Chapter 1: Introduction

IMO 2020 Fuel Regulations

Sulfur Effect

- Sulfur in fuels causes the emission of Sulfur oxides (SOx).
- SOx are harmful for human health by causing the respiratory symptoms and lung disease.
- In addition, SOx can cause acid rain which is harmful for the crops, forests and aquatic species, and contributes to the acidification of the oceans.

As a result

- Decreasing the sulfur content of the fuels will reduce the air pollution which will result in tangible health benefits.

What is IMO regulation for 2020 Fuels?

- The International Maritime Organization (IMO) – the UN agency responsible for ensuring a clean, safe, and efficient global shipping industry – will be implementing new regulations that will have massive impact on maritime shipping.
- The new IMO 2020 regulation will enforce a 0.5% sulfur emissions cap worldwide which will be starting January 1, 2020.
- IMO strategy is to reduce the greenhouse gas (GHG) emission at least 50% by 2050 compared to 2008.

Available options

As IMO 2020's implementation date nears, there are several options (Option 1-5) open to ship owners.

1. **Burn distillates**
2. **Burn hybrids or blends**
3. **Install EGCS**
4. **Burn LNG**
5. **Use other alternative energy sources**

Each of These options has pros and cons mostly concerning fuel availability, on-board fuel management, Capital and operational expenditure, As well as maintenance requirements.

Therefore, It is not a simple choice and the decision on what method of compliance is best depends on a number of factors, such as vessel type, trading area and remaining service life.

About the different compliant marine fuels, their pros and cons

Compliance option 1: Burn distillates

- One simple way to meet compliance is to burn low sulfur distillate fuels.
- Distillates are the lighter grade fuels from the refining process, the most common being marine gas oil (MGO/DMA) and marine diesel oil (MDO/DMB).

Pros

- No major modifications or capex (capital expenditure) needed - usually limited to minor engine system modification and tank cleaning
- Relatively simple changeover process between 0.5% and 0.1% fuels when transiting ECAs
- Reduced engine maintenance demands and reduced risk of engine failure

Cons

- This option carries maximum cost which brings the differential cost between high S and low S- carrying 250$/mT
- Concerns about operating fuel of low viscosity for a longer period leading to fuel leakage as well as fuel pump issues.
- Distillates with Fatty Acid Methyl Ester (FAME) pose issues upon storage
- The challenges related to the fuel with high FAME content is potential oxidation of biodiesel
- Its limitation in storage life,
- Need for the stability testing when fuels have high FAME.

Compliance option 2: Burn hybrids or blends:

- A number of producers have developed or are developing compliant products with characteristics similar to heavy fuel
- There are heavier than MGO and MDO but lighter than the residual fuel oils that are currently used.
- Some are specially produced products and are commonly referred to as 'hybrid' fuels.
- Other products are the result of blending, producing a heavy distillate or light residual blend.
- It may be possible that a 0.5%S residual fuel (e.g. 380 cSt) could be produced from either refining sweet crudes or,
- They might be produced from sour crudes undergoing a desulphurization process.
- But there are currently only limited efforts to make this widely available as a marine fuel (2).

Pros

- No major modifications or capex needed - usually limited to minor system modification and tank cleaning
- Expected to be more economical than distillate fuels

Cons

- Concerns about refineries' abilities to meet demand in 2020
- Uncertain supply can lead to price volatility
- Use of uncommon blend stocks to formulate these blends
- Concerns about excessive catfines
- Concerns about their ignition & combustion properties
- Some fuels may require onboard treatment, such as centrifugal separation, viscosity control, and heating
- Some products fall outside the specified grades in ISO 8217
- Higher risk of incompatibility if using different blends or hybrids

Compliance option 3: Install EGCS:

- Exhaust Gas Cleaning Systems (EGCS) are commonly referred to as scrubbers.
- These systems effectively wash the exhaust gas to remove sulfur dioxides and particulate matter.
- Post-2020, vessels operating an EGCS can continue to legally burn fuels with a sulfur content of greater than 0.5%.
- Systems are categorized as open loop, closed loop or hybrid.

Pros

- Capex typically US$2-2.5m for a 10 MW engine with payback period expected to be reasonably short (1 to 2 years)
- Expected low fuel costs – some market analysts have forecasted high sulfur fuels to plummet in 2020
- The lower fuel costs may make the vessel more attractive to time charterers

Cons

- Systems and equipment require a lot of space
- Power demands resulting in around a 2-3% increase in fuel consumption
- Concerns about maintenance demands and reliability
- The long-term viability of EGCS could be impacted by any future legislation on wastewater effluent discharge standards
- The availability of high sulfur fuels post-2020 is unknown and some refineries could divert streams elsewhere if not profitable
- The time required to retrofit EGCS on an existing vessel could take several weeks and require the vessel to be out of service.
- Increasing list of countries banning the use of open loop scrubbers leads to increase in OPEX as well.

Compliance option 4: Burn Liquefied natural gas (LNG):

- One of the main drivers for shipowners to turn to LNG as a marine fuel is that it emits zero SOx and Virtually zero particulate matter.
- To make storage and handling manageable, it is condensed into a liquid at close to atmospheric pressure by cooling it to approx. -162°C (2).

Pros

- Generally regarded as a very clean fuel and may be more resilient to any future changes in environmental legislation than the alternatives.
- Lower fuel costs
- Green credentials

Cons

- Relatively high capex (upgrade to gas or dual-fuel engines and storage and handling system) with an expected long payback period
- Limited infrastructure of LNG supply, therefore, restricting worldwide trading
- Bunkering challenges – higher risk operation and strictly controlled
- High delivery costs push up the real cost of fuel
- Lower energy density compared with traditional marine fuels – therefore more volume needed to carry the same equivalent of propulsion, as heavy fuel
- The global warming potential of methane is 28 times higher than CO2 over 100 years, and 84 times higher over 20 years
- Large tanks and restrictions on their position can result in loss of cargo carrying capacity
- Crew will require additional training in bunkering, storing and managing LNG

Compliance option 5: Use other alternative energy sources:

There are several alternative fuels or energy sources that are either available or currently in development.

These include:

Methanol (CH3OH):

- While it is easy to manage and store
- The main challenges are its low flash point and relatively poor energy density.

Hydrogen fuel cells:

- Fuel cell systems use an electro-chemical reaction to generate electricity.
- Strong green credentials but there are concerns on their high cost, size, and weight and expected life.

Liquefied Petroleum Gas (LPG):

- Composition can vary but consists mainly of propane, butane, and propylene.
- Its usage has similar positives and challenges to that of LNG as a marine fuel (2).

Penalties

Where there are regulations there will be breaches. How to minimize the breaches?

- In practice, the 0.5% sulfur requirement will be enforced globally by Port State Control (PSC) authorities.
- There are large differences between the penalties imposed on non-compliant vessels in various ECA zones.
- Implementation of the regulation will not be easy. Attempts to ignore the regulation will happen. Only through strict implementation an enforcement compliance can be achieved.
- The penalties for not following the regulations in North America are tougher than elsewhere: The US Coast Guard has the power to seize vessels in breach of sulfur regulations
- Owners could become liable for a heavy fine.
- Each EU state is responsible for policing its own territorial waters (3).
- **Table 1-1** shows the summary of financial penalties for non-compliance to SOx regulations.

Table 1-1 Penalties for non-compliance to SOx regulations in selected countries within SECAs[3].

Country	Maximum financial penalty
Belgium	Eur 6 million
Canada	CAD 25,000
Denmark	No maximum
Finland	Eur 800,000
France	Eur 200,000
Germany	Eur 22,000
Latvia	Eur 2,900
Lithuania	Eur 14,481
Netherlands	Eur 81,000 + gains
Norway	No maximum
Sweden	SEK 10 million
UK	GBP 3 million
USA	USD 25,000/d

Quiz

1. **What is the go-live date for IMO 2020?**
    a. **1/1/2020**
    b. 3/31/2020
    c. 3/1/2020
    d. 1/31/2020
2. **How does IMO 2020 save human lives?**
    a. **Toxic sulfur oxide gas inhalation, and particles in burned fuels, can cause lung and heart disease, and this reduces that**
    b. If the ship burns MGO, then it can manoeuvre far better in ports, and collisions will not occur saving lives
    c. When a ship burns HFO or HSHFO (high sulfur heavy fuel oil), then visibility is reduced, resulting in loss of life and limb
    d. Carbon dioxide causes global warming by blanketing the earth's crust, causing melting of polar ice caps and rising sea levels, resulting in more human deaths, which are prevented by IMO 2020
3. **By what latest date must the ship not store HSHFO onboard without an installed scrubber?**
    a. 1/1/2020 (First of January, 2020)
    b. 1/31/2020 (January 31st, 2020)
    c. 3/1/2020 (March First 2020)
    d. **3/31/2020 (March 31st, 2020)**
4. **What are some penalties imposed upon ships for not complying with IMO 2020?**
    a. Arrest of ship and delays in departure until emptied of high sulfur fuel and restocked with VLSFO
    b. Fines for non filing of FONAR form, when efforts were made to find VLSFO and they were unsuccessful

c. Spot checks of sulfur emissions and fines if non-compliant in US coastal waters

d. All of the above and more potentially