Reducing fuel costs by converting to burning Heavy Fuel Oils

SEAFISH

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Fuel costs are now a major influence in CPUE (cost per unit effort) on most fishing vessels in the UK, with record fuel prices being experienced. In the late 80's/early 90's fuel prices experienced short term increases usually in response to geopolitical problems or cut backs in production by OPEC countries. These short term increases were easily absorbed because sufficient quota was available, and the industry was in a relatively "buoyant" state. As a result of tighter quota and effort controls the industry has come under pressure – resulting in decreased earnings – whilst the last few years has saw a steady and sustained increase in marine fuel oil prices, particularly marine diesel and gas oil.

This has spurred fishing businesses to seek solutions to offset these fuel price increments and maintain earnings. Amongst possible solutions are bio fuels, re-engining, propulsion system development and fishing gear efficiency. Also coming under consideration is the potential of a switch to the relatively cheaper Heavy Fuel Oils (HFO) commonly used by the shipping industry.

This short report looks at the issues involved in converting to HFO, and gives a general example of the costs/returns of converting a 1490kw (2000hp) beamer engine to run on HFO. This example was chosen because most fishing vessels will not be suitable for conversion due to the use of higher revving engines and engines below 745kw (1000hp) would not be suitable to run on HFO. Vessels already using the newer medium speed HFO "ready" engines such as those produced by Wärtsilä MaK and ABC should be able to convert without a new engine purchase or engine conversion.

Generally an engine won't require many changes if it has already been updated with the latest technology, particularly with anti-polishing rings in the cylinders. However, the vessel will require new auxiliary equipment for handling heavy fuel oil onboard, particularly for heating the fuel oil to a correct viscosity before the engine injection system.

Required auxiliary equipment for HFO operation:

- HFO unloading unit
- HFO storage tank (1 or 2)
- HFO transfer pump unit
- HFO buffer tank
- HFO separators (2)
- HFO day tank
- HFO booster unit
- Pump & filter unit
- Return fuel unit
- Lubricating oil separators
- Sludge collecting tank
- Heaters (tank, separators, pipe trace, booster unit), (1 set)

Unloading / storage and transfer system:

The unloading unit consists of pumps to transfer fuel into the storage tanks. Storage tank/tanks are to enable storage of the HFO at a suitable temperature (30° C for CST 180) to ensure that the fuel oil can be pumped by the transfer system and requires heating in order to control and maintain the correct viscosity of the HFO in the storage tank. The transfer system is designed to transfer (pump) the HFO from the storage tank to the buffer tank prior to the HFO treatment operation.

Treatment system:

The treatment system ensures that a sufficient amount of clean HFO is available for engine operations and consists of a buffer tank, separator units and day tank. The HFO is transferred from the storage tank to the buffer tank (also known as the settling tank) and HFO separation takes place prior to the fuel oil transferring to the day tank ready for passing through the fuel feeding system. The day tank should have a large enough (maximum) capacity to ensure fuel supply for 8-12 operating hours.

Fuel feeding and return fuel system:

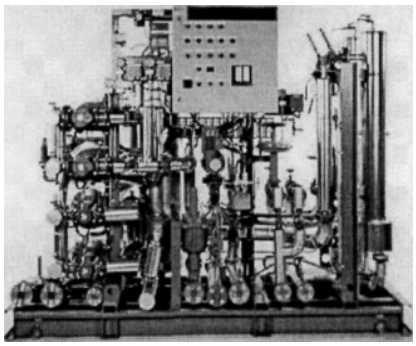
This system supplies clean HFO from the day tank to the engine injection pumps ready for burning in the engine and includes heating elements and a viscometer to ensure the viscosity of the fuel oil is optimum before entering the engine consisting:

- Booster unit with heaters (steam or electric),
- Viscometer to control the viscosity (with temperature adjustment),
- Feeder and booster pumps to ensure the correct pressure and flow of the fuel when it enters the circulation system.(the booster unit can also supply fuel oil to more than one engine).
- Pump and filter unit with fuel oil filters and fuel feed pump is required when there is more than one engine connected to the same fuel oil system (booster unit).

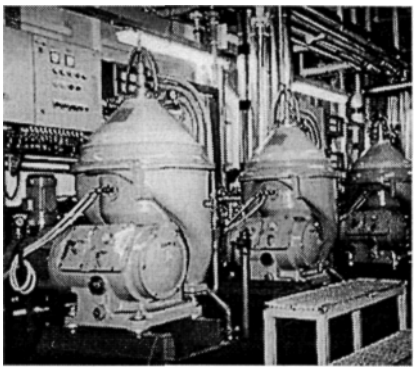
List of possible engine modifications (costing about £50,000):

- 8 Injection pump elements
- Anti-polishing ring modification on liners and pistons
- Suitability of fuel oil filter for HFO (if built-on)
- Exhaust valves (recommended Nimonic type)
- Rotocaps or Rotomats for exhaust and inlet valves

HFO separators:



HFO booster unit:



Legislative Issues with using HFO:

Environmental legislation influences heavy fuel oil quality in certain geographical regions and in particular the UK and Europe. The IMO and EU are setting much tighter limits on the sulphur content of heavy fuel than have so far been required. IMO Annex VI of Marpol 73/78, which came into force on 19 May 2005, limits the sulphur content of heavy fuel oil to a max. 4.5 % m/m globally and to a max. 1.5 % m/m in SOx Emission Control Areas (SECAs), except if the vessel is equipped with an approved after-treatment exhaust gas cleaning system or any other technical method that is verifiable and enforceable to limit SOx emissions to max. 6.0 g/kWh measured as S02.

To date, the Baltic Sea, the North Sea and the English Channel have been designated as SECAs and ships have a one-year transition period in the Baltic Sea and a two-year transition period in the North Sea and English Channel before they are required to start burning max. 1.5 % m/m heavy fuel oil when entering these SECAs. The EU legislation is described in Directive 1999/32/EC and at this stage follows the content of the IMO Annex VI of Marpol 73/78 and are expected to be implemented 2007-210. Generally speaking most HFO do not produce SOx levels above 4.5% m/m but in order to meet the 1.5% m/m level after-treatment is required.

Listed below are the decided and planned actions of the IMO and EU concerning the upcoming sulphur legislation of liquid fuels.

Decided actions - IMO
Annex VI of MARPOL 73/78

• 4.5% m/m sulphur cap from May 2006 globally
• 1.5% m/m sulphur cap from May 2006 in the Baltic Sea
• 1.5% m/m sulphur cap from February 2007 in the North Sea and English Channel

Proposed actions - EU
EU Directive 1999/32/EC

• 0.2% m/m sulphur cap (later 0.1 % m/m) for distillate fuel - all ships at berth in EU ports and all inland vessels.
• 1.5% m/m sulphur cap - all ships operating in the Baltic Sea,
North Sea and English Channel and all cruise/passenger vessels on regular service inside European waters.
• 4.5% m/m sulphur cap - all ships except cruise/passenger vessels on regular service to or from EU ports - EU waters except for the Baltic Sea, North Sea and English Channel
• Still under discussions - entry into force: 2007-2010.

Economic summary:

This is based on converting a 1490kw (2000hp) beamer engine to run on HFO which already has a suitable engine (not including costs to convert unsuitable engine, add ~ £50,000) and assumes it burns around 6,000 litres per day. Conversion costs estimated at £170,000.

Fuel type	Cost per litre 1/7/06 (pre Middle East)*	Cost per litre 20/7/06*	Saving/ ltr converting to HFO 1/7/06	Saving/ ltr converting to HFO 20/7/06	Cost recovery in days using HFO 1/7/06	Cost recovery in days using HFO 20/7/06
MGO[1]	29.4p	28.48p	14.24p	12.46	**199**	**227**
MDO[2]	27.86p	26.96p	12.7p	10.94	**223**	**259**
HFO[3]	15.16p	16.02p				
Note			**7p**		**405**	

* Prices ex pipe at refinery, delivery charges extra and dependant on quantity and distance.

1 Marine Gas Oil
2 Marine Diesel Oil
3 Heavy Fuel Oil of 380 cst quality . Quality ratings range from 180 cst (best) 380cst (most widely used) 500cst (low) and 700cst (very low).
Note - Danish fishermen report that the price difference between 180 cst and MGO usually sits about 7p/litre delivered

Prices for two separate dates are used to show the difference in price movements over a period of high tension in the Middle East and emphasise that whilst MGO and MDO moved down in price from 1st to 20th the price of 380 cst moved up. MGO and MDO tend to move very closely in line with the price of crude oil, 380 cst tends to have more dependant on availability. All oil prices are based on the US Dollar so the rate of exchange to the pound sterling also has a significant effect on the price.

Market forces affecting HFO are much different to those of normal fuels and include:

- Refineries switching to produce higher distillate products (Diesel etc)
- Increases in Bitumen/Tarmac demand worldwide
- Increase in Asian HFO refinery capacity
- Increase in extracting oil from oil shale/sands
- Large merchant vessels switching to 500cst and 700cst fuels.

Conclusion:

The purpose of this document is to highlight to fishing businesses the many things that vessel owners need to consider prior to a quite large investment per vessel. The information is accurate at the time of writing and the information printed here is meant as an initial guide. Anybody wishing to pursue the use of HFO should contact their local supplier for more detailed costs. All conversion costs are estimates and will vary according to vessel and engine. In conclusion, whilst it may be economical for some larger vessels to consider or owners who are building new vessels or buying new engines, the vast majority of UK vessels would be unsuitable for conversion to HFO. Further costs which need to be considered are the employment of a suitably qualified/experienced Engineer full time and that the engine would need to be overhauled within 4 years. A considerable amount of space may be taken up by the additional equipment necessary to run the vessel on HFO.