keting, believes that mixtures of bitumen and water or biodiesel have greater scope as energy sources. 'Low priced bitumen mixtures, like those available in huge quantities in Venezuela, would last for 150 years,' he said. Researchers are also studying fast-growing plant crops that could be used in biofuels.

One of the key strengths of the diesel engine lies in its adaptability to alternative fuels without necessitating changes in its basic operating principle. The company points out that biodiesel could be used today in its engines. Moreover, at the beginning of the 1990s, MAN B&W and the Technical University of Munich successfully conducted tests with compression-ignition engines running on hydrogen, widely perceived as a future energy source.

Hercules Project

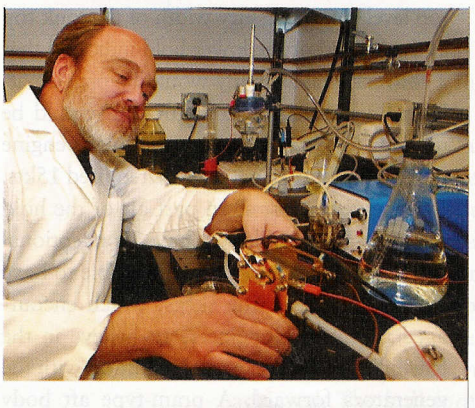
MAN B&W is a leading player in the Hercules integrated project, possibly the most ambitious and far-thinking marine engineering research effort ever launched under EU sponsorship. It is aimed at developing new technologies to cut marine engine emissions while raising efficiency and reliability. Work was implemented in March this year, drawing in an unprecedented number of partners representing producers, users, universities and technology specialists.

Management of the project has been assigned to Augsburg-based Uleme EEIG, set up jointly for that specific purpose by key project partners MAN B&W Diesel and Wärtsilä Corporation. The 40 participants in the Hercules initiative are tasked with achieving a 20% reduction in NOx (oxides of nitrogen) and 5% less particulate emissions by 2007. Parallel goals include a 1% improvement in fuel consumption and 10% enhancement in engine reliability, relative to best available technology already in service.

Efficiency and reliability gains, it is argued, will improve the through-life costs picture as well as lowering the through-life environmental impact of shipboard machinery, in terms of carbon dioxide (CO^2) emissions as well as NOx and other pollutants. Reliable sources estimate that shipping activity contributes about 5% of total oil-based CO^2 releases into the atmosphere each year.

The Hercules vision is for a 3% cut in fuel consumption and CO^2 emissions by 2010, along with a 30% reduction in NOx, relative to the IMO 2000 standard, 20% cut in other emissions, 20% enhancement in reliability, and 10% reduction in lifecycle cost. By 2020, it is envisaged that technology development will have resulted in a 5% improvement in fuel efficiency and corresponding CO^2 unit output, 60% less NOx, 40% less particulates and other emissions, 40% reliability gain, and 20% cut in lifecycle costs.

One of the most significant aspects of the long-term technical project, besides its scale and clearly-defined aims, is the participation by four of Europe's most progressive shipowning groups. Hapag-Lloyd, Kristen Navigation, A.P.Møller-Maersk and Wallenius Marine will contribute to different areas of investigation, and offer the means for monitoring and testing new methods and techniques in seagoing service.



The Future Workshop programme has the aim of stimulating ideas for engine technology and fuels in the decades to come. Researchers are also studying fast-growing plant crops that could be used in biofuels

Klaus Marek, head of Hapag-Lloyd's ships' technology and inspection team, succinctly identifies operators' expectations of the project: 'Without changing schedules, we want to increase the engines' energy efficiency and, in so doing, make a further contribution to environmental protection. Our customers are placing increasing importance on this.'

The long-term Hercules programme covers both two-stroke and four-stroke machinery, and has been divided into nine technical work packages, to investigate and foster inter-related developments in areas such as the thermodynamics and mechanics of engines with extreme design parameters, advanced combustion concepts, and multi-stage 'intelligent' turbocharging.

The various modules also encompass so-called 'hot' engines, using energy recovery and compounding techniques, as well as engine-internal emission reduction methods and advanced after-treatment methods for heavy fuels, new sensors for emissions and performance monitoring, low-friction engines, and adaptive control for 'intelligent' engines.

Financial sponsorship for the long-term endeavour has been secured both from Brussels, under the EC's Sixth Framework Programme provisions covering technological research, and from the Swiss federal office for education and science. Professor Nikolaos Kyrtatos, director of the laboratory of marine engineering at the National Technical University of Athens (NTUA) has been nominated as project coordinator. The laboratory will also be extensively involved in various study modules. MER