CONCAWE's market fuel survey: assessing progress in biofuel blending

Evaluating oxygenate concentrations in service station fuels from 17 European countries

The use of bio-derived blending components in transport fuels is increasing around the world as a result of legislative initiatives to reduce transport greenhouse gas (GHG) emissions, improve energy security and support agriculture. Within the European Union, the Renewable Energy Directive (2009/28/EC) requires that transport fuels must contain at least 10% energy content of renewable products by 2020. This energy target will largely be achieved by blending sustainably-produced biofuels into today's market fuels.

Meeting this overall European target is the responsibility of each Member State and each country has already reported their approach through National Renewable Energy Action Plans (NREAPs) published in 2010. These plans vary significantly from one country to the next depending upon the specifics of the country's transport demands, agricultural production and the availability of alternative energy options that can also be used to meet the renewable energy mandate.

The renewable bio-components that will be available in large enough volumes by 2020 to meet the demand are likely to be bio-ethanol produced from sugar fermentation, ethers manufactured from bio-ethanol and bio-methanol, and esters and hydrocarbons produced from vegetable oils and animal fats. Although some progress is being made on more advanced bio-components derived from biomass, like straw and wood, these products are not expected to contribute substantially to meeting the EU renewable fuel mandate before 2020.

Today, up to 2.7% oxygen by weight can be blended into gasoline in most countries through the use of oxygen-containing components at up to 5% by volume of ethanol (E5[1]) or higher volumes of ethers, such as ETBE, MTBE and others. Ethanol from renewable sources can be used to manufacture ETBE and the renewable fraction of the ETBE blending component counts toward the renewable mandate. In the future, more bio-derived methanol may also be used to manufacture MTBE in order to increase the renewable fraction in gasoline blending.

For diesel fuels, esterified natural oils, called fatty acid methyl esters (FAME), can be blended up to 7% by volume in diesel fuels (B7[1]) as long as they comply with the EU FAME standard (EN 14214) before blending. Many different vegetable oils, animal fats and used cooking oils are now routinely used in Europe to produce oxygen-containing FAME, while some fraction of these natural oils is also hydrogenated to produce an oxygen-free blending component. The European Committee for Standardisation (CEN) is making progress revising the EU-wide fuel standards which will increase the allowed percentages of biofuels to higher levels in transport fuels for compatible vehicles.

CONCAWE's market fuel survey

To find out more about the oxygenates that are actually being used in different European countries, CONCAWE conducted a survey of gasoline and diesel fuels from 17 countries covering the winter months of 2010–11. Fuel samples were collected directly from service stations that were selected to provide a good geographical distribution within each country and a representative cross-section of different fuel grades. The number of samples from each of the 17 countries was selected to reflect the relative fuel demand in different countries with more samples picked up from the larger countries and fewer from the smaller countries.

Overall, 100 gasolines and 142 diesel fuels were collected and analysed in a single laboratory to ensure consistent results. Special precautions were taken to safeguard the quality of the fuel sample from the time that it was collected until the analysis had been completed. The survey focused primarily on oxygenate concentrations and types, and did not verify that they were all produced from renewable sources. Other measurements were completed to compare the quality of the market fuels to the prevailing specifications. For the diesel fuel samples, the presence of any hydrogenated natural oils was not measured because these components are almost indistinguishable from the diesel fuel itself.

The survey results

Figure 1 shows the average oxygenate contents that were measured in the 100 gasoline samples. As can be seen, the oxygenate contents varied substantially from one country to the next, ranging from about 2.5% vol-

[1] Biofuel contents are expressed as the percentage of bio-component in fossil fuel on a volume basis. For example, E5 stands for 5% volume ethanol in gasoline while B7 stands for 7% volume fatty acid methyl ester (FAME) in diesel fuel.

Figure 1 Oxygenate contents in gasolines from 100 service stations

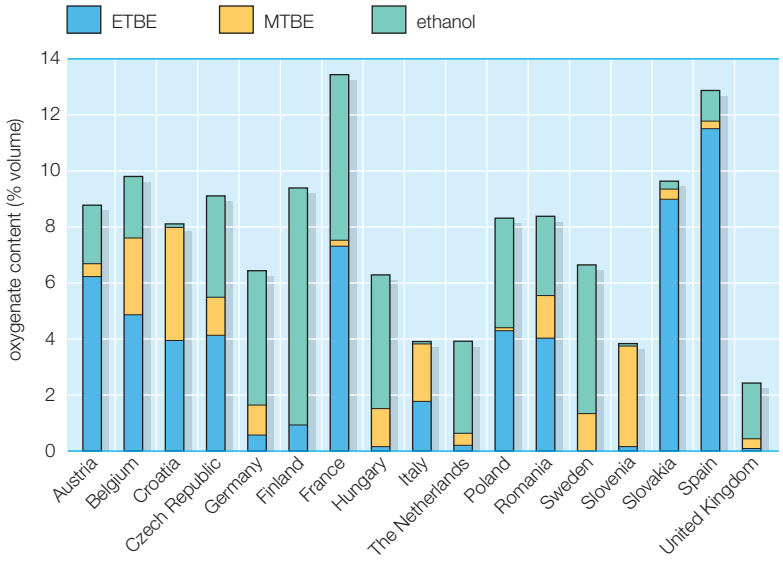
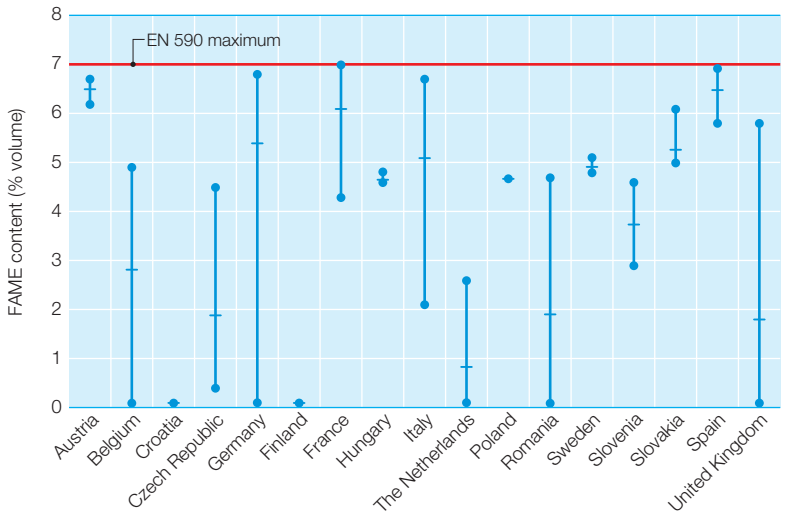


Figure 2 FAME contents in diesel fuels from 142 service stations



ume in the UK to more than 13% volume in France. More interestingly, the types of oxygenate that were used in each country were also quite different, with Finland using mostly ethanol, Spain and Slovakia using mostly ETBE, and Slovenia using mostly MTBE. Other countries, like France, Poland, Belgium, and Romania, used a mixture of ethanol and ether while Croatia and Italy used a mixture of ETBE and MTBE.

In Figure 2, the average FAME contents, as well as the maximum and minimum values, are shown for the 142 diesel fuels. The red line at the 7% volume mark shows the maximum FAME content that is currently allowed by the European diesel fuel specification (EN 590).

Again, clear differences can be found from one country to the next. For example, many countries, like Austria, Germany, France, Italy, Slovakia and Spain, showed average FAME contents higher than 5% volume with occasionally large differences between the maximum and minimum values. FAME contents less than 5% volume were found in Belgium, the Czech Republic, The Netherlands, Romania, Slovenia and the UK, again with reasonably wide variations in the maximum and minimum values. Essentially, no FAME was found in the samples from Croatia and Finland.

Although the oxygenates varied from country to country in this survey from the winter of 2010–11, it is important to note that all of the fuels dispensed from service station pumps were in compliance with the prevailing EU and national specifications. And, because today's newer vehicles are compatible with the oxygenate levels found in this survey, the EU's objective of reducing GHG emissions from the fuels used by the transportation sector may be just a little closer to reality.