Development of the marine fuel market
- an overview -

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The future development of the marine fuel market will be mainly influenced by the following factors:

- Environmental aspects
- Availability
- Costs

International legislation concerning exhaust emissions will have a substantial effect on ship operation. Alternative propulsion systems are under development. Solar cells and nuclear propulsion will not be efficient and acceptable for merchant vessels.
A variety of different combustibles has been burnt in internal combustion engines during the last 100 years. Theoretically, there are many alternatives to fossil fuels. From the economic, environmental and social point of view it does not make much sense to burn biofuels in large marine engines on the high seas.

Gaseous fuels like LNG and LPG are excellent energy sources for vessels in emission control areas. For some ship types LNG may be a cost-effective and environmentally friendly fuel. The supply infrastructure and the safe bunkering are the major challenges today. The conditions of the international energy market will dictate the future gas prices for small scale LNG supplies of ships.

Against this background also in the foreseeable future chemical energy contained in fossil fuels will remain the most common source of energy onboard ships. However, the worldwide oil consumption will grow significantly. Most of the oil reserves were found in politically unstable regions. In the long run the prices of oil products will increase significantly and serious conflicts are therefore most likely.

Fuels for Shipping in ECAs

After 2015 the sulfur content of fuels burnt in emission control areas will be reduced to only 0.1%. All parties involved in shipping should prepare for this dramatic step. Generally, the reasonable alternatives for future shipping in ECAs are:

- Gas-fuelled dual-fuel engines
- Further use of heavy fuels in combination with onboard exhaust gas cleaning technologies
- Combustion of distillate products

The price of low-sulfur Marine Gas Oil will be determined by supply and demand in the land-based market. The additional costs for distillate operation instead of heavy fuel oil will probably vary between 40 and 50% of the crude oil price.

Global shipping

On the high seas heavy fuel oils with reduced sulfur content will be burnt in marine engines. Most probably not before 2025 the sulfur content of HFO will be limited to 0.5%. This drastic reduction will be a real challenge for the oil industry, standing at a crossroad. They have to decide whether to convert the refineries in order to further cut down the output of residues drastically, theoretically down to zero. Alternatively the oil industry has the option to invest a huge amount of money in the development and installation of extremely expensive hydrodesulfurization facilities for the treatment of residues.

In any case the quantities of residues produced in modern refineries with increasing conversion capacities will

be reduced to less than 10% of the total oil production, i.e. half of the residues produced 20 years ago. Furthermore, international shipping, which consumes roughly one third of the residues produces in oil refineries, has to accept a severe competition with power plants burning also heavy fuels. These developments have already raised the value of heavy fuel oil. Until 2005 the price of HFO has been approximately 60% of the crude oil price. During the last years the price ratio has increased to 80%. Residues are no more cheap waste products.
For the oil industry it is probably more attractive to invest roughly 10^{11} USD in further conversion plants than in desulfurization facilities for residues. The production of heavy fuel oil with only 0.5% sulfur will in any case significantly increase the price. First indications lead to additional costs from 80 to 150 USD/t.

Against this background marine fuel oil will lose its status as a cost-effective source of energy. For the oil industry the marine fuel market will become even less attractive than today. In the coming 30 years several oil companies will probably withdraw from the marine fuel market with significant consequences for shipping.

Horst Rulfs *graduated and obtained his doctor's degree at the Technical University of Hanover. After joining the Deutsche BP he was section manager involved in technical services and research. In 1984 he was appointed Professor at the* ***Hamburg University of Technology*** *in the Institute of Thermal Power Plants and Marine Engineering. Prof. Rulfs has additionally been working for more than 30 years as a consultant investigating engine damage cases.*