

It is well well-known that the *MEPC.70*<sup>15</sup> (October, 2016) fixed the new global fuel sulphur limits at 0.5% Sulphur. Furthermore, the recent *MEPC.71*<sup>16</sup> (July, 2017) ruled-out any possible delay of the 2020 implementation date.

**Table 1: IMO Fuel Sulphur limits**

<u>IMO Global</u>		<u>SECA / ECA</u>	
<u>Date</u>	<u>Sulphur %</u>	<u>Date</u>	<u>Sulphur %</u>
1 <sup>st</sup> Jan 2012	3.5	1 <sup>st</sup> Jul 2010	1.0
1 <sup>st</sup> Jan 2020	0.5	1 <sup>st</sup> Jan 2015	0.1

In order Ship Owners and Operators to harmonize their existing fleet with these global and ECA sulphur limits imposed by IMO, apart from using LNG as fuel that is to be separately discussed, they are left with two (2) options:

**OPTION 1: “STAND-STILL”**

**PROS**

- Avoid any high retrofit investment cost
- Asset Play Flexibility to sell the vessel any time without having to payback any new scrubber
- Exploit possibility of low fuel oil price differentials between IFO380 and LSFO

**CONS**

- Address potential engine/ components failures when burning LSFO of 0.5% S and 0.1% S
- Invest for engine/ components compatibility to burn 0.5% S and 0.1% S LSFO. Crew training
- Be passive in high fuel oil price differentials and potentially be exploited by speculators

**OPTION 2: “INSTALL A SCRUBBER”**

**PROS**

- Hedge vessel’s position against high fuel oil price
- Diversify the Company’s Fleet costs that are dependent on fuel oil price differentials
- Option to exploit low IFO380 prices due to lack of demand for high sulphur (3.5% S) fuels
- Potential selling opportunities by adding value to the second hand price of the vessel

**CONS**

- High initial investment cost with constant annual maintenance & repair costs
- Potential investment loss in case of vessel’s mandatory early sale
- Increase in annual fuel oil consumption
- Train Crew for scrubber operation
- Local restrictions in washwater discharge

From the above it is evident that the future fuel oil price differentials between IFO380 (<3.5% S) and the new 0.5% S and 0.1% S fuel oils or MGO, will dictate the payback period of a new scrubber retrofit installation. Several views <sup>1, 6, 12, 22, 23, 25, 26</sup> have been expressed for forecasting the future price of low sulphur fuels, but given also the lack of past data, the prices of oil differentials cannot effectively be predicted. However, it is expected that fundamentals such as supply and demand will finally drive the fuel oil price differentials. Regarding the adequacy of the low sulphur fuel supply at the date of implementation, there are several contradicting opinions <sup>8, 17, 23, 25, 26</sup>. Nevertheless, it may be the consensus based as further experts<sup>5</sup> that blending sweet with sour HFOs will not be enough to solve the lack of supply and blending with distillates (e.g. MGO) will be necessary not only for 0.1% S, but also for 0.5% S global limits.

Considering that IMO is not extending the implementation date of the 0.5% S limits as such was clarified in *MEPC.71*, it is up to the refineries to set the new 0.5% S fuel price in order to meet the expected high demand. Consequently, it is our view that until competition between refineries/ bunker suppliers becomes effective and until new hydrocracking plants are erected so that new 0.5% S fuel oils comprise less distillates, the prices of LSFOs will remain high. Prices differentials are also expected to widen in general, once crude's oil prices surge. This concludes to the dilemma of vastly investing for a scrubber or be exposed to highly volatile fuel price differentials. Henceforth, such dilemma shall not be considered within a single vessel perspective, but within the company's fleet perspective. Consequently, it may be optimally recommended **to diversify in order to mitigate the Company's risk. Such is achieved by partially hedging the Company's exposure against high future fuel oil price differentials.**

**Streamlined Naval Architects Ltd.** has thus developed a [freeware spread-sheet calculator](#), where Ship Owners and Operators can easily use in order to obtain ship specific key financial data and assess the feasibility of the investment of a new exhaust scrubbing system installation.

From a technical point of view, Ship Owners and Operators shall also effectively address the fact that not all engine components of existing vessels are in general built for continuous burning of ultra-low sulphur fuels. Consequently, relevant Guidelines<sup>19</sup> and Service letters<sup>20, 21</sup> address this issue by outlying the potential concerns and by providing methodologies and retrofit works required on existing vessels to burn such fuels.

### BURNING LOW-SULPHUR FUELS

#### POTENTIAL ISSUES

- Low viscosity may cause internal leakage and damage to fuel pumps or other components of "Service and Transfer Fuel Oil" Systems
- Increased Cat-fines (Al-Si)
- Scuffing in case of high BN oils
- Rare issues of Low lubricity on plunger/ barrel
- Fuel change-over may cause seizures in fuel valves, fuel pump plungers or suction valves
- Possibility of ignition delay, defective combustion and waxy precipitations
- Fuel compatibility issues
- Boiler issues such as low flash point and volatility, loss of flame detectability, increased turn-down ratio, excess air for combustion and black smoke

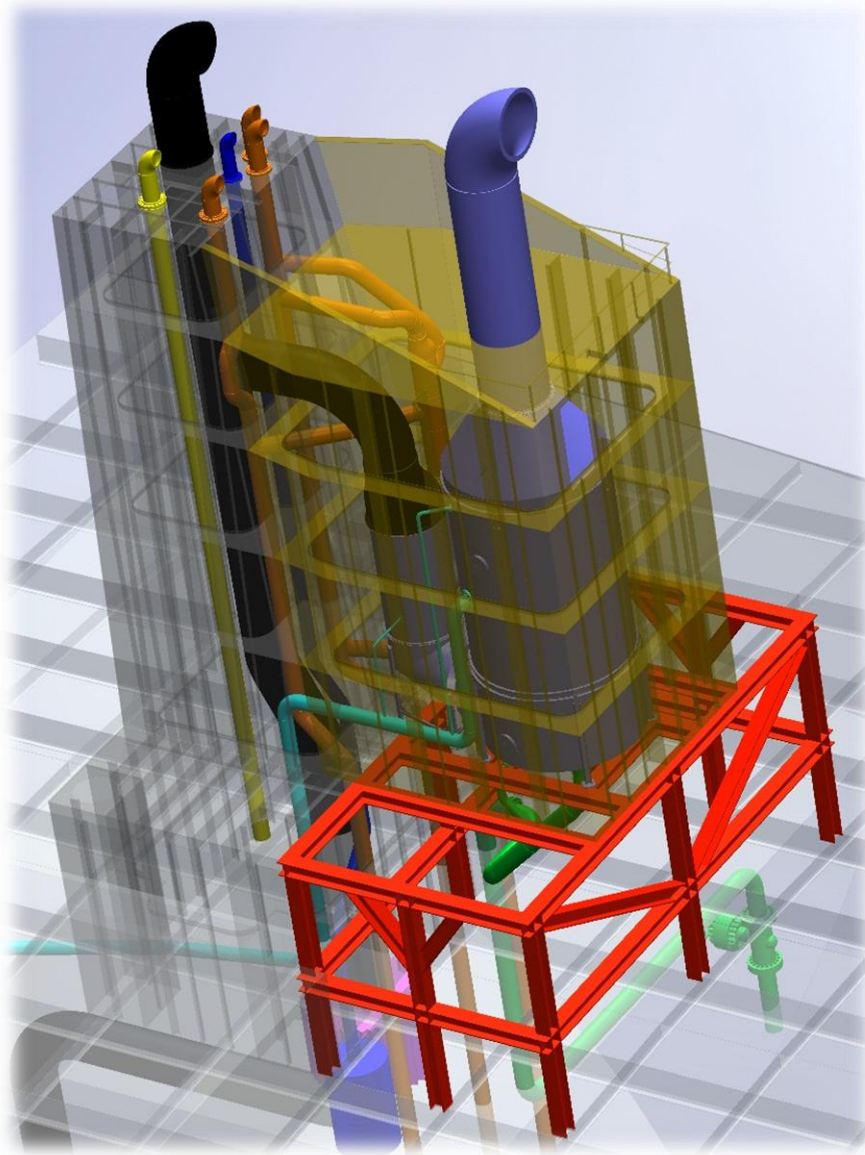
#### MITIGATING ACTIONS

- The viscosity of fuel should be kept above 2cST at engine inlet by lowering and optimizing the FO temperature of the corresponding fuel
  - Proper FO separation at the correct temperature
  - Use low BN oils, unworn fuel oil pumps and feed rates specific to the (% S) type of fuel
  - Train to follow specific change-over procedures and keep temperature gradient not >2degC/min
  - Keep fuel temperature above pour point
  - Use different fuel tanks and do not mix fuels
  - Duplication of fuel-oil valves, install IC-type flame eye, use proper atomizer, adjust the control settings of air-to-fuel ratios
- Modify *Fuel* and *LO* systems if necessary by: i) adding FO cooler(s), ii) adding a LO storage tank for additional BN Lub oil categories, iii) add an overflow tank dedicated for ULSFO, iv) adding extra return line from the overflow tank to the ULSFO tank, v) adding LSFO service and settling tanks

On the contrary, if the installation of a scrubber system in order to comply with the 2020 IMO sulphur cap requirements is considered as the most viable option, then the choice of an "open-type" or "hybrid-type" scrubber becomes imminent. "Hybrid-type" scrubbers systems, despite being more expensive and slightly more complicated, have the capability of being used in areas where discharge from scrubber's washwater is prohibited. Areas where washwater discharge is prohibited<sup>1</sup> by local/ regional authorities include certain ports of Germany and Kiel Canal, 3nm from the shores of Belgium and the US State of Connecticut. In accordance with the latest [2013 VGP](#)<sup>28</sup>, part 2.2.26, the discharge in US waters is allowed considering: i) slightly stringent discharge criteria than IMO, ii) continuous monitoring, iii) sample analysis and reporting. The EPA will also revert in the future with further general conditions that are to be met following the completion of drafting of a water quality certification report. Additional areas where "open-type" scrubbers may face operational and/or efficiency issues are areas of low alkalinity and/or salinity.

**Streamlined Naval Architects Ltd.** can offer the following services to Ship Owners & Operators:

- Feasibility study for a scrubber selection
- Assess various scrubber designs and preliminary investigate the extent of retrofit works required (Adequacy of existing sea-chests, funnel and engine casing modifications for each selected scrubber, optimal routing principles of new piping and exhaust piping, optimal positioning and arrangement of the scrubber's main parts and possible required additional tanks, electric-load calculations, preliminary back-pressure calculations, lightship check)
- 3D-laser scanning as required
- Preparation of Class related Drawings in co-operation with scrubber Maker, discussions and follow-up with Class
- Detailed design including structural modification drawings required, FEA strength analysis, 3D arrangement, detailed pipe routing and detailed exhaust pipe routing, piping production drawings for prefabrication and time-saving during retrofit
- Drafting or assisting the drafting the specification for offer tendering from Yards for scrubber retrofit
- Project management and on-site supervision



*Figure 1: Indicative rendered view showing retrofit modifications for a scrubber installation*



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