
IMO 2020
MARCH 2019 UPDATE

National Oil Recyclers Association (NORA)

New Orleans Mid-Winter Meeting

March 7, 2019

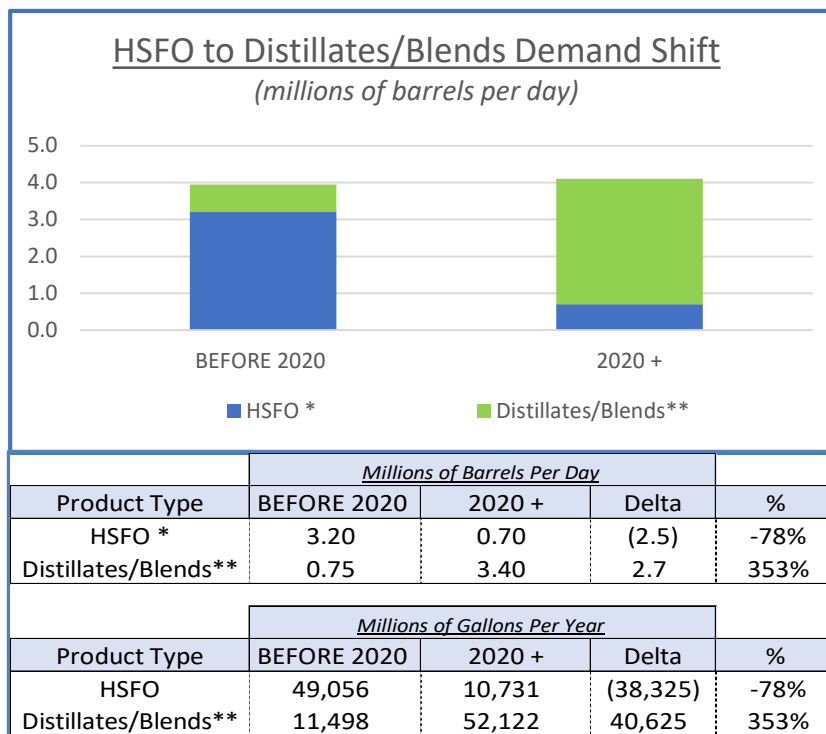
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IMO 2020 Market Shift

“Largest shift in fuels since the change from coal to fuel oil” (Exxon – Mobil)

- Worldwide rule creating maximum 0.5% sulfur on high seas (ECAs are already 0.1% max sulfur)
- Starts 1/1/2020, less than 10 months away with no delays and no phase-in **BOOM!**
- “Massive” demand shift from High Sulfur Fuel Oil (HSFO) * to Distillates/Blends **

Scrubber uptake, global compliance, LNG, port policies, and FONARs are some variables affecting composition and extent of the demand shift



* HSFO =
IFO 380, No. 6 Oil,
Bunker C, (Resid)

** Distillates/Blends =
Marine Gas Oil (MGO)
and/or Low Sulfur Fuel
Oil (LSFO)

How big is the “massive demand shift” versus used oil markets?

Used oil markets are utterly dwarfed by the decline in HSFO demand volume

Volumetric Comparisons	
HSFO Drop Relative to	
Total Used Oil	4.4x
New Scrubbers	3.6x
Total Asphalt	2.3x
Total Base Oil	2.2x

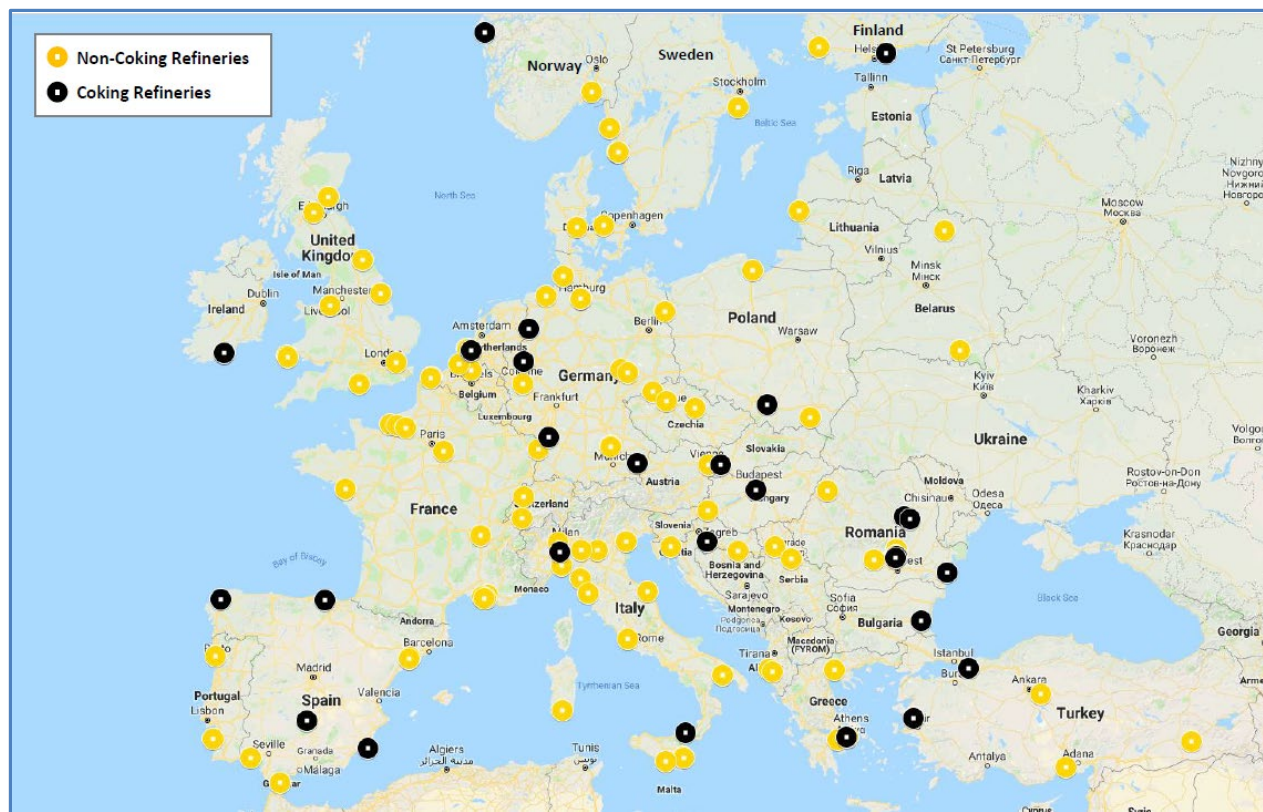
Consequence of IMO HSFO Market Change
Small shift in HSFO volume (or its components)
easily overwhelms traditional used oil markets.
Instead of selling TO HSFO buyers, used oil
suppliers will be selling AGAINST HSFO producers

Table below shows sources and assumptions for above market comparisons

Market Timing	million bpd	million gpy	Assumption or Source
<u>Pre-2020 Total Market</u>			
Used Oil	0.56	8,600	50% of all Base Oil is available
Base Oil (G-I-II-III)	1.12	17,200	Global Base Oil Refining Guide 2018
Asphalt	1.07	16,400	Goldman Sachs May 30, 2018
<u>Market Change in 2020</u>			
Scrubbers	0.70	10,700	Goldman Sachs May 30, 2018
Distillates & Blends	1.40	21,500	Goldman Sachs May 30, 2018
HSFO Drop	-2.50	-38,300	S&P Global/Platts

Who are the other HSFO participants?

Every refinery without coking (or carbon rejection) capacity is now a replacement fuel provider



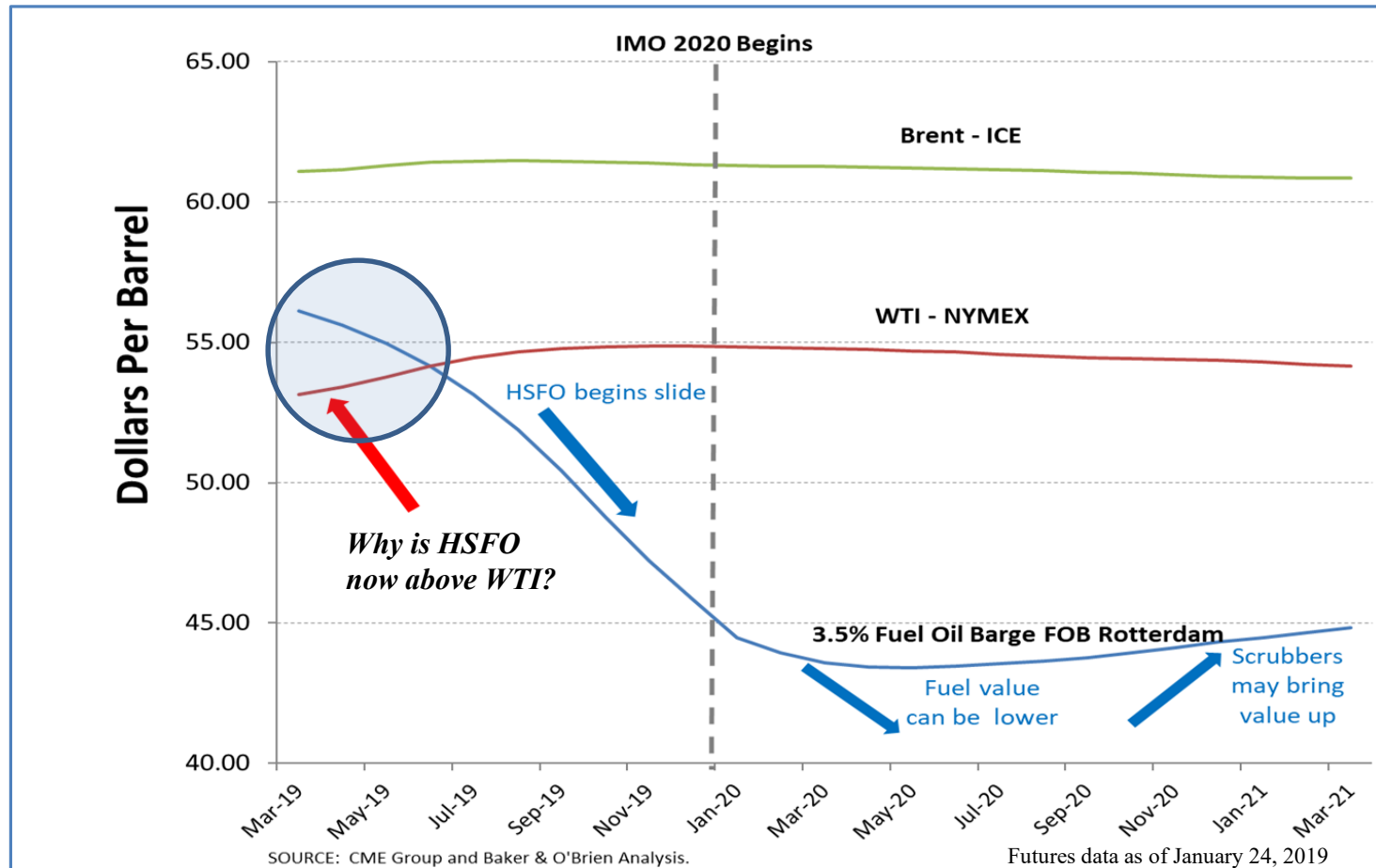
“IMO 2020 regulations will acutely impact European and Russian refiners, which have large surpluses of high-sulfur fuel oil that need to be placed elsewhere in the market.”

SBA Consulting (Stephen Ames)

ICIS World Base Oils & Lubricants Conference - February 21, 2019

Futures market says HSFO's value is heading.... *down*

CME Group shows future price trading for HSFO 3% Fuel Oil



So a very ugly HSFO market is rapidly approaching. *Why is HSFO trading up today?*

Why is HSFO trading up? (2 possible explanations)

1. Crude oil slate is getting lighter and/or 2. Refineries making HSFO are selling direct

- Refineries shifting to lighter crude oil slates and producing less HSFO
- Refineries making HSFO are taking pre-emptive sales action (selling hard into power, asphalt etc.)
- Thus refineries are making less HSFO ***and*** seeking secure market outlets for their HSFO
- Total volume of HSFO demand will decline rapidly in later Q3 and Q4 2019 => drop in value
- As values deteriorate, traders and shippers will try to avoid holding HSFO inventory
- HSFO supply and availability may become spotty, especially in smaller ports

When the HSFO market declines substantially, where can the used oil go?

Where *can* used oil go?

Destination product quality and supply/demand balance contribute to used oil value pickup

- Cautionary Note 1: These are relative values only, and it assumes ULO = 0
- Cautionary Note 2: Relative values will vary over time and by geographic region
- Cautionary Note 3: Regulatory factors often impact relative values over time
- Cautionary Note 4: Technology selection can materially affect relative product values

Hypothetical Example of Value Chain				
Stage	Product	Points	Pickup	Source Basis
1	Used Lube Oil (ULO) Street Pickup	0		50 points off RFO
2	RFO (aggregated DW/DA ULO)	50	50	60% to 80% of HSFO
3	High Sulfur Fuel Oil (HSFO)	75	25	60% to 80% of Brent
4	Vacuum Gas Oil (VGO 0.5%)	120	45	Argus
5	Low Sulfur Fuel Oil (LSFO)	138	18	6:1 HSFO/ULSD Blend
6	Ultra Low Sulfur Diesel Oil (ULSD)	149	11	Argus
7	Marine Gas Oil (MGO)	150	1	Platts
8	Base Oil (G-I/II)	169	19	Argus Average
9	Base Oil (G-III)	231	62	Argus Average
WTI	83			
Brent	105			
<i>Sum of pickup from ULO street value to MGO = 150</i>				

Current processing by geographic locale also affects value pickup

Assessing ULO End Markets and Values

3 basic questions to answer

- Which product markets have growing demand?
- What product characteristics are necessary to meet the growing markets' requirements?
- How can the target markets be accessed (directly or indirectly)?

Stage	Product	Relative Size	Volume Direction	Price Direction (b)
1	Used Lube Oil (ULO) Street Pickup	small	steady	down
2	RFO (aggregated DW/DA ULO)	small	steady	down
3	High Sulfur Fuel Oil (HSFO)	huge	down	down
4	Vacuum Gas Oil (VGO 0.5%) (a)	small	up	?
5	Low Sulfur Fuel Oil (LSFO)	huge	up	up
6	Ultra Low Sulfur Diesel Oil (ULSD)	huge	up	up
7	Marine Gas Oil (MGO)	large	up	up
8	Base Oil (G-I/II)	moderate	steady	?
9	Base Oil (G-III)	small	up	?

(a) Assumes VGO derived from ULO.
(b) Assuming crude oil prices are held constant.

Product Quality

Product must meet market requirements or it will take discounts or be non-marketable

- New IMO 2020 product markets are MGO (near term) and LSFO (long term)
- MGO's high product quality is difficult (color, chlorides, clarity, oxidation stability)
- LSFO is a blended product that is comprised of many and varied streams
- LSFO blending tests underway for compatibility, stability, sediment, and other qualities

Stage	Product	IMO 2020 Flight to Quality (MGO)					Oxidation Stability	Ash	Metals	Sediment	Sulfur	Water	Viscosity Index
		Color	Chlorides	Clarity	Compatibility								
					<0.1% (ECA)	<0.5% (2020)							
1	Used Lube Oil (ULO) Street Pickup	---	---	---	nm	nm	nm	---	---	nm	++	---	nm
2	RFO (aggregated DW/DA ULO)	---	---	---	nm	nm	nm	---	---	nm	++	+	nm
3	High Sulfur Fuel Oil (HSFO)	---	-	---	nm	nm	nm	-	-	nm	---	-	nm
4	Vacuum Gas Oil (VGO 0.5%) (a)	+	--	---	---	---	---	+++	++	tbd	+++	+	nm
5	Low Sulfur Fuel Oil (LSFO)	tbd	tbd	tbd	this is the standard		nm	tbd	tbd	nm	+++	tbd	nm
6	Ultra Low Sulfur Diesel Oil (ULSD)	+++	+++	+++	varies *	varies *	+++	+++	+++	varies *	+++	+++	nm
7	Marine Gas Oil (MGO)	++	+++	+++	varies *	varies *	+++	+++	+++	varies *	+++	+++	nm
8	Base Oil (G-I/II)	+++	+++	+++	nm	nm	nm	+++	+++	nm	+++	+++	-- to ++
9	Base Oil (G-III)	+++	+++	+++	nm	nm	nm	+++	+++	nm	+++	+++	+++

(a) Assumes VGO derived from ULO.

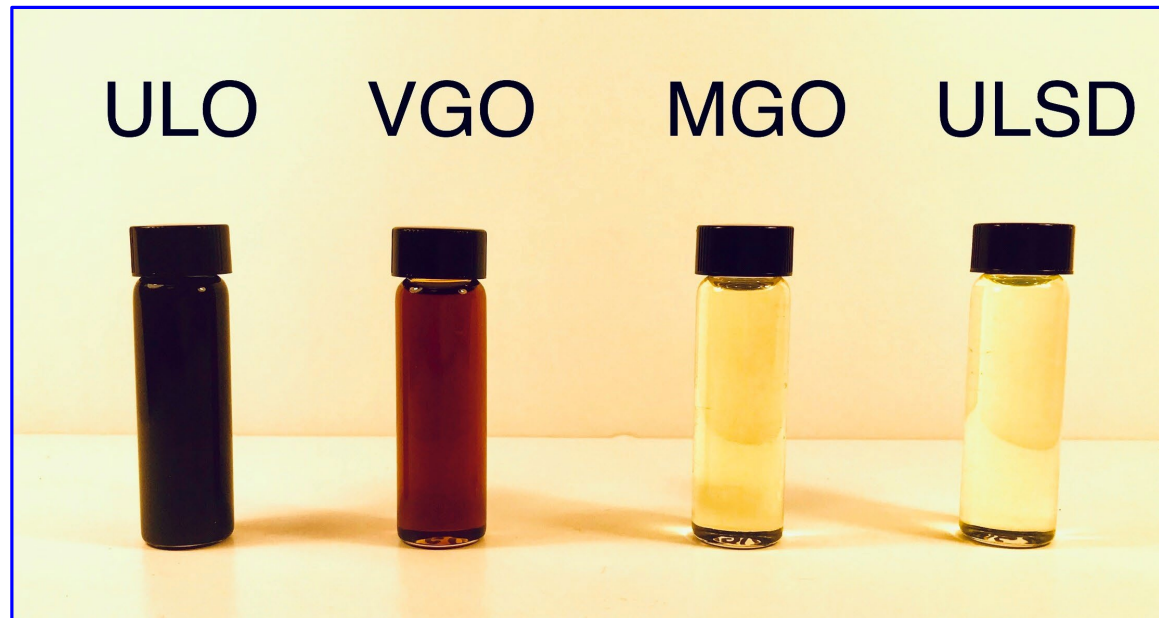
* *Compatibility and Sediment characteristics of ULSD and MGO vary with respect to their suitability with other LSFO blend stocks*

Key: + is good, +++ is best
 - is bad, --- is worst
 nm is not meaningful
 "varies" means LSFO blend dependent
 "tbd" means standard or guideline is unknown

Visuals: ULO => VGO => MGO and ULSD

Lighter product is often a proxy for higher quality

- Ship owners very anxious to avoid repeating the *Bad Bunkers* debacle of Houston Summer 2018!
- Lighter color often correlates well with fewer impurities
- Clarity is often a good indicator of oxidation stability
- Oxidation stability, no chlorides, low sulfur, and clarity, all become important



Summary Conclusions and Comments

Sea change ahead in the near term

- IMO 2020 will take effect on January 1, 2020, less than 10 months from now
- Huge, rapid demand shift from HSFO (resid) to MGO/LSFO (distillates and blends)
- Ship owners' flight to higher product quality – with MGO the near term winner
- HSFO is no longer a valid proxy indicator for ULO's current or future value
- What ULO index makes sense in light of upcoming product market demand changes?
Should an index be derived from;
 - a. products? USLD, MGO, LSFO ***or***
 - b. supply? Brent, WTI
- Major news releases happening more frequently as 1/1/2020 approaches

Choice of proactive versus reactive approach to securing safe harbors for used oil