IMO 2020: A Sea Change is Coming

Ralph J. Grimmer
Stillwater Associates LLC

U.S. Coast Guard/Shell Seminar
Martinez, CA
October 31, 2018

Legal Disclaimer

Disclaimer

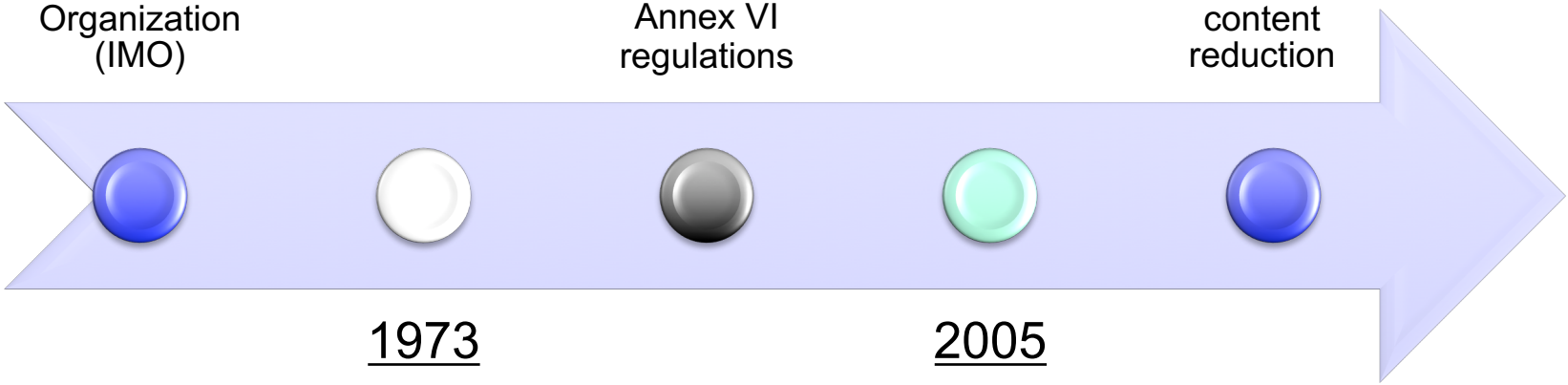
Stillwater Associates LLC prepared this presentation for the sole benefit of the 2018 U.S. Coast Guard/Shell Navigating the Future Seminar.

Stillwater Associates LLC conducted the analysis and prepared this report using reasonable care and skill in applying methods of analysis consistent with normal industry practice. All results are based on information available at the time of presentation. Changes in factors upon which the report is based could affect the results. Forecasts are inherently uncertain because of events that cannot be foreseen, including the actions of governments, individuals, third parties and competitors. NO IMPLIED WARRANTY OF MERCHANTABILITY SHALL APPLY.

Agenda

1. IMO 2020 overview
2. Refiner perspective
3. Marine fuel supply
4. Enforcement
5. Impact on crude oil, diesel/gasoil, and fuel oil prices

IMO 2020: The Lead Up to This Big Change



1948

United Nations founds the International Maritime Organization (IMO)

1973

IMO begins regulating marine pollution via MARPOL 73

1997

IMO adopts MARPOL Annex VI regulations

2005

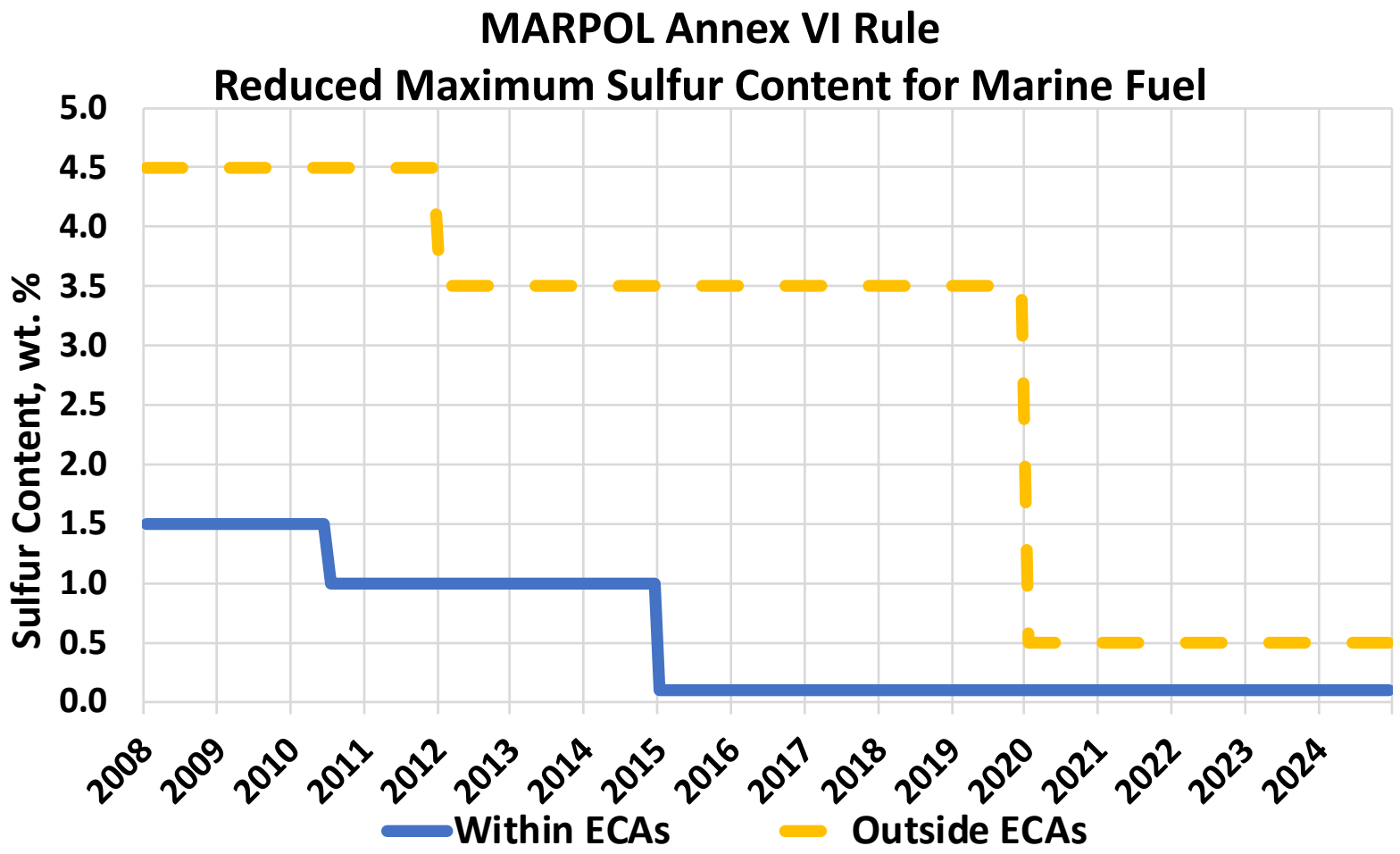
MARPOL Annex VI limits marine fuel to 4.5% sulfur content

2008

IMO defines timeline for sulfur content reduction

IMO 2020 was scheduled back in 2008.
IMO opted to not defer implementation to 2025 after its 2016 review.

IMO 2020 is the last of the 2008 MARPOL Annex VI sulfur content stepdowns



IMO 2020 reduces maximum marine fuel sulfur content by 85%

Vessel Operator Marine Fuel Options

1. Low sulfur compliant fuel (i.e. 0.5% sulfur max.)
2. “Acceptable” high sulfur heavy fuel oil (HS HFO)
    - If vessel equipped with onboard scrubber, or
    - If IMO implements a waiver (FONAR) process
3. Compliant alternative fuel (e.g. LNG, methanol)
4. Deliberate use of non-compliant fuel (i.e. cheating)

Compliant fuel will be the predominant marine fuel in 2020

Recap of 2016 EnSys/Navigistics study volumes

	2020 w/o IMO Change		2020 With IMO Change & Vessel Speed Up		Delta Consumption	
	mtpa	MMBPD	mtpa	MMBPD	mtpa	MMBPD
Global Fuel Oil Consumption						
Marine Fuel Use						
HS HFO	253	4.4	48	0.8	(205)	(3.6)
ECA & Global Fuels	88	1.7	283	5.5	195	3.8
LNG	11		11		0	0.0
Total Marine Use	352		342		(10)	0.2
On Land Fuel Oil HFO Use	210	3.7	210	3.7		
Total HS HFO + On Land HFO		8.1				

Source: EnSys Energy with Navigistics Consulting Supplemental Marine Fuel Availability Study Final Report dated July 15, 2016

The 3.6 MMBPD reduction in marine HS HFO use displaces high sulfur resid from marine fuel into refineries & power plants

Key Issues on 2020 Marine Fuel Mix

1. How much “acceptable” HS HFO will be consumed?
   - Orders for scrubbers have jumped in the past 5 months
2. How prevalent will deliberate non-compliance be?
3. Will there be sufficient compliant fuel?
4. How significant will marine fuel quality issues be (e.g. compatibility & stability)?

IMO 2020 for refiners: threat or opportunity?

Opportunity

- Refineries with resid upgrading (e.g. cokers)
  - Especially for refineries that process heavy sour crudes
  - Especially for refineries with high distillate yield

Threat

- Refineries that produce significant yields of HS HFO
- Asphalt refineries?

Capacity to upgrade high sulfur resid varies by region

********** Percent of Crude Capacity **********

Continent Totals	Flexicoking	Delayed Coking	Visbreaking	Resid Hydrocracking	Resid Desulfurization	Hydrogen, MMCFD	Sulfur, Tons/day	Asphalt
Africa	0.3	2.1	1.8	0.0	0.0	3.4	27	1.4
Asia	0.8	1.7	2.3	0.7	3.0	12.9	69	1.4
Europe	0.5	2.2	6.7	0.5	0.7	17.6	97	1.9
North America	1.6	11.3	0.3	0.7	1.1	20.0	260	3.6
Australia/ New Zealand	0.0	0.0	0.0	0.0	0.0	17.5	34	1.9
South America	0.3	5.6	2.5	0.0	0.0	6.3	47	1.5
Total World	**0.9**	**4.4**	**2.6**	**0.6**	**1.8**	**14.9**	**119**	**2.1**

Source: Oil and Gas Journal 2017 Worldwide Refining Survey

North America refining capability to handle surplus high sulfur resid is substantially greater than both Europe & Asia

Refineries will optimize amidst changing market prices

Key refining price differentials will widen appreciably

1. Light sweet crude vs. heavy sour crude
2. LSFO vs. HSFO
3. Diesel/gasoil vs. HSFO
4. Diesel/gasoil vs. gasoline & jet fuel

Refiners will optimize short-term & longer-term processing strategy for their existing “kits” as market price direction solidifies

Refiners and traders will be challenged to adjust to new requirements

	Stillwater estimate, MMBPD
• Displaced HS resid will be significant	1.8 - 2.9
• Distillate demand will increase	0.8 - 2.1
• Refineries crude runs will likely increase	1.4 - 3.9

- Crude oil, products, and intermediates trade flows will be altered

Refiners face tough investment decisions

High sulfur resid displaced from HS HFO pool

1. Potentially a bigger problem than supply of compliant fuel
2. Displaced volume very likely to exceed global refineries' ability to process in 2020

Lead time to engineer, permit, and construct new processing facilities typically 5-7 years

Pace of non-refinery changes will influence investment decisions

1. Scrubber installations
2. Fleet conversion to alternate fuels
3. IMO marine greenhouse gas (GHG) regulations

Since the IMO decision (Oct. 2016), there has not been a marked increase in announced global resid processing projects

Marine fuel quality concerns are a significant issue

Two primary quality concerns for 2020 marine fuel quality

1. Compatibility
2. Stability

Recent HS HFO quality issue in Houston, Panama, & Singapore

Fuel specifications for new compliant fuel

1. New ISO 8217 standard unavailable until ~ 2022
2. Publicly Available Specification (PAS) likely available as interim solution

Vessel operators will want to:

1. Revisit fueling patterns and fuel sources
2. Draw on existing relationships with bunker suppliers

Deliberate Non-Compliance

Estimates of deliberate non-compliance have been as low as 9% and as high as 35%

Clearly, deliberate non-compliance will look more attractive to unscrupulous vessel operators if:

1. Enforcement is weak
2. Fines are small

Deliberate non-compliance was not quantified in the EnSys-Navistics study.

- However, EnSys-Navigistics assumed 19% of marine fuel would come from HS HFO consumed by vessels with scrubbers.

IMO recognizes the need for effective enforcement if the intended IMO 2020 benefits are to be realized

IMO 2020 Enforcement Authority

Current enforcement mechanisms are weak

1. IMO itself has no enforcement authority
2. Only Flag States have authority by IMO to enforce open oceans compliance. Flag state penalties are small.

New and potential enforcement mechanisms

1. IMO voted to provide authority to Port States in its MEPC 73 meeting last week
    - Carriage of marine fuel in bunker tanks with more than 0.5% sulfur content will be prohibited, but not until March 2020
2. Possible loss of insurance coverage
3. Public pressure through large corporations

Last week's MEPC decision will significantly improve compliance

Where will future prices land?

Forward view of prices

1. ICE and NYMEX futures thinly traded beyond Dec. 2019
2. No futures contract yet for IMO 2020-compliant fuel
3. Platts not yet reporting forward prices for IMO 2020-compliant fuel. Argus quote is new and only a linear blend of gasoil & HSFO.

The LSFO - HSFO differential widens (Jan. ‘19 vs Jan. ‘20), but not as much as some might expect

Current View of Future Prices

Industry prices have not yet moved as much as many experts expect they ultimately will

- The price differential for vessels chartered with and without stack gas scrubbers has been slow to widen sufficiently to support investment in vessel retrofits for stack gas scrubbers
- Brent & WTI futures prices currently reflect a slow decline over the next 36 months

Price differentials: Dec. 2018 vs. Jan. 2020

- Rotterdam & Singapore gasoil futures prices relative to Brent are only widening by ~ $3.25/bbl
- Rotterdam & Singapore HSFO futures price relative to Brent are only declining by $13-14/bbl

Keeping abreast of futures prices will be crucial to building and adapting strategy & tactics

Current View of Futures Prices - Europe

Commodity	Units	Dec 2018	June 2019	Jan 2020	June 2020	Dec 2020	Dec 2021
Brent Crude	$/bbl	83.09	81.50	79.27	77.51	75.37	72.18
ARA Low Sulphur Gasoil	$/mt	734.0	726.3	728.2	713.1	695.4	661.0
Rotterdam 1% LSFO	$/mt	465.0	447.4	453.8	454.8	453.3	442.6
Rotterdam 3.5% HSFO	$/mt	456.0	430.8	348.9	350.4	359.4	358.3
LSFO - HSFO Diff.	$/mt	9.0	16.6	104.9	104.4	93.9	84.3
LS Gasoil - HSFO Diff.	$/mt	278.0	295.5	379.3	362.7	336.0	302.7

Data source: Intercontinental Exchange (ICE) and CME Group. Prices are as of 10-10-18.

Brent price gradually declines $9/bbl from Dec. 2018 to Dec. 2021.
Rotterdam 3.5% HSFO price drops $82/mt from June 2019 to Jan. 2020.

Current View of Futures Prices - Singapore

Commodity	Units	Dec 2018	June 2019	Jan 2020	June 2020	Dec 2020	Dec 2021
Brent Crude	$/bbl	83.09	81.50	79.27	77.51	75.37	72.18
Singapore Gasoil	$/bbl	97.62	96.70	97.08	95.07	92.68	
Singapore 380 cSt HSFO	$/mt	484.4	453.2	372.08	370.1	374.0	383.8
Brent - Gasoil Diff.	$/bbl	14.53	15.20	17.81	17.56	17.31	

Data source: Intercontinental Exchange (ICE) and CME Group. Prices are as of 10-10-18

Singapore 380 cSt HSFO price drops $65/mt from June 2019 to Jan. 2020

In summary, IMO 2020 will have a significant impact

1. Most impactful sudden specification change for shipowners and refiners … ever (because it's global)
2. Q4 2019 - Q3 2020: Significant market turbulence
3. Markets will restabilize over time. How long with that take?
4. Shipowners and refiners have been slow to invest thus far
5. Compliant fuel forward prices not readily transparent
6. HSFO and heavy sour crude prices will be driven lower relative to light sweet crudes, compliant marine fuel, and clean refined products
7. Shipowner and refiner investments post- 1-1-2020 will cause widened price differentials to narrow
8. Higher diesel, jet fuel, and gasoline prices will be felt by businesses and consumers

Stillwater Associates LLC

… experience runs deep

"A Sea Change Is Coming"

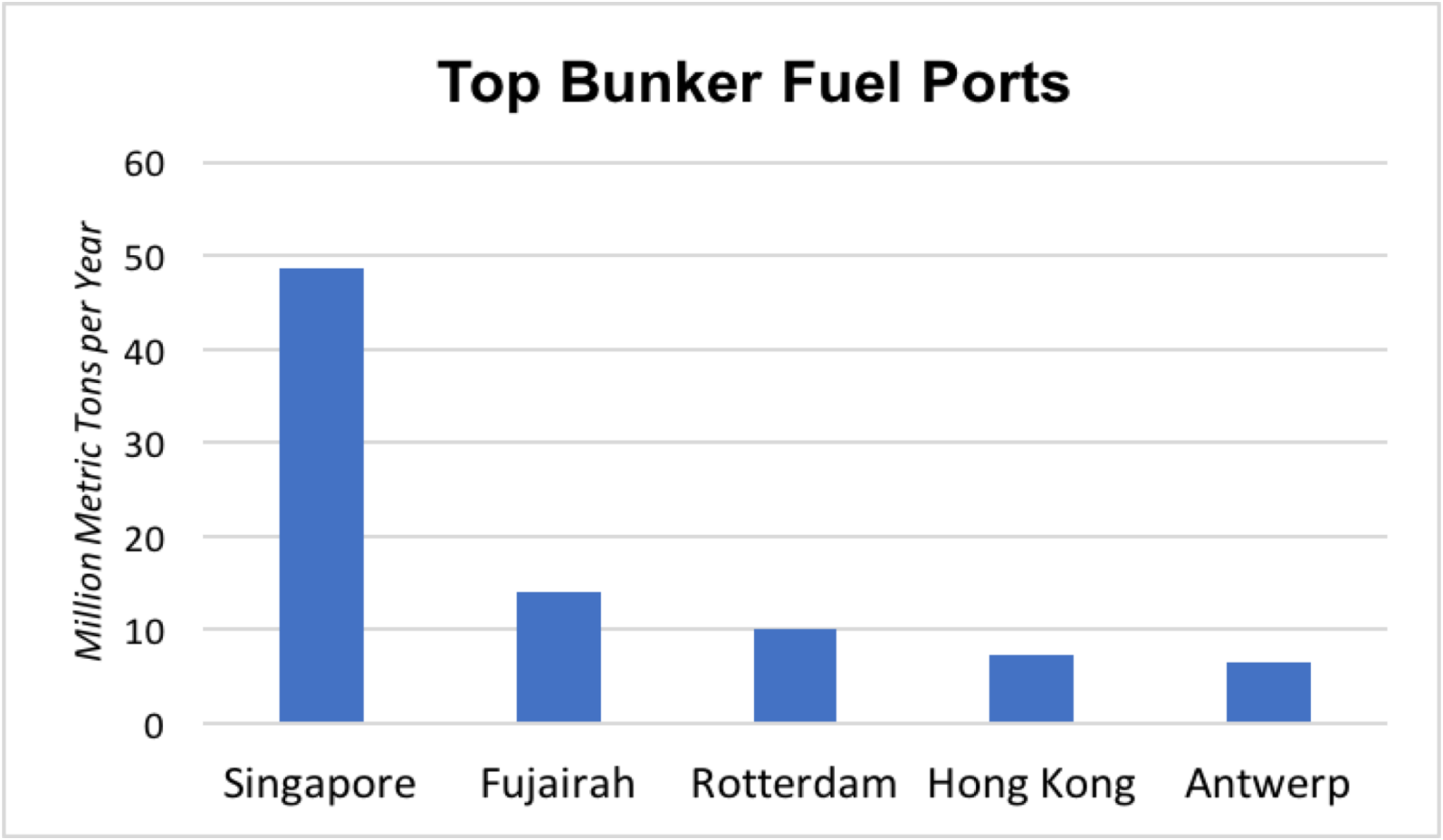
Presenter: Ralph Grimmer
Senior Associate, Stillwater Associates
rgrimmer@stillwaterassociates.com
888-643-0197

For more information, please contact us:

Stillwater Associates website	www.stillwaterassociates.com
IMO 2020 newsletter articles	https://stillwaterassociates.com/tag/imo-2020/

Appendix

Largest Bunker Fuel Supply Ports

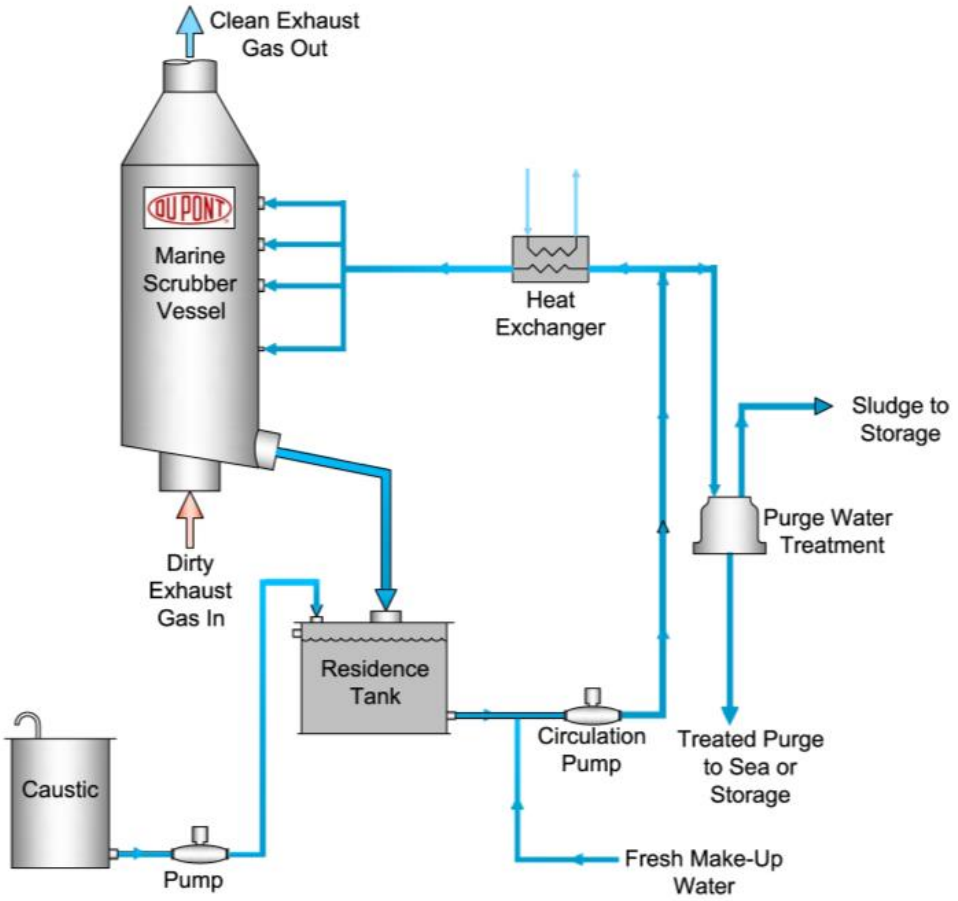


Source: 20/20 Marine Energy

The above 5 ports supply almost 30% of the 300+ MM mT/yr global bunker fuel demand

Shipowner Decision Factors on Scrubber Installation

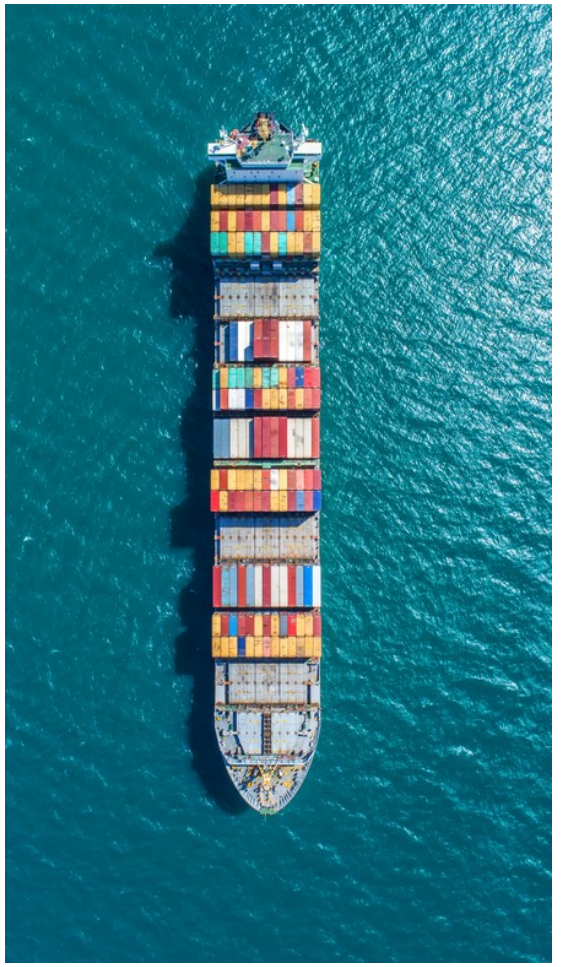
1. Shipowner financial condition
2. Other IMO regulations (e.g. ballast water; future GHG)
3. Capital costs and operating expenses
4. Ability to recoup capital investment
    - Owner/operator - fuel and other operating costs
    - Charter out - charter rate differential



Vessel scrubbers are expected to cost $4-7 million plus port time

Shipowner Decision Factors on Scrubber Installation

5. Existing vessel or new build?
   a. Existing vessel
      - Vessel age
      - Shipyard time
      - Structural compatibility
   b. New build
      - Compliant fuel vs. HSFO vs. LNG
6. Fuel availability
   a. Tramper vs. liner vessels



Scrubber installations and conversions to alternate fuels appear more likely to occur for new builds and liner vessels

Global Refining Capacity by Continent

********** Processing Capacity, MBPCD **********

Continent Totals	Crude	Flexicoking	Delayed Coking	Visbreaking	Residual Hydrocracking	Resid Desulfurization	Hydrogen, MMCFD	Sulfur, Tons/day	Asphalt
Africa	3,298	9	69	60	0	0	113	890	46
Asia	43,085	344	753	1,009	297	1,304	5,578	29,592	616
Europe	16,594	88	368	1,105	78	120	2,927	16,147	315
North America	22,920	367	2,580	74	155	247	4,595	59,506	829
Australia/ New Zealand	555	0	0	0	0	0	97	191	10
South America	5,188	17	291	131	0	0	325	2,440	80
Total World	**91,640**	**825**	**4,061**	**2,379**	**530**	**1,670**	**13,635**	**108,766**	**1,895**

Source: Oil and Gas Journal 2017 Worldwide Refining Survey

93% of global asphalt capacity and more than 90% of all resid processing capacity is in North America, Asia, and Europe