



Briefing 08/66 December 2008

The use of bio-diesel by local authorities

This briefing provides an outline of a recent assessment of the potential to use 'waste oil' derived bio-diesel in the running of council vehicles. It is provided to local authority chief executives, council leaders, elected members and APSE transport contacts.

Key Issues:

- Environmental Issues
- Engineering Factors
- Risk Management
- Biodiesel Policies
- Cost implications
- Vegetable oil alternatives
- Commercial supply of bio-diesel

1. Introduction

APSE has recently undertaken an assessment of the potential to use 'waste oil' derived bio-diesel to run Council vehicles. Two aspects of such a scheme were assessed:-

- Bio-diesel supply
- Implications on a current fleet

A local authority must be able to secure a reliable source of 'waste oil' derived bio-diesel in sufficient quantity and quality to sustain the scheme into the future. Use of alternative fuel has implications for vehicles, both technically and legally as warranties may be voided.

2. Background

“Bio” is a multi-purpose prefix which is often misleading. In terms of biodiesel, recent press reports have inferred that biodiesel is capable of shrinking the carbon footprints of fleets up to 70%.

However, the environmental benefits of biofuels are still being debated within the scientific community. Some large companies have now stopped biofuel trials as the intensive farming methods used to produce biofuels can result in a larger carbon footprint than traditional fuels, and the sustainability of supply is uncertain.

There are other biofuels available, such as bioethanol (the petrol equivalent), but these would require major investment into new fleets of vehicles and supporting infrastructure. Most manufacturers approve a mix of 5% biodiesel and 95% normal diesel (EN590) and will invalidate warranty if a mix of more than 5% is used. It is estimated that a 5% mix gives a 2-3% reduction in carbon footprint.

Levels of biofuel mix in excess of 20% will impact on engine service intervals which will require to be reduced as oil and fuel filters require changing up to twice as often, increasing cost and downtime.

Biodiesel has a lower calorific value than normal diesel of between 7% and 8% which leads to an increase in fuel consumption. A recent trial on MAN and Scania Chassis over 5 months on 95% biodiesel to 5% normal diesel found much higher levels of fuel consumption. Vehicle performance dropped from 8.5 to 7 mpg and fuel and oil filters had to be changed every 6 weeks. Analysis of costs during the trial determined that 17.65% more fuel per mile travelled was being used, putting users at a distinct disadvantage against competitors. It is likely that for refuse collection vehicles, with prolonged high engine revs to power binlifts and packing mechanisms, this figure could be even higher.

3. Environmental Issues

Biodiesel's ability to cut CO₂ emissions is its attraction. The CO₂ emitted when the fuel is burnt has been absorbed by the crops grown to produce it; so this is not additional CO₂ like that from petroleum diesel. It is generally agreed that a typical 100% biodiesel (B100) cuts net CO₂ emissions by 50-70%. The savings with a typical B5 blend are around 3% and approaching 20% with a B30. The standard for B100 biodiesel demands a sulphur content of less than 10 parts per million (ppm) and low sulphur helps keep particular emissions low. Low sulphur and low particulates should make biodiesel particularly attractive for any vehicle with a diesel particulate filter (dpf), yet expert opinion is divided.

A study by Eminox and Johnson Matthey into the effects of B30 biodiesel on buses in France fitted with their continuously regenerating traps (CRT), concludes that the fuel “should not present any problems”. However, Volvo trucks will not approve B30 for any vehicles fitted with a DPF and MAN say biodiesel must not be used with a CRT.

Engineers from Scania have approved the use of any blend biodiesel with a DPF despite the risk that the phosphorus content of the biodiesel will poison a DPF and shorten its life. EN 14214 caps biodiesel's phosphorus content at 10ppm.

Most tests indicate that emissions of oxides of nitrogen (NO_x) increase when using biodiesel but this problem is addressed by second-generation biodiesels. Biodiesel is reckoned to be virtually free of polycyclic aromatic hydrocarbons (PAH). Incomplete combustion of these in diesel engines leads to emissions that add to the particulate count and are blamed for respiratory problems.

On the crucial issue of fuel consumption, anyone switching from diesel to pure biodiesel can expect a fuel economy drop of around 8%, but most operators switching to blends below B20 are unlikely to notice any difference.

4. Engineering Factors

When it comes to engine health, biodiesel gets mixed reports. It's lubricity is good but it's boiling point is considerably higher than that of petroleum diesel, so any unburnt fuel getting into the engine cylinders is less likely to burn and more likely to accumulate in the sump, diluting the oil. Engine and vehicle manufacturers insist on oil-drain intervals being reined-in when biodiesel concentrations beyond B5 are used, which may result in significant costs to councils if maintenance and downtime costs are increased. The following key factors must be fully considered:-

- **Solvent Action**

Biodiesel is a solvent and can be aggressive on some fuel-hose rubber so careful selection of hose materials and regular checks for leaks are recommended by vehicle manufacturers. Solvent action cleans out sediment and deposits which built up in fuel systems and diesel tanks, so fuel filters are more prone to blocking immediately after a switch to biodiesel. Some manufacturers demand that fuel filters are changed more frequently thereafter.

- **Water content**

Biodiesel's tendency to absorb moisture tends to attract more water than diesel in vehicle tanks and bulk storage tanks. This is a concern to fuel injection manufacturers, so an additional water separator may be needed. As bacteria can thrive at the point where fuel and water meet, fuel filters can also be blocked.

- **Viscosity**

Pure biodiesel is 50-100% more viscous than petroleum diesel and has an inferior cold filter plugging point. This gives an increased risk of fuel filter blocking in winter and there are fears that it can cause excessive heat in rotary fuel pumps, causing them to seize, leading to poor injector nozzle spray atomisation. Volvo trucks suggest a switch back to conventional winter-grade diesel when the ambient temperature falls below 10 degrees celcius.

5. Risk Management

There are technical problems associated with the use of biodiesel but the risks are manageable, commensurate with blend and strength. Most leasing and contract hire companies seem happy with the use of B5 diesel meeting the EN590 specification, but are not allowing their vehicles to be used on a blend stronger than B5.

However, a number of manufacturers are now prepared to accept stronger blends within their warranty terms, as long as there are additional maintenance procedures. The common thread through all manufacturer policies is the European standard EN 14214 – minimising the risk of indifferent and inconsistent fuel quality.

6. Biodiesel Policies

The views of vehicle and engine manufacturers on the use of biodiesel vary and it is not possible to detail all the different engine and vehicle types used by Local Authorities.

However, many of the most popular manufacturers are developing their engines to accept increased blends of biodiesel as long as there are changes to maintenance and servicing regimes. Further information on manufacturers' current policies is available on request.

7. Cost Implications

Bio-diesel receives a 20p/litre reduction in fuel duty against conventional diesel, however, at the current norm of 5% blend this only equates to 1p/litre reduction. It also has a lower calorific value than normal diesel of between 7% and 8% which leads to an increase in fuel consumption. Trials on larger vehicles have determined a decrease in mpg of between 15 and 20%.

Engines have to be serviced at shorter intervals when running on biodiesel and fuel filters require changing up to twice as often, increasing downtime and costs.

New vehicles with Euro 5 engines have low emissions attracting reduced Vehicle Excise Duty, better fuel consumption and lower maintenance costs.

8. Vegetable Oil Alternatives

A number of local authorities are using either vegetable oil such as soya oils or used cooking oil from schools, local restaurants and chip shops to power both light and heavy commercial vehicles directly. However, due to limited availability of fuel, and the initial cost of the conversion kits, many of these schemes are limited to one or two vehicles. The cost of a vegetable oil engine conversion kit for a small van is approximately £1,000. The van would need to cover approximately 36,000 miles to cover the cost of the conversion kit which would take more than three years on an average mileage vehicle. The kit for a larger van costs between £1500 and £2000.

9. Commercial Supply of Biodiesel

To use bio-diesel on a sustainable basis, local authorities would need to secure supplies of consistent quality fuel.

The market for bio-diesel is still in its infancy with many small operators offering to supply in IBC's containing 1,000 litres. A typical tanker load is 30,000 litres and delivery costs are around £600 per delivery. However, most of the smaller supply companies have not secured long term supplies of oil and therefore production may be sporadic with a knock-on effect for deliveries. The production process is relatively simple allowing small scale production, however quality is variable and procedures for removing tallow are varied. Any contamination can have significant implications for the vehicles involved, even if only a requirement for an increased frequency of servicing. There are however, a limited number of commercial suppliers able to fulfil the necessary supply criteria of quantity and quality. Many supply a blended biodiesel e.g. Greenenergy supplied bio-diesel from the following feedstock between 15.4.08 and 14.5.08 – Soy 62%, Tallow 25%, Palm 7%, Rapeseed 4% and cooking oil 3%. Tesco run their fleet on a 50% blend of this and fossil based diesel.

There are several commercial operations producing bio-diesel in large volumes. The majority take oil feedstock from a variety of sources and blend it with mineral based diesel.

10. APSE comment

APSE is keen to see the development of any fuels which reduce CO2 emissions and would therefore encourage engine and vehicle manufacturers to facilitate the use of

increased blends of biodiesel. However, as detailed above, there are many other considerations for local authorities when contemplating increased use of biodiesel.

Although biodiesel is better for the environment and health than petroleum diesel, it can result in increased costs for local authorities in terms of the frequency of servicing and maintenance, and due to the fact that biodiesel leads to higher levels of fuel consumption with significant decreases in miles per gallon particularly for larger vehicles.

Local authorities must also consider the availability of biodiesel and the sustainability of supplies. A typical local authority uses around 750,000 litres of derv per year and there are a limited number of suppliers of waste derived bio-diesel of up to 100% blend who claim to be able to supply in sufficient volumes.

The use of vegetable oil alternatives is also limited for authorities. Local collection of used cooking oil is a labour intensive process and produces relatively small volumes of low grade feedstock, and the rising value of cooking fat means that it is unlikely that local authorities could secure sufficient supplies to process in economic quantities.

Given the current oil price instability and the loss of the lower tax band for bio-diesel in 2010, the future price is likely to track that of mineral oil with limited economic rationale for change over. If mineral oil prices remain low then bio-diesel may cease to be economically viable to produce and therefore supply.

As mentioned earlier in this briefing, the intensive farming methods used to produce biofuels can result in a larger carbon footprint than traditional fuels therefore the base supply of bio fuel products can have significant implications if they are not from renewable sources.

Anne Clayton
Principal Advisor