

Non-road diesel

Status and possible developments

The draft 2005 Fuels Directive, proposed by the European Commission in May 2001 (updating 98/70/EC), included a consolidation of the requirements for non-road diesel, but did not impose any more stringent limits on this fuel. Amongst its amendments to the Commission's proposal, the EU Parliament proposed that non-road diesel should meet the same specifications as road diesel from 2005. As we reach the last stages of the legislative process, this debate is still ongoing.

Meanwhile, the European Commission's GEME (Group on Emissions from Non-Road Mobile Machinery Engines) is reviewing the next stage of emissions legislation for engines used in non-road mobile machinery applications, which would amend Directive 97/68/EC. Such legislation (Stage 3) is likely to be implemented towards the end of the decade. Although emission limits have yet to be agreed it is likely that advanced engine and/or exhaust after-treatment technologies will be needed. These advanced technologies may require a reduction in fuel sulphur content to enable the required improvements in emissions to be achieved. GEME therefore established a Task Force on Non-Road Fuels, to investigate the fuel requirements of the various engine technologies that may be required and to identify the potential issues related to the introduction of such fuels.

Against this background, EUROMOT (European Association of Internal Combustion Engine Manufacturers) was asked to prepare a report on the engine and exhaust after-treatment technologies required to achieve various stages of emissions reduction, and to demonstrate the related 'enabling' fuel sulphur levels. Concurrently CONCAWE was asked to prepare a summary of the current European situation with regard to non-road diesel specifications and distribution system issues. The Commission took on the job of clarifying the current position on fuel duty levels and contracted a consultant to report on the refining and cost implications of changing non-road diesel specifications.

EUROMOT suggested fuel requirements for various engine technologies

Although Stage 3 emissions limits have yet to be agreed, it is likely that reductions in both PM and NO_x emissions will be specified. The engine and machinery manufacturers submitted a Joint European Industry Proposal on Stage 3 emissions limits in December 2000, suggesting that Stage 3 should be implemented at least seven years after Stage 2. They highlighted the implications of applying exhaust after-treatment technologies in this sector. More recently, EUROMOT submitted a report on the engine technologies needed to achieve various levels of emissions improvement beyond Stage 2. They identified the likely technological steps involved, which would have increasing impact on fuel requirements, viz.

Engine technology required	Suggested max. fuel sulphur content
Engine design improvements without EGR ¹	500 ppm (1000 ppm if only NO _x reduction needed)
Engine design improvements, including EGR	350 ppm
Exhaust after-treatment for 90% PM and/or NO _x reduction	10 ppm

The requirement expressed by EUROMOT for 350 ppm sulphur for systems with EGR is only supported by limited technical data and remains a point of debate. EUROMOT also suggested changes to fuel properties other than sulphur. However, the Task Force concluded that sulphur was the primary fuel factor and the single potential technology enabling fuel property.

¹ Exhaust gas recirculation: a technology to reduce NO_x emissions

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CONCAWE summarized the current status on non-road fuel specifications

CONCAWE reviewed the current European position on specifications, market volumes and distribution system issues for non-road diesel and other gasoils. The situation differs considerably across the EU Member States and any change to fuel specifications has potentially a significant impact on the refining and distribution systems, as well as raising questions with regard to the fuel duty regimes. If changes to fuel sulphur content are judged necessary to enable future non-road engines to achieve Stage 3 emissions standards, further analysis will be required to identify the optimum solution in each Member State.

Market volumes for the non-road sector are difficult to estimate precisely, since the figures available in published statistics such as the IEA's² do not discriminate between the volumes used in non-road mobile machinery and those used in heating systems (e.g. in agriculture). With a number of reasonable assumptions, we were able to use the IEA figures to obtain the overview shown in Figure 1. For the whole of the EU-15 (plus Norway) the total gasoil market distribution in 1998 was 53% road diesel, 9% non-road diesel, 36% heating oil and 2% for inland waterways.

The EN 590 European standard provides a harmonized minimum quality for road diesel in the whole of EU-15. Some countries such as the UK, Sweden, Finland and Denmark, have introduced tax incentives for special qualities exceeding the requirements of EN 590. A single grade of road diesel is generally marketed in each country. For heating oil and non-road diesel, there is no such European standard. Sulphur is limited by the Sulphur in Liquid Fuels Directive which specifies a maximum sulphur content of 2000 ppm max, to be reduced to 1000 ppm by 2008. Some Member States have national standards for heating oil, which may also include non-road diesel. Others have no national standards and the quality is controlled either by individual oil companies or on the basis of local oil industry standards.

The countries grouped to the left of Figure 1 operate substantially similar 2-grade distribution systems with an EN 590 road diesel grade and a separate gasoil grade, with dye/marker and commanding a lower duty rate, for non-road and heating oil use. Spain and Norway have a specific separate non-road gasoil grade. In the countries grouped in the centre of the chart EN 590 road diesel is supplied to part or all of the non-road diesel market, different mechanisms being used to apply the relevant duty rates. In view of its very small heating oil market, Portugal uses road diesel for all applications, albeit with a dye for heating oil and non-road. Sweden and Denmark already have lower sulphur content for all grades. The CONCAWE report provided a detailed summary of the specifications currently used and the potential distribution issues likely to be associated with any changes.

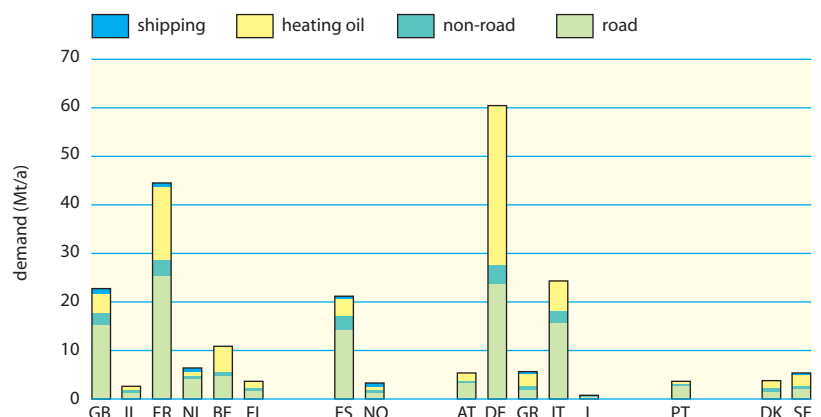
Outlook/next steps

The initial work of the Non-Road Fuels Task Force has now been completed. The European Commission has now to put forward its proposal on Stage 3 emissions legislation, including any related proposals on fuel quality. CONCAWE has pointed out that these proposals should be based on demonstrated air quality benefit, cost-effectiveness and understanding of other implications of proposed changes such as potential increases of CO₂ emissions.

In this regard, it is worth noting that the Auto/Oil II emissions inventory showed that the relative contribution of the non-road sector to total emissions is very small and

Figure 1
This overview of European diesel/gasoil demand by country was based on IEA data, with some additional assumptions regarding the volumes used in non-road mobile machinery and those in heating systems.

European diesel/gasoil demand by country



² International Energy Agency

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EU-15 PM emissions inventory, 1990–2020 (European Commission data)

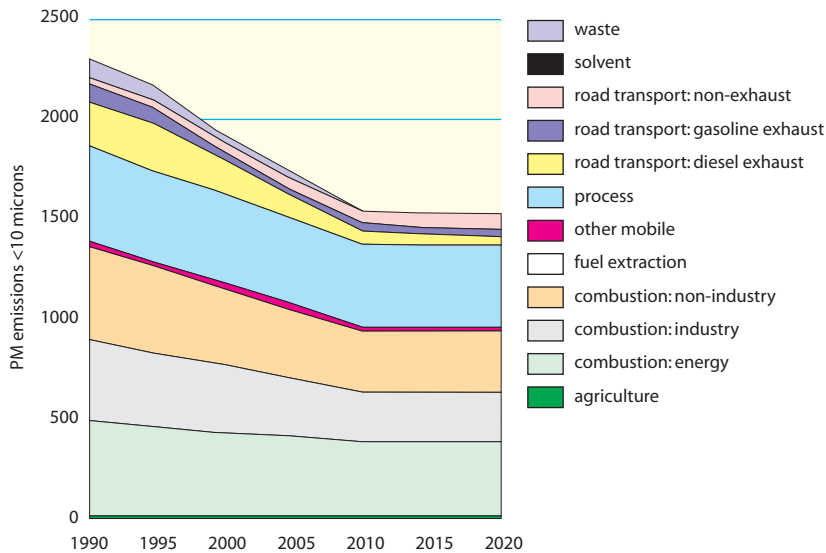


Figure 2
Reducing the relatively small contribution of non-road mobile sources to total PM emissions is unlikely to deliver substantial improvements in overall air quality.

will remain so even when contributions from e.g. the road sector have decreased. Figure 2 illustrates this point for PM (non-diesel road emissions are included in ‘other mobile’). Hence reducing emissions from the non-road mobile sources is unlikely to deliver substantial improvements in overall air quality.

If a reduction in the sulphur content of non-road diesel is deemed necessary after the air quality impact assessment, there appear to be three potential options, to be jointly considered by the oil industry and authorities:

- supply the non-road diesel market with road diesel quality, but at a lower tax rate;
- introduce a specific non-road diesel grade with the required sulphur content;
- reduce sulphur content across the whole gasoil pool, including heating oil.

All of these options raise significant refining, distribution, consumer and/or taxation issues. There are significant differences in the markets, specifications, distribution systems, duty regimes and duty points across the Member States. Given these differences, if change to fuel sulphur content for non-road diesel is deemed necessary, the optimal solution is likely to be different in each country. A flexible approach, specifying the maximum sulphur content for European non-road diesel based on demonstrated technical needs in relation to air quality objectives, but leaving implementation to the Member States, would be likely to produce the most cost-effective overall solution.