2020
IMO'S 0.5% SULFUR CAP
What you need to know

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Changes on the Horizon

Almost 100 years, after the vessels started to shift from burning coal to fuel oil, the shipping industry faces another profound change, in its fuel consumption tactics. This change will come, as a result of IMO environmental regulation. Sulfur limits for bunker fuels worldwide, will drop from 3.5% to 0.5% starting on 01/01/2020.
IMO regulation of SOx levels

**Outside ECAs**

Maximum limits for sulphur content of the fuel oils:
- Since 1\textsuperscript{st} January 2012 is 3.50%
- On and after 1\textsuperscript{st} January 2020 will be 0.50%

**Inside ECAs**

Maximum limits for sulphur content of the fuel oils is:
- 0.10% since 1\textsuperscript{st} January 2015
Serious Dilemmas for Fuel suppliers

Variability is predicted for Marine Fuel prices, in the first years after 2020

Heavy Fuel Oil is expected to FALL sharply in PRICE, while the PRICE of Low-Sulphur Fuels will dramatically RISE.

Even if refineries, decide to invest in new capacity, or upgrade the existing plants, they would not be ready by the deadline.
Retrofitting

According to data from “Clarksons Shipping Intelligence Network” (SIN), the number of vessels fitted with Exhaust Gas Scrubbers, reached 240 on December 2017. Other sources raise this figure to 300 and even more. With only about 500 Scrubbers’ potentiality to be fitted in a year (based on global yards’ capacity), all estimations provide for about 25% of the global fleet, to be fitted with Scrubbers by 2025.
Orderbook for Scrubber projects (November 2017)
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Alternative fuels and Powering options

Engines burning other kind of fuels (such as LNG, Bio-fuels, Fuel cells, Hydrogen), using other Technology options (Nuclear, Batteries) or vessels driven by Renewable energy sources (Wind and Solar) energy, are still not wide-spread

- because bunkering infrastructure is not fully developed globally and
- because technology is not mature enough
Ship Owners/Operators

They are facing the options of:
- vastly INVESTING FOR A SCRUBBER or,
- be EXPOSED to highly volatile fuel price differentials.

For Bunker Fuel supply, they will have to decide, whether to UNDERTAKE TERM CONTRACTS, or operate on the SPOT MARKET from 2020 and on.

Especially for those operating a large fleet on a spot basis with differing voyage destinations, this would be DIFFICULT TO DECIDE, mainly due to the risk of fuel compatibility.

As it is predicted by the Oil Companies, there will not be one single very low sulfur fuel oil, with a 0.5% sulfur content available in the market, but new fuel blends will appear.
The issues of Fuel blends

Engineers and chemists are “ringing the bell” regarding the new fuel blends, advising that these, will most probably, cause ENGINE FAILURES.

The two key-properties to watch into these blends are:

• **Stability** - whether a fuel will separate over time or under particular conditions, and

• **Compatibility** - whether two fuels brought into contact with each other, will separate.

Additionally, Sludge forming at the bottom of a bunker tank after a fuel separation, can block a vessel's filters and lead to engine malfunction and failure.
To fit a scrubber or not to fit

**Adopting 0.5% sulfur fuel:**
- AVOIDS the high retrofit investment cost,
- INCLUDES INVESTMENT for engine/components’ compatibility to burn 0.5% LSFO and,
- CREATES UNCERTAINTY about the price and availability/supply issues of these fuels, which may appear at certain areas of the world.

**Equipping vessels with exhaust gas cleaning systems:**
- REQUIRES a large upfront payment, as well as the cost of taking the vessel to dry dock in order to install the equipment and,
- CREATES AN INCREASE in annual fuel oil consumption.
- But STRENGTHENS vessel’s position against future high fuel oil prices,
- is cost effective over time and,
- ADDS VALUE to the second hand price of the vessel.
The future Fuel Oil price differentials, between FO<3.5% Sulphur and the 0.5% Sulphur - 0.1% Sulphur FO or MGO, WILL DICTATE THE PAYBACK PERIOD of a new Scrubber retrofit installation.
Burning Low-Sulphur Fuels

NOT ALL engine components of existing vessels, are in general built for CONTINUOUS burning of ultra-low sulphur fuels.

Potential Issues

• Low viscosity may cause internal leakage and damage to fuel pumps or other components.
• Fuel change-over may cause seizures in fuel valves, fuel pump plunger valves or suction valves.
• Possibility of ignition delay, defective combustion and waxy precipitations.
• Boiler issues, such as low flash point and volatility, loss of flame detectability, increased turn-down ratio, excess air for combustion and black smoke.
Vessel Modification for Scrubber

- The retrofitting project is COMPLICATED and work must be started well in advance.
- Shipyards currently LACK retrofit experience, so a good project manager is recommended.
- A typical exhaust scrubber retrofit can take 4-6 weeks in shipyard – excluding the pre-planning design and engineering stages. Very good PLANNING and PREPARATION is required to achieve this.
- Space at shipyards may also run short over the next few years, if a large percentage of the global fleet, require scrubber retrofit work.
- The COST-EFFECTIVENESS of a scrubber, is also a function of how long a vessel will spend in an ECA zone and its REMAINING LIFETIME.
- Once sulfur is capped globally, all vessels will have an incentive to install a Scrubber, but it will still make less financial sense, for a vessel with 10 years or less of operational life.
The main concept of Scrubbers: Sulphur in the exhaust gas is neutralized by an absorbent

Different absorbents can be used:
- Sea water
- Caustic soda
- Magnesium hydroxide
- Limestone (for Dry Scrubbers)

The most common solution is to use sea water, as the absorbent in an «open loop» system. Manufacturers also offer «closed loop» and «hybrid» systems, using caustic soda or magnesium hydroxide.
The main types of Scrubbers

OPEN LOOP: uses ambient seawater for exhaust gas scrubbing. The SEA WATER is filtered for heavy metals and particulate matter and then DISCHARGED INTO THE SEA, containing all the sulphur cleaned from the exhaust.

These are simpler systems and do not require large amounts of waste storage and handling on board, but there are issues of water intake quality.

More IMPORTANTLY, some ports and areas may not permit the discharge of the waste water containing sulphur.
CLOSED LOOP: uses FRESH WATER that is chemically treated usually by caustic soda injection, to effect scrubbing.
Most of the scrubbing agent is re-circulated with only MINIMAL water intake and effluent discharge.
These systems, avoid the issues of waste water discharge, but are more COMPLEX, more COSTLY TO RUN and create WASTE STORAGE AND HANDLING issues on board.
The main types of Scrubbers (3)

A HYBRID SYSTEM:
A COMBINATION of closed and open loop scrubber, in order to offer only the advantages of both Solutions, through FLEXIBILITY.

DRY SCRUBBER:
The system sprays DRY REAGENTS - calcium hydroxide Ca(OH)2 - into the exhaust stream.
These chemicals can react differently, depending on which material they are specifically targeting for removal.
Exhaust Gas is not cooled down, since the gas cleaning operation is possible in hot exhaust.

    No Wash water is used.
The DRAWBACK is that, consumable Ca(OH)2 needs to be bunkered.
Considerations over Scrubber installation

Characteristics (dimensions – weight - placement) of:

• actual Scrubber equipment and support structure
• Scrubber auxiliary equipment (pipes, pumps, coolers, switchboard)
• required tanks (e.g. process/recycle, fresh water, chemical, sludge, holding)

Sea chest and wash water outlet pipe location

Space requirements for actual installation work (work space)

Integration with existing systems
Weight and Volume of the vessel will INCREASE

Stability:
• Inclining test might be required and maybe load line modifications, if more than a certain weight is installed
• Less cargo intake
• Reduced efficiency of the ship
• Wind area increased

Affect upon Equipment:
requirements may arise, for anchor and mooring equipment
Modifications of existing structure and tanks/piping arrangement
The next day to IMO 2020 Global Sulphur Cap

With OLDER VESSELS, there is less payback time for investment of the SCRUBBER installation. It may be more ECONOMICAL, to switch to cleaner fuel alternatives.

It is a trade-off, which depends on the INDIVIDUAL economic and operational specifics of each ship and trade.

Fit the Scrubber and the ship can CONTINUE to burn heavy fuel, which is usually going to be both cheaper and more readily available.

However, fitting a Scrubber involves:

- significant capital expenses,
- crew training costs,
- ongoing costs in energy use,
- maintenance cost and,
- possibly waste removal.
Scrubbers to remain minority option in 2020

• Beyond upgrading refineries to produce more middle distillates for shipowners, the other principal means of cutting marine sulfur emissions by 2020 is to clean the emissions on board the vessel.

The more scrubbers are installed, the less switching from HSFO to 0.5% blend will be required and the less strain will be placed on the global refining system.

• However, scrubbers are expected to be installed on a minority of the global fleet by 2020.
Scrubbers to remain minority option in 2020 (2)

The vessel’s age, plays a considerable role in this case.

- With older vessels, there is less payback time for investment of the SCRUBBER installation. For a very old vessel, it may be more economical to switch to cleaner fuel alternatives. The payback is also better for ships with high powered engines – it is not viable to plan retrofit for ships with low powered engines.
Fitting a scrubber will allow a ship owner to continue burning high-sulfur fuel oil from 2020 while still complying with the new 0.5% limit. But retrofitting a vessel with this technology can cost between $3 million and $5 million, as well as some time at a shipyard in most cases.
To determine the profitability of fitting a scrubber, shipowners need to take a view on the price spread between 3.5% and 0.5% sulfur bunker fuel in 2020. If they believe 3.5% prices will plummet and 0.5% prices will climb as the demand shifts, the up-front capital cost of the equipment may appear a sensible investment. But if there is a significant uptick in ship owners fit scrubbers, the more high sulfur fuel oil demand will be preserved and the price-spread between the two fuels may be narrower than they expect.
Price-spread estimation

• An **AFRAMAX** burns about 35 tonnes per day. The spread between LSMGO and HSFO is about $185 / mt. Assuming that this will go up to $250 / mt by 2020, bunker costs could be around $8,750 per day higher for burning LSMGO, compared to burning HFO.

Assuming that a vessel spends about 100 days at port and/or for delays, that leaves about 265 days of trading. Multiply that by the incremental rise in daily bunker costs, it would add up to **$2.3m** for each vessel per year.
Price-spread estimation (2)

- For a **SUEZMAX** (old type engine), burning about 50 tonnes per day, the annual rise to fuel cost reaches **$3.3m** for each vessel.

- **New built SUEZMAXES** (energy efficient, equipped with electronic engines and hull / propeller modifications) burn about 30 tonnes per day. For these vessels the annual rise to fuel cost reaches **$2.0m** for each vessel.
A simple calculation can be carried out based on spread between cost of LSFO and high-sulfur marine fuel (HSFO), cost of exhaust gas scrubber including operating cost, annual fuel consumption, and residual ship life to justify the decision.
## Price-spread estimation (4)

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<tr>
<td>AFRAMAX</td>
<td>35 M/T</td>
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<td>8,750 $</td>
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<td>265</td>
<td>2.0m $</td>
<td>TOTAL: 3,5m $</td>
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What you need to know

...now you know!

Thank you for your attention