Effects of MARPOL VI on Petcoke, Distillates, Resids, Vacuum Tower Bottoms and the Light-Heavy Spread

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Definitions

- IMO: International Maritime Organization
- A UN agency responsible for establishing regulations for worldwide shipping
- 172 member states
- The IMO has no authority to monitor or enforce its own regulations
- The IMO has shifted regulation of compliance to the member states
MARPOL VI

- MARPOL = Marine Pollution
- Annex VI of MARPOL regulations addresses air pollution from oceangoing ships.
- The international air pollution requirements of MARPOL Annex VI establish limits on nitrogen oxides emissions and sulfur emissions and requires the use of fuel with lower sulfur content.
  - 0.1 wt% in near-shore emission control areas (ECA) 0.5 wt% everywhere else.
- The IMO goal is to protect people's health and the environment by reducing air pollution.
IMO set a January 2020 date for compliance

• The decision was made on October 28, 2016 by the IMO at its 70th session in London.
• This was a surprise to many market participants.
• Most shippers and refiners thought the implementation would be delayed to 2025.
• The key specification is worldwide compliance with a 0.5 wt% sulfur cap on global bunker fuel.
• January 2020 in less than two years away.
The 2020 global marine fuel sulfur cap is the latest of a series of regulations set by the IMO.

- **ECA = Emission Control Area**
- Average S in today’s bunkers = 2.5%

Most likely scenario: Impact on US refining and shipping will be significant.
MARPOL VI effects

- MARPOL VI will most likely have a **significant effect** upon the world’s **refining and shipping** industries, beginning in late 2019, and extending to at least 2023-24.

- Understanding the most likely future MARPOL VI-related market scenarios and the true economics of the various treating options will benefit forward-thinking refiners and shipping firms.
World resid demand has been declining, but demand for resid for bunker fuel has held steady

- We expect that demand for resid in bunker will drop significantly starting in 4Q 2019.
- The IEA estimates up to 2mn b/d of low S distillates will be diverted into the bunker market in 2020.
- Unless a ship-based option is widely adapted, a significant portion of the ~3mn+ b/d of high sulfur resid used in bunker fuel will need to find a new home, or be converted to low sulfur material.
- Demand for low sulfur distillates will, most likely, increase significantly.
Bunker fuel is a significant proportion of total residual fuel consumption

- Average sulfur content of bunkers currently is around 2.5%.
Low sulfur crude supply key to 0.5% fuel availability?

- 10.4mn b/d (only 13%) of global production is medium and heavy sweet (<35 API and < 0.5% S).
- We expect that the increasing amounts of TLO coming in the market will not have a major effect on low S distillate and low S fuel oil supply. This crude will not produce much fuel oil, and it will produce less low S distillate than most crude on the market.
Likely implementation, enforcement issues

- Could be worldwide or regional delays in implementation.
- Potential for temporary waivers.
- Possible uneven observance by member states.
- Uneven enforcement.
- Ineffective enforcement.
- Legality of issuing fines for violations outside of jurisdictions is unclear.
- Huge incentive to cheat.
  - The IMO regulations allow the use of higher sulfur bunker fuel in areas where there is no 0.05 wt% sulfur fuel available.
  - It is likely that some ship operators will be tempted to claim this allowance to explain non-compliant fuel on their vessel, even if they have the fuel reasonably available.
Ship-board scrubbers – Too little, too late

• Different scrubber options are available.
• Total installed costs (TIC) probably more expensive than most current P50 estimates ($3mn-6mn+ for new vessels, and $6mn-10mn+ for retrofits).
  ◦ High level of uncertainty with current TIC estimates.
• Existing shops cannot install scrubbers fast enough to fit all large, viable ships by January 2020.
• Scrubbers more likely on new ships versus retrofits.
• Space requirement is significant, resulting in revenue losses.
• Caustic storage (fresh and spent) and other waste will be a major technical issue, opex issue, and (possibly) enforcement issue.
• If resid conversion or resid desulfurization investment is substantial, scrubber investors may not recover investment.
• Many shipowners are still on the sidelines.
No significant MARPOL VI related new resid conversion investment announced

- Most refiners probably thought that January 2025 was going to be the implementation date.
- Regardless, large, state-of-the-art cokers will take 5+ years to get from concept to start-up (in US Gulf coast), and many years to pay back.
- Many refiners expect shipowners to have installations complete and the market to equilibrate before payback time.
- Plus high-level of uncertainty regarding IMO implementation and compliance.
- Some investment in hydrotreating expansions and upgrades underway.
- Some planning/engineering stage high conversion investments could be accelerated.
Most likely results

- Significant excess of high sulfur resid, looking for a home, starting in 4Q 2019.
- Demand for low sulfur distillate will increase, to the point of pulling in LS VGOs, LS VTBs and some ULSD.
- Sweet - sour product spread will increase.
- Sweet - sour crude spreads will increase.
- Sweet crudes with high distillate content will be priced at a premium.
- Anode grade coke prices will likely increase.
- There will be some surprises when blending begins, such as asphaltene precipitation, off-spec viscosities and engine lubricity issues.
Most likely results (cont.)

- Low conversion refiners will see margins suffer. Some will shut down.
- High conversion refiners will be in better shape than they are today.
- IEA estimates ~2mn b/d of distillates will be diverted into the bunker market in 2020. Argus’ scenarios range from 1.75mn-2.2mn b/d.
- If light-heavy spread stays wide for many years, this could incentivise some major conversion investment.
- Regional delays in implementation, temporary waivers, uneven enforcement and cheating.
- Wild cards: Observance/cheating levels, IMO waivers, IMO institutes a prolonged phase-in for the regulations, enforcement levels, longer-term low sulfur-high sulfur spreads.
Low S-high S product differentials will widen

- Initial switch will disrupt normal price relationships.
- Longer term, prices should return to pre-2020 basis once most vessels are scrubber ready, and as alternative fuel use grows.
- No significant level of preemptive major refinery investment, versus what was already announced, but some refineries will eventually install some additional hydrotreating/desulfurization and resid conversion capacity. (There have been a few US hydrotreating upgrades recently.)
- Will incentivize investment in vessel scrubbers.

Two Argus Scenarios from Argus MARPOL VI effects model

USGC ULSD - 3% HSFO Differential
(fob, through January, 2018)
Light-heavy oil spread will widen, for a while

- The spread will widen for a while.
- Spread widening will likely be slightly offset by oversupply of TLO.
- Will spread get wide enough, long enough to incentivize additional US coker investment? Probably not.
- Margins for refiners making HSFO will shrink. We expect some refinery closures (globally). Most forecasts for duration of wider spreads will not justify major resid conversion investment.
- Margins for high conversion refiners (who make essentially no high sulfur fuel oil) will improve.

Sample results from Argus’ model runs. (two high probability scenarios)
Breakdown of Current US Low S Distillate Use

- Industrial Use: 3.3%
- Off-Highway: 3.3%
- Bunkers: 4.0%
- Commercial Use: 4.3%
- Farms: 5.3%
- Railroads: 6.0%
- Residential: 6.5%
- Trucks, Buses & Automobiles: 64.2%
- Utilities: 0.9%
- Oil Firms: 1.9%
- Military: 0.2%

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LNG will be part of a longer-term solution

- Approximately 80 LNG-fueled ships will be in operation by end of year 2017.
- Approximate 60 LNG-fueled ships on order.
- However, not enough worldwide infrastructure in place to have a near-term effect.
- Today, LNG bunkering ports are mainly located in northwest Europe and the Baltics. Others are in development stage.
- Eventfully, this could be a significant part of the solution.
- Not a major impact in 2020-24 period.
MARPOL will impact feedstock and product economics
Increased low S distillate demand for use in bunker fuel will temporarily offset relatively low worldwide demand growth.
Differences in PADD-to-PADD high sulfur resid production are significant

- PADDs 3 and 5 produce the most high S resid.
- However, on the basis of non-coking refineries, per PADD, we see a different story. PADD 1 has the highest value, followed closely by PADDs 5, 3 and 2.
- Due to MARPOL VI effects, high sulfur resid will most likely plummet in value starting in 4Q 2019. Hydrocracking refiners and hydro-skimmers will see their margins shrink.
Blending calculation (one of dozens of possibilities)

High sulfur resid
3.5% S
3mn bl

ULSD
0.001% S
18mn bl

Low S Bunker
0.5% S
21mn bl

6:1 mix ratio of high sulfur resid to ULSD to achieve the 0.5 wt% spec.
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