

The European marine fuel market - present and future

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SYNOPSIS

The MARTOB project has assessed the present status of the marine fuel market, and challenges related to changes to meet increased environmental requirements. New requirements including a stricter sulphur cap on marine bunker fuels have been proposed. The new legislation will include both distillate and residual fuel qualities, and affect all segments of shipping operating in European waters. Uncertainties related to the balance between future demand and supply of low sulphur fuel qualities have been assessed by the MARTOB project, and conclusions from these studies will be presented.

INTRODUCTION

In January 2002 the European Commission announced that it is preparing a Community Strategy on Air Pollution from Sea-going Ships, to be presented autumn 2002. It is expected to include a proposal for modifying directive 99/32/EC on the sulphur content on liquid fuels so as to extend its scope to include heavy bunker fuel oils, as well as proposals for the introduction of economic incentives.

The aims of the measures expected that the Commission will highlight are:

1. To reduce the overall emissions in the so-called SECAs (SO_x Emission Control Areas - the North and Baltic Seas) as well as in all EU port areas.
2. To establish a regulatory regime with which all seagoing ships will be able to comply by using only two different fuels.
3. To ensure that fuels complying with EU standards will be available in all EU ports.

Among the means for achieving these aims are the following, all of which are to be written into directive 1999/32:

- Member states bordering on the SECAs of the North and Baltic Seas must ensure that only marine fuels with a sulphur content of less than 1.5 per cent are used in their territorial waters, and possibly also, if applicable, in their exclusive economic zones. This shall apply to all vessels of all flags, either from the date of the MARPOL Annex VI coming into force or from January 1, 2005, whichever is the earlier.
- Only fuels with less than 0.2 per cent sulphur may be used in inland waterways and EU port areas. (It is suggested that the latter should be defined as extending from the "outer limit of territorial sea to the quayside.")
- By 2005 member states must ensure that all marine gas oil sold in their territories shall have less than 0.2 per cent sulphur. (A change in the definition of gas oils is suggested, so as to exclude the so-called DMB and DMC grades.)

The driving force behind new regulations related to the sulphur content in fuels consumed by ships, is the increasing relative emission of sulphur oxides from shipping in Europe if nothing is done. Assuming no change of the present marine fuel qualities and abatement measures being implemented on land sources, it has been predicted that shipping related sulphur emissions will represent two third of the total sulphur emissions in Europe in 2010.

Author's Biography

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Several voices claim that the most cost efficient way to reduce sulphur emissions is to perform measures in the marine bunker fuel market⁸. In a study on behalf of the European Commission, BMT² concludes that the fuel cost for shipping in Europe will increase approximately 700 million USD annually if a cap in the region 1-1.5% is set on marine fuel sold in Europe.

Although several studies now have been performed to establish emission inventories and to assess effect of a sulphur cap in Europe, few have considered the availability of these fuel qualities and the supply/demand balance for these fuel qualities in European waters.

THE MARINE BUNKER MARKET

The international market

With 95% of world international trade transported by ship, the fortunes of the shipping industry are strongly linked to world trade. Marine fuels account for about 20% of total fuel oil demand, so the development of this market has important implications for refining industry.

Growth will continue in future, but increasing demand for bulk and general cargo trade will most probably be balanced by increased efficiency by tankers as newer, more efficient double-hulled vessels replace single-hulled vessels. Depending on world economic growth, energy use by marine transport is expected to grow by around 1.5 % per year until 2020, with higher growth rates in gas oil bunkers compared to fuel oil because of sulphur restrictions, particularly for coastal voyages.

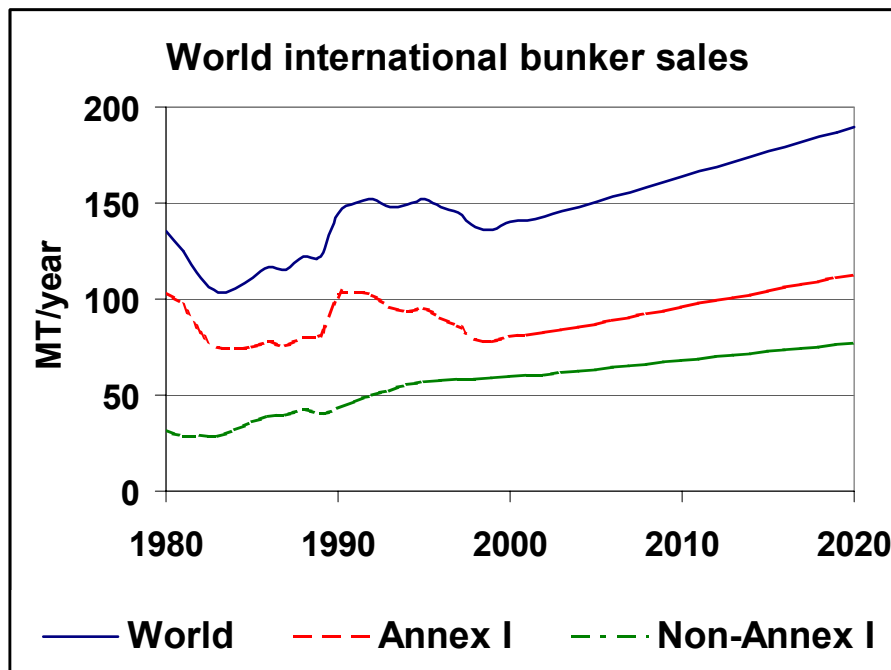


Figure 1 Development of world international bunker sales divided by Kyoto Protocol Parties (Source EIA, 2002)

As shown by figures 1 and 2 the world consumption of international bunker fuel is expected to continue to increase the next decade. The world total consumption of bunker is obviously significantly higher than indicated in figure 1, as sales to domestic consumption is not included in the figure. In order to establish a consistent understanding of the fuel consumption on a regional level, international bunker and domestic bunker fuel sale figures needs to be combined, a task which represents a challenge due to inconsistent reporting on marine bunker sales.

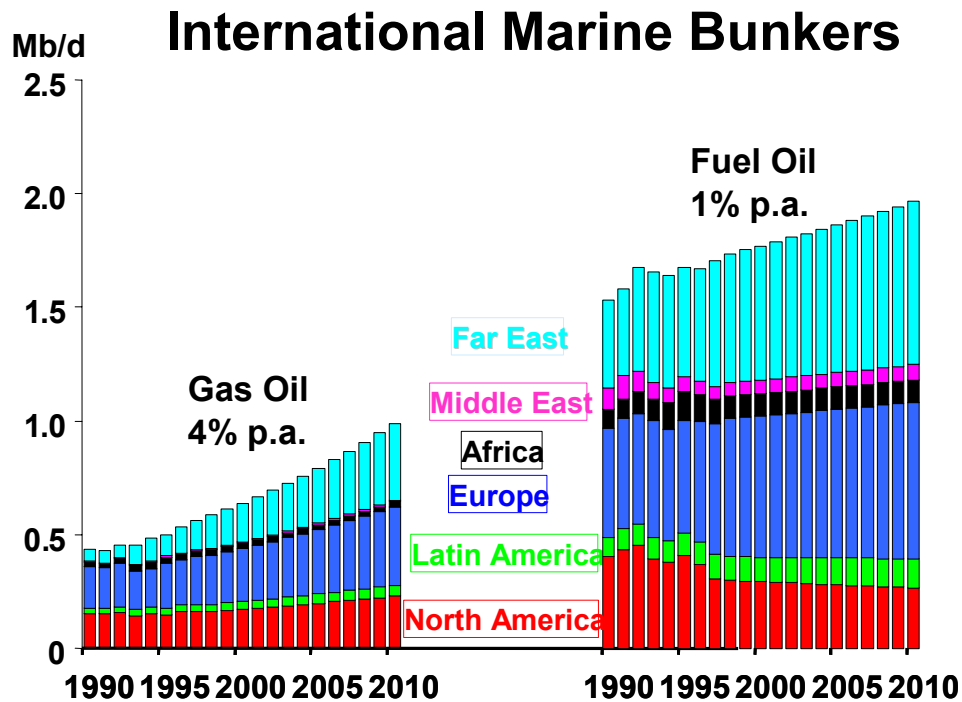


Figure. 2 Regional developments of international bunker sales ^{3,9}

The European market

Several assessments have been made recently to try to quantify the marine bunkers consumption in Europe. As seen from Table 1 the various studies does not provide consistent results, and this is to some extent due to different approach to the task, and how international/domestic sale and consumption have been considered.

Table 1 – Estimated sale and consumption of marine bunker fuel in Europe

Study performed by	Reference year	Total million tonnes
Bunker consumption		
BMT ²	2001	33,5
ENTEC ⁵	2000	49,5
Bunker sales		
BMT ²	2001	40,6
Beicip-Franlab ¹	2000	43,6

² Source (BMT, 2000).

⁵ Source (ENTEC, 2002) Fuel consumption is not presented in the study, but has been calculated based on the applied emission factor 3179 kg CO₂ per tonnes fuel consumed

¹ Source (Beicip-Franlab, 2002), Including 1999 figures for EU Accession countries

The most significant conclusion drawn from the comparison of different studies is that a significant uncertainty still exists with respect to the consumed volume of marine fuel oil in European waters. As a consequence of this it will be equally uncertain what effect new legislation will have on this market.

Based on sale figures collected in workshops arranged in connection with the MARTOB project, the sales in Europe of marine fuel oil have been estimated to be approximately 42.1 million tonnes (2001 figure). This figure does not include distillates, hence the figures found by Beicip-Franlab seems to be closest, but still somewhat low as this figure includes distillate sales.

With respect to low sulphur fuel oil (not MDO/MGO) with a sulphur content below 1.5%, the European supply has been estimated to be approximately 6.5 million tonnes, where the marine share represents less than 1 million tonnes annually.

Most inland consumption is moving to low sulphur fuel oil or natural gas. The IMO has proposed a reduction in the global maximum sulphur level in marine bunker fuel from 5% to 4.5%, which compares with the current global typical range in the order 2.8-3.5%, with only 0.02% of fuels used world-wide in shipping at a sulphur content over 4.5% and with the world average at 2.7%.

The proposed introduction of SO_x Emission Control Areas (SECA's), within which the sulphur content of fuel used on ships will be limited to 1.5% is expected to have a major impact on the supply side of the market. The Baltic and North Seas have been proposed as initial SECA's. Ratification by IMO members is not expected before 2005. More immediate are plans by the EU to impose sulphur limits on fuel oil used within EU territorial waters, probably set at 1.5% maximum. In either case, the provision of adequate quantities of segregated low sulphur bunkers does not currently exist.

AUGMENTING LOW SULPHUR FUEL OIL SUPPLY

The options

The options available to a refinery for increasing Low Sulphur Fuel Oil Supply to the bunker market are:

- Re-blending from the current HSFO market
- Switch to a lower sulphur crude diet
- Invest in Residue Desulphurisation (RDS)
- Redirect the low sulphur fuel oil destined for inland markets

Re-blending from the current HSFO market

A limited supply of lower sulphur content HFO could be available by re-blending current HSFO with MDO, or other components. This option presents a risk for producing unstable LSFO bunkers. Dilution of a thermally cracked residue with too high concentration of a paraffinic diluent ("cutter-stock") such as gas oil could result in an unstable fuel. It is consequently necessary to ensure that the aromaticity of any diluent is high enough to keep the asphaltenes dispersed. The addition of catalytically cracked cycle oils is one way of doing this, and so providing an adequate stability reserve.

Assuming properly done blending (right components from selected grades, and in correct order), the Beicip-Franlab report¹ suggests that around 4 MT of 1.5% S bunkers could be available in North Europe and about 0.7 MT in the south, as indicated below. The sulphur content of the remaining HSFO would increase to about 3.4 wt% in the North and 3.2 wt% in the South. Those figures and those for 1% S HFO case are presented in the table below.

Table 1 – Potential low sulphur bunker production by re-blending

<i>POTENTIAL LSFO BUNKER PRODUCTION BY RE-BLENDING</i>		
HFO Bunkers Sulphur Cont. wt%	Atlantic/NEW/Other (MT)	Mediterranean (MT)
<1.0	1.2	0.4
<1.5	4.0	0.7

This option may cover a small part of the market today, in SECA's (Sulphur Emission Control Areas) like the Baltic and North Sea where max. Sulphur 1.5% is required. But in general terms this represents a non-significant option, as it is not giving a viable solution in this problem. However, we need to be cautious as uncontrolled blending with feedstocks available in the market may give huge problems to the shipping due to unstable products. Stability is one of the critical parameters for handling fuel oil on board the vessels.

Switch to a lower sulphur crude diet

If we consider three different crude oils, Brent blend, Iranian Heavy and Arabian light, it is evident that there is a clear diversity in quality and yield, which will affect the refineries processing and output.

Table 2 – Crude oil data and typical output quality

Crude oil Analysis	Arabia light (Saudi Arabia)	Iranian heavy (Iran)	Brent blend(UK)
Density at 15C	0.860	0.872	0.830
Sulphur content %	1.90	1.89	0.35
Residue yield %	44.5	47.0	35.7
Atmospheric distillation			
(Residue) Density at 15C	0.959	0.972	0.923
(Residue) Sulphur Cont. %	3.28	3.02	0.78

Refineries will be constrained by their capability to handle more than a certain amount of a particular type of crude. This will depend on the configuration of the refinery to cope with the volumes of products created by crude processing and the constraints within which the refinery is allowed to operate, particularly in respect to environmental emissions.

Invest in Residue Desulphurisation (RDS)

Refinery processes for desulphurisation of HSFO are likely to be very expensive with each plant costing well in excess of \$200 mln. At such levels, it is highly unlikely that the refining industry would be prepared to consider investments to support a low sulphur bunker business, without confidence in a significant and sustainable price increase for this higher quality product.

It is very difficult to indicate what the additional investment cost will be, but according the source “*Costs and benefits of controlling SO2 emissions from Ships in the North Sea and Seas to the West of Britain, May 1998, page 26*”⁶, we will have following additional cost increase in manufacturing cost:

Table x – price premium on low sulphur fuel oil

Bunker Sulphur Content	Additional cost of producing low S bunker fuel compared with current high S bunker fuels (US\$/t)*
2% Mass	35-50
1.5% Mass	45-70
1.0% Mass	55-85
0.5% Mass	65-95

The above figures are much in line with the figures provided by BMT² and Beicip-Franlab¹.

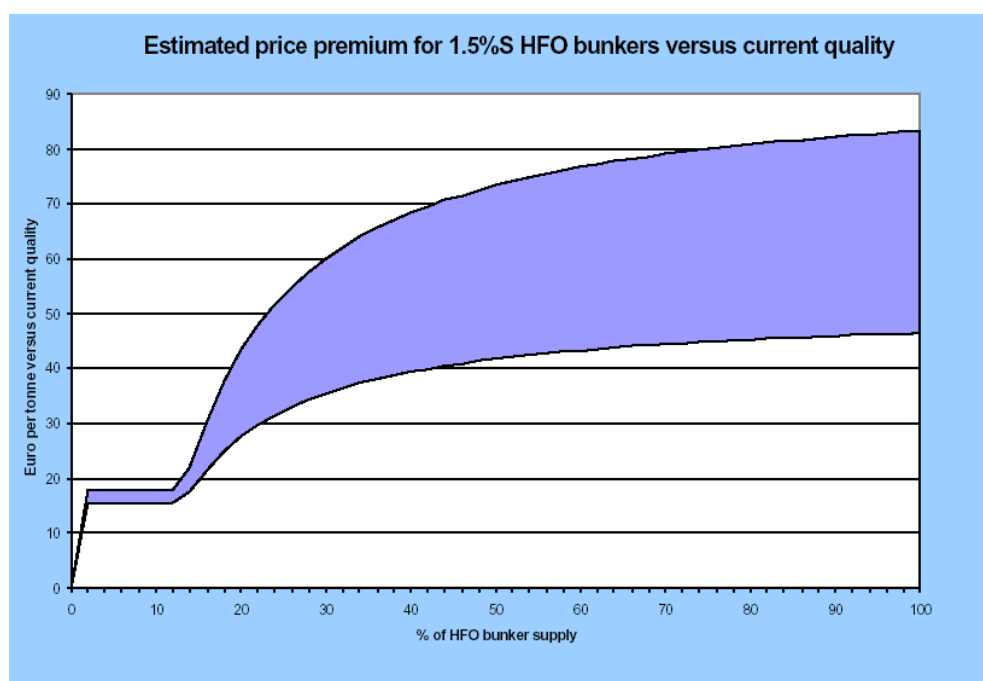


Figure 3 - Estimate of price premium for low sulphur fuel oil (from Beicip-Franlab, 2002)¹

Redirect the low sulphur fuel oil destined for inland markets

The enforcement of the directive 1999/32/EC from January 1st 2003, will represent a significant increasing demand for LSFO 1% S max. and the contrary for HSFO. This will represent, on the base of the forecast for 2005 a deficit of about 8-10 MT LSFO, and a surplus of 12 MT for HSFO. This unbalance will be more significant for the Southern and Mediterranean refineries. In N.W.E and Nordic countries is being today produced a significant amount of LSFO, mainly diverted to the local ferry segment as bunkers, and exported to counties where they need LSFO for the utilities. This volume is already allocated, and if shipping wants this product they will have to bid it away from the inland market.

Main producers of LSFO are the refineries in Scandinavia, where the logistics for using North Sea crude are favourable. However the volume of this LSFO gone to the bunker market is linked up to long term contracts with the ferry companies, and hence not available for open spot bunker market. Therefore it is unlikely that the refiners there will ever put this product on the open market. As far as 1% avails are concerned the fact that 1% has blown out from a negative Low sulphur to High sulphur to +13-15usd/te suggests that the market believes it will become tight next year as the new legislation

comes in. Key factors will be Portugal and Spain who rely on fuel oil when hydroelectricity is scarce. France is unlikely to change their demand. Italy is already mainly 1% and as they have moved over to gas but this has substituted its HSFO demand not LSFO demand and if anything ENEL has increased its imports. Greece is the other big unknown as they burn vast amounts of HSFO.

Feasibility of increased low sulphur fuel oil supply

If tighter sulphur specifications are introduced for bunkers, this will reduce the capability of refineries to support the bunker market. The capability of the oil refining industry to produce more low sulphur fuel oil for both the inland and the bunkers market is limited through a combination of factors such as the availability of low sulphur crudes and the configuration of the refineries to cope with the different product volumes associated with high and low sulphur crudes.

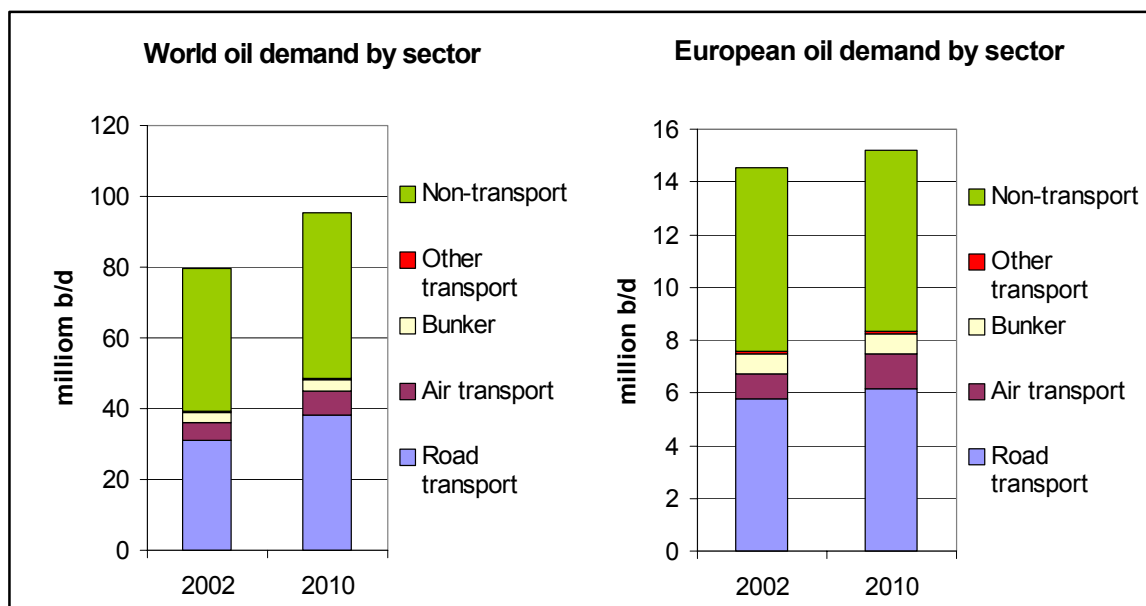


Figure 4 Demand of oil by sector (Source EIA, 2001)

The oil industry is unlikely to consider the bunkers market as a particularly attractive market within which to make substantial investments to convert high sulphur components into low sulphur fuel. In Figure 4 the position of the marine bunker market relative to the major oil markets are indicated. As indicated by the figure, bunker only represents approximately 5% of the European oil market in a situation where stricter requirements are expected in several sectors.

If the sulphur control areas were to be introduced including all consumption with fuel with maximum 1.5% sulphur, two options occur:

1. Operators would need to switch to distillates, and the distillate market redirected/increased to meet the increasing demand.
2. The availability of low sulphur fuel oil must increase. This would either imply increasing refinery output of these qualities, or redirect present LSFO market shares presently held by land-based consumers.

Due to the arguments above, it is considered most feasible in the short term to switch to distillates, and in the longer run changes are required in the present refinery structure to be able to supply a significant larger amount of LSFO.

SUMMARY AND CONCLUSION

The introduction of the Directive 1999/32/EC from January 1st, 2003 will limit the sulphur content of inland fuel oil to a maximum of 1%. This will create a disposal issue for the oil refining industry for high sulphur fuel oil components.

An alternative outlet for high sulphur fuel oil is the bunker market. However, if tighter sulphur specifications are introduced for bunkers, this will reduce the capability of refineries to support the bunker market.

The capability of the oil refining industry to produce more low sulphur fuel oil for both the inland and the bunkers market is limited through a combination of factors such as the availability of low sulphur crudes and the configuration of the refineries to cope with the different product volumes associated with high and low sulphur crudes.

The oil industry is unlikely to consider the bunkers market as a particularly attractive market within which to make substantial investments to convert high sulphur components into low sulphur fuel.

The required use of low sulphur (1.5%) bunkers within EU territorial waters, with even tighter sulphur specifications (0.2%) within port areas will present a major challenge for the marine business in terms of segregation of fuels both in ship and shore tankage and delivery systems.

More work needs to be done to quantify the impact of the above changes in respect to the ability of the refining industry to meet the changing demand, and to assess the overall cost impact on the business. This should take account of work currently being undertaken by ConcaWE into the impact on the European oil industry resulting from the introduction of lower sulphur specifications for both inland and marine fuels.

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