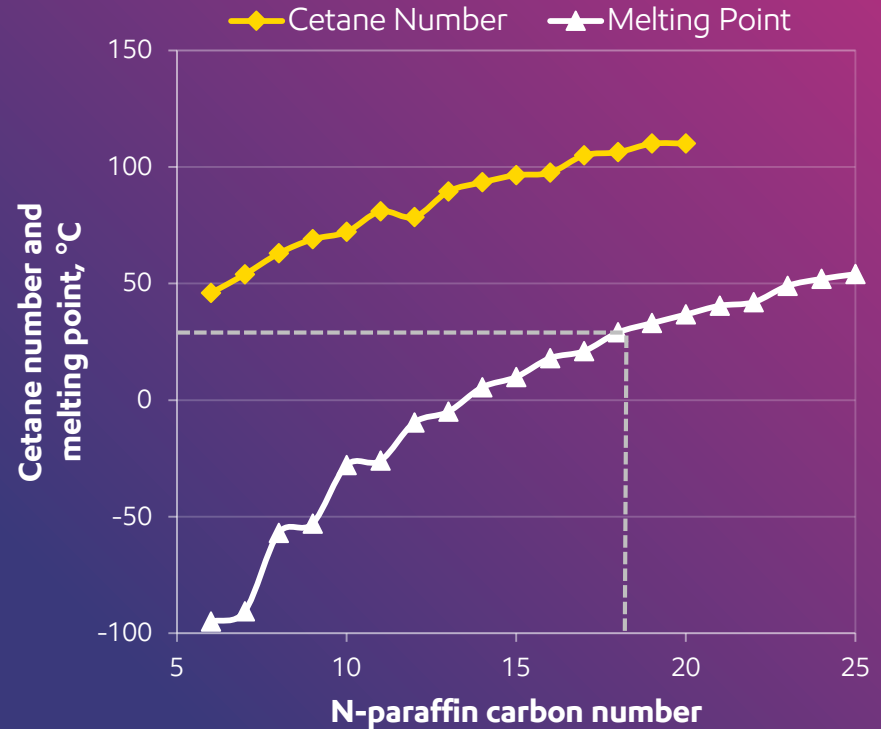
- Saturate double bonds releasing heat
- Triglycerides break into fatty acids chains forming propane
- Oxygens are removed
- High consumption of H₂
- Water gas shift and methanation also occur

End result:

Long chain n-paraffins remain

Renewable diesel requires cold flow management

- There are three main diesel cold temperature specifications required
 - Cloud point – temp wax crystals begin to form
 - Cold filter plugging point (CFPP) – temp at which a filter plugs with wax crystals
 - Pour point – temp when the diesel solidifies
- Long chain normal paraffin (C15+) primarily influence these properties
 - Excellent diesel cetane
 - High melting point (pour point)
- Solutions to correct poor low temperature performance of diesel involve managing long chain paraffin content



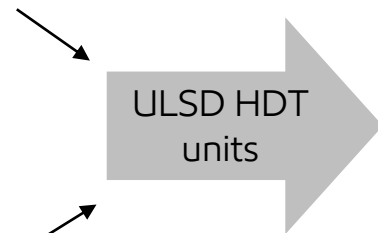
Conventional & renewables diesels face same winter diesel specifications

Conventional feeds

Kerosene
Virgin GO
Cracked GO
Vacuum GO

Green diesel feeds

100% bio feeds
Co-processed bio with conventional



Renewable diesels: more challenged to meet CFPP specifications due to high n-paraffin content

Euro V diesel specifications

Property	Specification	
	Min	Max
Density, kg/m ³	820	845
Sulfur, ppm		10
Cetane Number	51	
PAH, wt%		11
Flash Point, °C	55	
T95 Recovered, °C		360

Winter diesel

Class	A	B	C	D	E	F
CFPP, °C	5	0	-5	-10	-15	-20

Or for more severe cold environments

Arctic diesel

Class	0	1	2	3	4
CFPP, °C	-20	-26	-32	-38	-44
CP, °C	-10	-16	-22	-28	-34

Traditional corrections for cold flow adjustment

	Blending kero into diesel pool	Reducing the feed endpoint	Selectively crack paraffin
Paraffin management strategy	Dilute the n-paraffin with lower CP material	Cut out the high Carbon # n-paraffin from the diesel	Catalytically crack the n-paraffin to naphtha and LPG
Benefit	Simple blending in the feed or prod tank	Better hydrotreating performance	Feed flexibility
Disadvantage	<ul style="list-style-type: none">• Downgrade to diesel• May back out EP	<ul style="list-style-type: none">• Downgrade to VGO• Lower yield of diesel	<ul style="list-style-type: none">• High naphtha/LPG yield• Lower cetane

Not a valid option for bio feeds

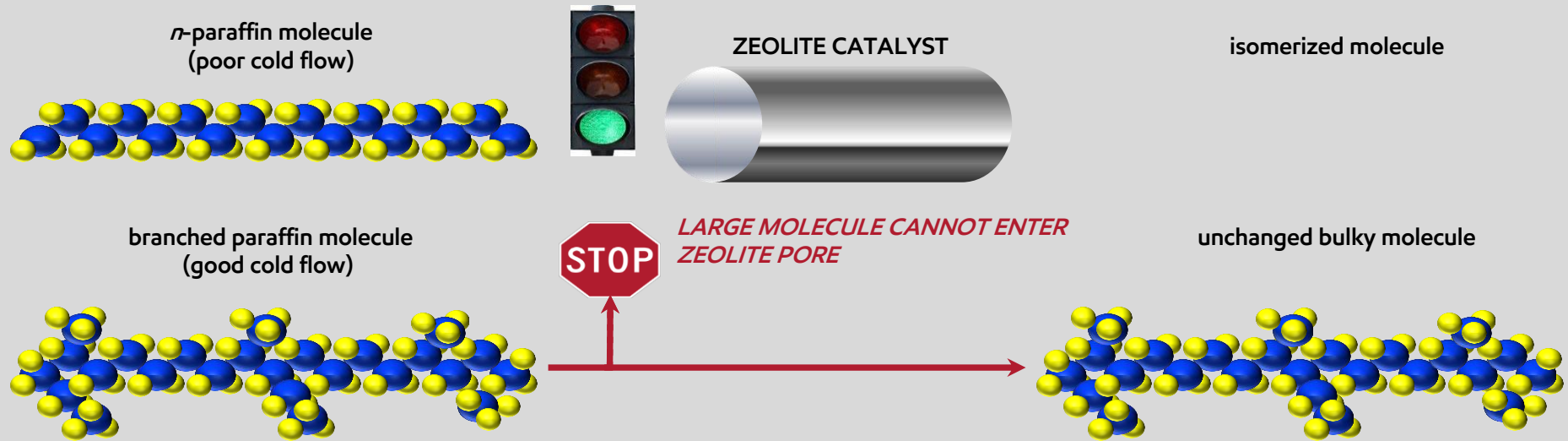
ExxonMobil Dewaxing Catalyst offers an effective solution for cold flow improvement for n-paraffins sourced from traditional fossil feed **or** renewable feeds.

ExxonMobil Dewaxing Catalyst isomerizes n-paraffins to iso-paraffins, which maximizes distillate yield

- Iso-paraffins have excellent low temperature performance while retaining high cetane

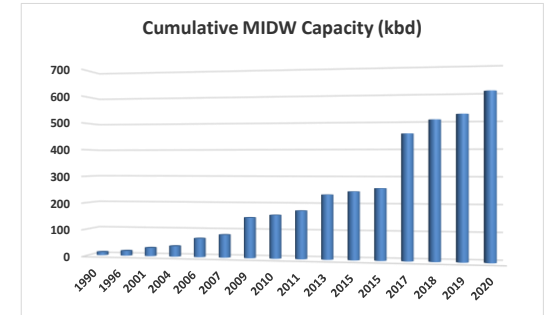
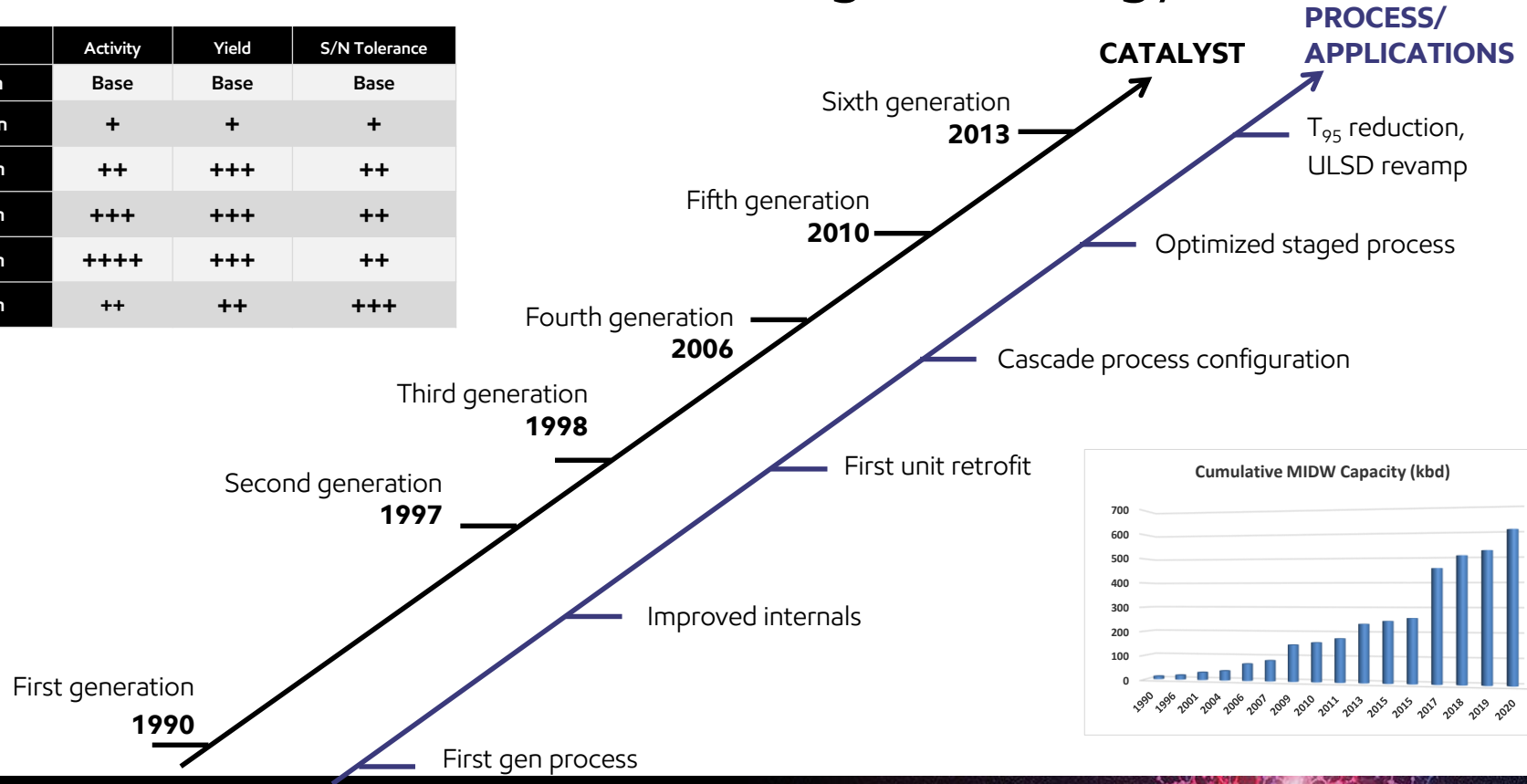
ExxonMobil isomerization dewaxing technology for winter diesel production

- ExxonMobil dewaxing catalysts are shape-selective catalysts designed to convert n-paraffins to
- iso-paraffins; result is MAX Diesel Production
- Iso-paraffins retain high cetane but reduce the pour point and cloud point dramatically



Evolution of ExxonMobil dewaxing technology

	Activity	Yield	S/N Tolerance
1 st Gen	Base	Base	Base
2 nd Gen	+	+	+
3 rd Gen	++	+++	++
4 th Gen	+++	+++	++
5 th Gen	+++++	+++	++
6 th Gen	++	++	+++



Dewaxing deployment options in bio services- BIDW™ catalyst

100% renewable feed or co-processing: **SWEET SERVICE OPTION**

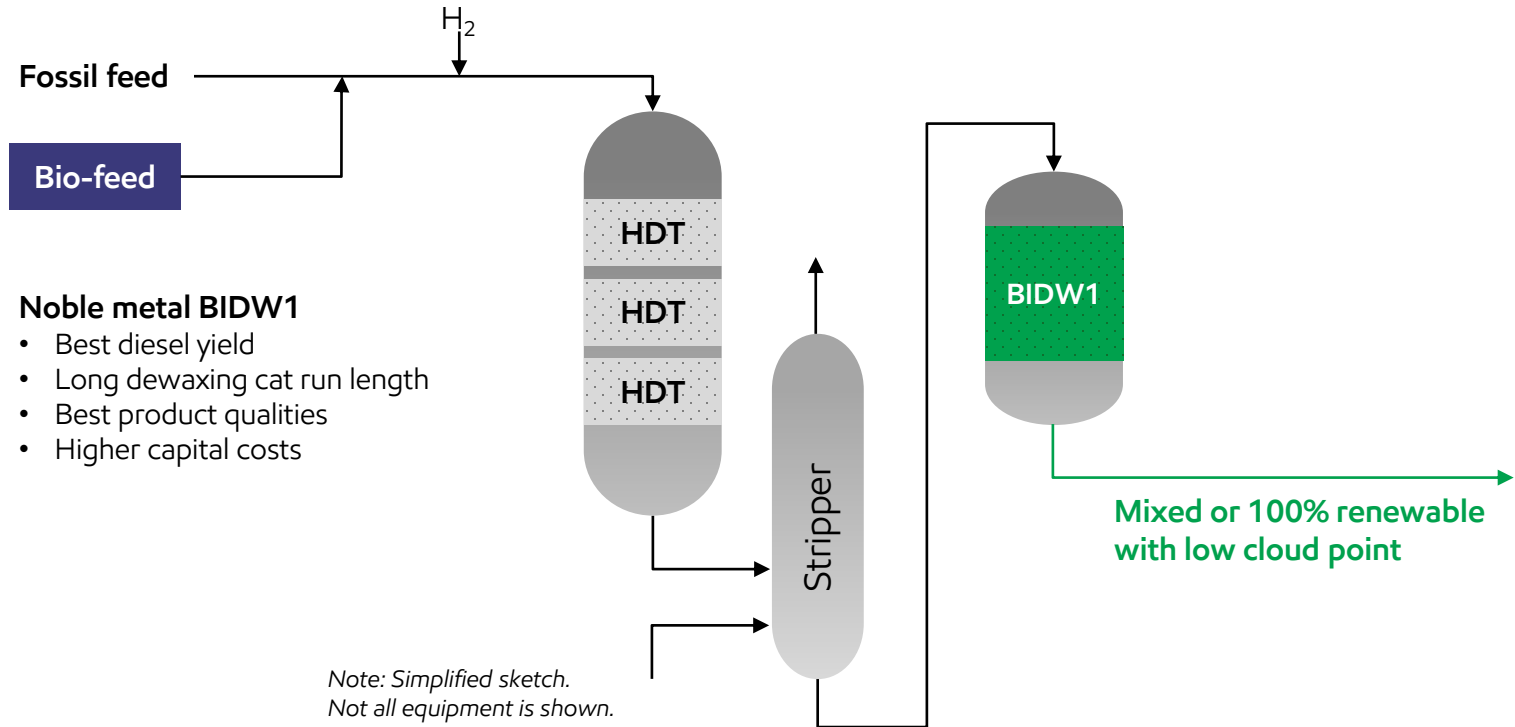
- HDT effluent stripped prior to dewaxing reactor
- Noble metal BIDW1
- Best yields & run length
- Best product quality

Co-processing with HDT effluent direct feed to dewaxing: **SOUR SERVICE**

- Base metal BIDW2
- BIDW2 drop-in to existing HDT reactor
- Or new BIDW reactor added
- Minimizes capital costs

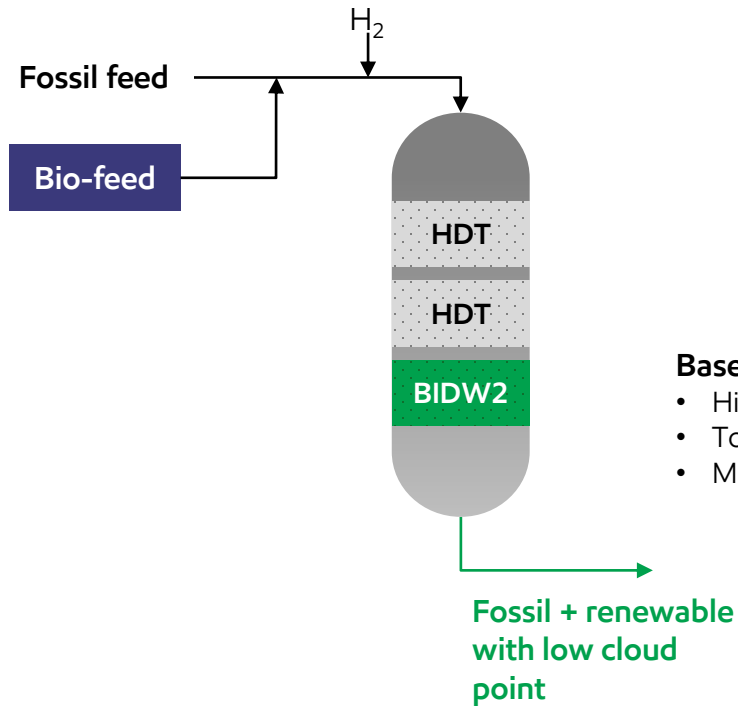
100% bio feed or co-processing in sweet service

Sweet service dewaxing option

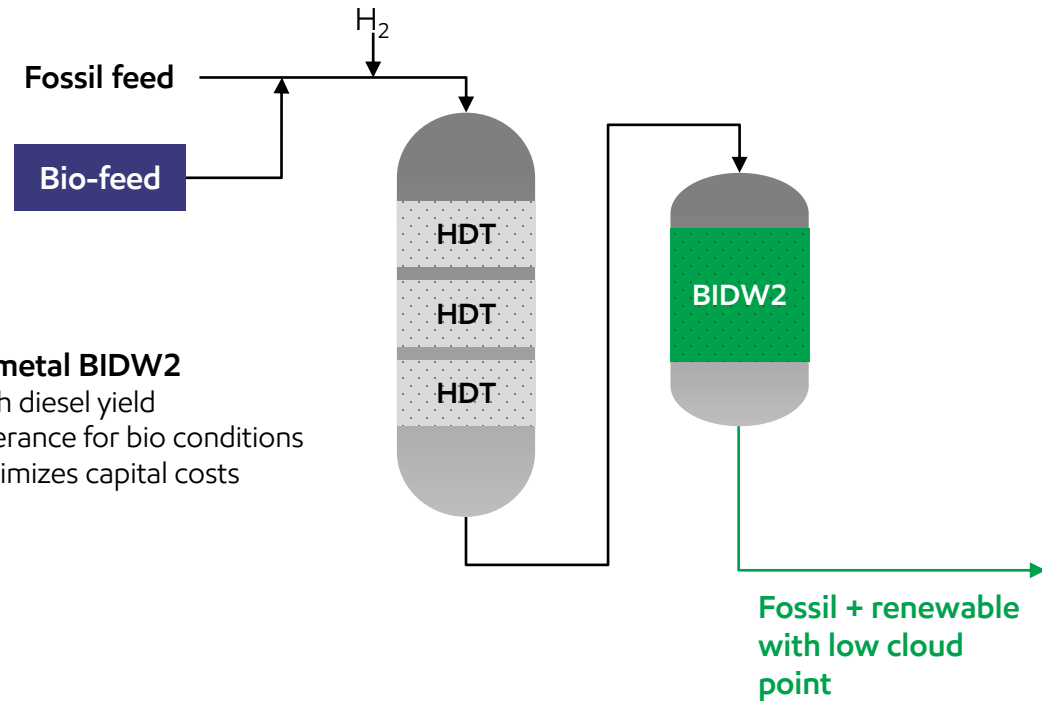


Co-processing with sour service dewaxing

Drop-in option



New dewaxing reactor option



Base metal BIDW2

- High diesel yield
- Tolerance for bio conditions
- Minimizes capital costs

Why choose BIDW™ for your bio processing needs?

High selectivity to maximize diesel yield

- In deep delta cloud service typically required with bio feeds, BIDW has exceptional ability to retain more diesel product and avoid cracking

Robust catalyst with high tolerance for poisons

- Base metal BIDW can withstand HDT effluent conditions in bio
- Both base and noble metal have high tolerance for N and S

Run length maximization

- Sweet service options run exceptionally long
- Sour service can match HDT life

Reduced H₂ consumption

- Isomerization is generally H₂ neutral
- High selectivity saves H₂ by avoiding cracking

BIDW™ catalyst advantage for bio-feedstocks



BIDW provides higher yield of green diesel vs. alternatives



Lower hydrogen consumption vs. alternatives

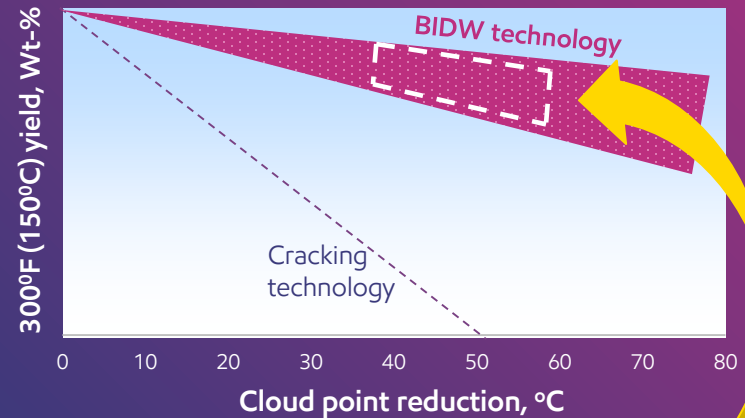
Quality

Improved cetane value



Proven stability and longer catalyst life easily >5 years

Renewable diesel yield vs. Cloud point reduction



Significant yield advantage observed at high delta cloud

An aerial photograph of a winding road covered in snow. The road has dark tire tracks. Four vehicles are visible: a dark car at the top, a white car on the left side of the curve, a green car at the bottom left, and a large red and white semi-truck at the bottom right. The surrounding landscape is a flat, snow-covered field.

The challenge to produce winter diesel is to manage n-paraffin content and distribution.

Proper management of n-paraffin content in the diesel is critical to maximizing the value from unit operations.

ExxonMobil dewaxing technology enables a refiner to maximize value from the diesel and kerosene range molecules from both traditional fossil feeds and bio feeds

- ExxonMobil Dewaxing Catalysts have been managing refiner cold flow needs for 50 years
- ExxonMobil has experience and technology to meet a refiner's needs
- BIDW™ catalysts are well suited to handle the additional dewaxing severity and conditions required from bio feed sources



Connect and
collaborate with us
to advance your
business today.

Dean Parker

Technical Sales Manager

Dean.e.parker@exxonmobil.com

+1-832-625-5351



Evguenia Copley

Sales Manager, Europe, Russia

evguenia.copley@exxonmobil.com

+832-625-9018



Contact us /
Ask a question



@XOM_chemical



[linkedin.com/
showcase/
exxonmobil-chemical](https://www.linkedin.com/showcase/exxonmobil-chemical)



Note: You must
have the
WeChat app
installed



Thank you



©2020 ExxonMobil. ExxonMobil, the ExxonMobil logo, the interlocking "X" device and other product or service names used herein are trademarks of ExxonMobil, unless indicated otherwise. This document may not be distributed, displayed, copied or altered without ExxonMobil's prior written authorization. To the extent ExxonMobil authorizes distributing, displaying and/or copying of this document, the user may do so only if the document is unaltered and complete, including all of its headers, footers, disclaimers and other information. You may not copy this document to or reproduce it in whole or in part on a website. ExxonMobil does not guarantee the typical (or other) uses. Any data included herein is based upon analysis of representative samples and not the actual product shipped. The information in this document relates only to the named product or materials when not in combination with any other product or materials. We based the information on data believed to be reliable on the date compiled, but we do not represent, warrant, or otherwise guarantee, expressly or impliedly, the merchantability, fitness for a particular purpose, freedom from patent infringement, suitability, accuracy, reliability, or completeness of this information or the products, materials or processes described. The user is solely responsible for all determinations regarding any use of material or product and any process in its territories of interest. We expressly disclaim liability for any loss, damage or injury directly or indirectly suffered or incurred as a result of or related to anyone using or relying on any of the information in this document. This document is not an endorsement of any non-ExxonMobil product or process, and we expressly disclaim any contrary implication. The terms "we," "our," "ExxonMobil Chemical" and "ExxonMobil" are each used for convenience, and may include any one or more of ExxonMobil Chemical Company, Exxon Mobil Corporation, or any affiliate either directly or indirectly stewarded.

ExxonMobil