ABSTRACT

The concept of optimum octane number assumes a car population matching the available motor gasoline quality. Reducing the permissible gasoline lead content without measures being taken to optimise the RON requirement of the car population may have two consequences:

First, crude oil consumption in the refinery will be increased. For example, providing the existing car population with an unleaded gasoline pool of 96 RON could lead to energy penalties in the order of 8-10% compared to providing the same quantity of 96 RON gasoline containing 0.4 gram lead/litre.

Secondly, it is important to note that requiring pool octane numbers above 96 RON at 0.15 gram lead/litre and above 93 RON for unleaded fuels would touch on the limits of technology for some existing refinery configurations.

Thus, although it may be possible to manufacture these gasolines, they could not be produced in the quantities necessary to satisfy market demand without the construction of additional secondary processing capacity.

It may therefore be concluded that if further restrictions on gasoline lead content are considered desirable for environmental reasons, their introduction should be phased in with the introduction of engines designed to minimise the inevitable increase in total energy consumption by having octane requirements in line with the optimum RON described in this report.
INTRODUCTION

Since private transport currently consumes a significant part (around 11%) of the total energy used in Western Europe, it is a field which may be capable of yielding worthwhile savings in monetary and crude oil utilization terms.

One of the most effective ways of reducing fuel consumption in the private car is through engine design changes, but these may also affect gasoline quality requirements. Measures directed towards protection of the environment, i.e. emission control, which involve design changes in engines or associated equipment or reductions in the lead content of gasolines, may lead to higher fuel consumption in the engine and also to the use of more crude oil in the manufacture of the appropriate gasoline. There is, therefore, a complex inter-relationship between total energy economy, gasoline quality and emission control.

The Energy Directorate of the European Economic Comission (EEC) requested the petroleum and automobile manufacturing industries to conduct a study into these relationships to obtain a rational planning basis for any future legislative actions dealing with vehicle exhaust emissions and energy conservation.

In response to this request the CCMC (Comité des Constructeurs du Marché Commun) issued a report (1) on the relationships between vehicle fuel consumption and compression ratio/octane requirement for vehicles meeting the 1975 EEC emission regulations. At the same time CONCAWE (the oil companies' international study group for Conservation of Clean Air and Water - Europe) conducted a study to evaluate the crude oil requirements and refining costs of manufacturing gasolines at different octane quality and lead additive levels (2). CEC, the Co-ordinating European Council for the development of performance tests for lubricants and motor fuels assisted these studies in providing the necessary interphase between the two organizations and in combining the results of both groups in order to reach general conclusions (3).

The original CONCAWE study (2) dealt only with the impact on crude requirements and refining costs of reducing lead from 0.6 g/L to 0.4 g/L to 0.15 g/L. However, EEC subsequently asked CONCAWE to extend the study to include an estimate of the impact of unleaded gasoline on the total energy consumption of road transport. The purpose of the current report is to describe the basic methodology of these joint studies (1,2,3), the main results concerning gasolines containing 0.6-0.15 g Pb/L, and the best estimates obtained by extrapolating the refining study (2) to an unleaded gasoline situation.