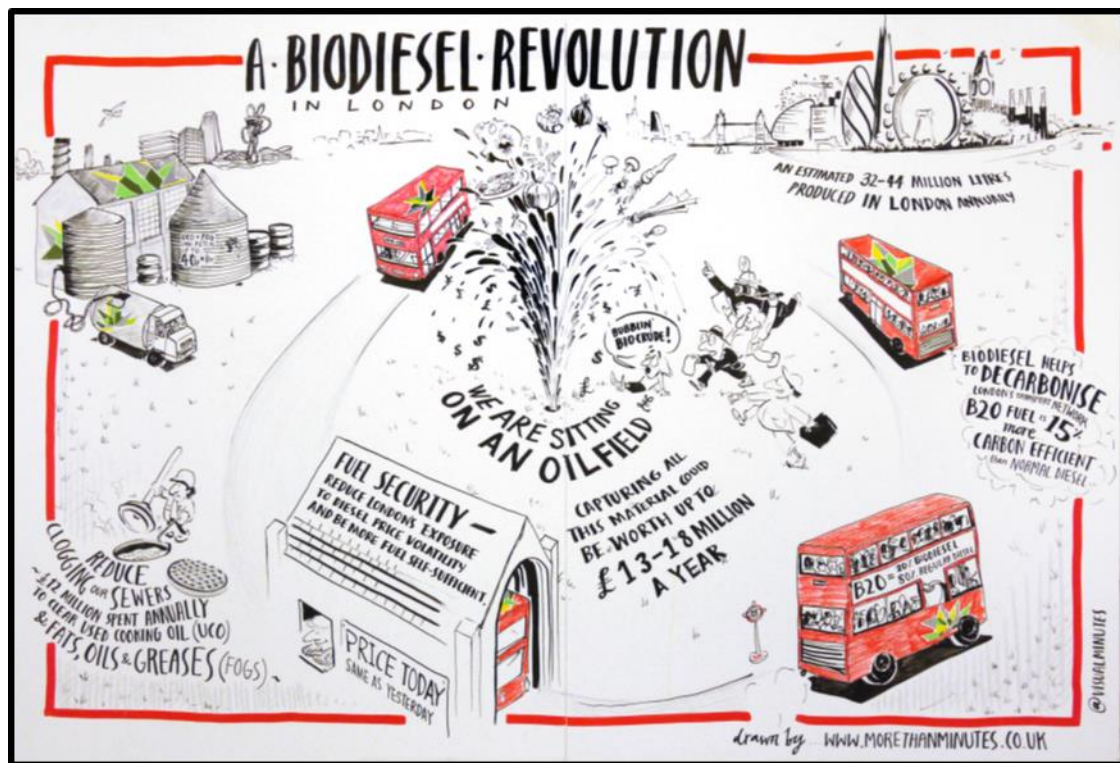


GREATER LONDON AUTHORITY

The Mayor's Biodiesel Programme

Operational Guidance Note V2

For: Local Authority Fleet Managers and Attendees of the Biodiesel Stakeholder Event, January 2015



Publication: June 2015

Background

In January 2015 City Hall held an event to share updates on the progress of the biodiesel market. This note highlights the Mayor's biodiesel ambition for London, some of the points that were made by the speakers, and is designed to help answer some common questions and debunk some myths around biodiesel use. For those who are considering using biodiesel as an alternative fuel, we're happy to talk you through this process, answer any further questions, or put you in touch with people who can help you decide if biodiesel is a good option for your fleet. Contact details are provided at the end of this note. More information on the Mayor's biodiesel programme can be found at www.london.gov.uk/biodiesel.

Cover Image: More Than Minutes; 'Biodiesel Revolution' Cartoon

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1. Introduction

To help create a low carbon, high tech transport network in London, the Mayor of London would like London's buses and municipal fleets to be powered by biodiesel made from waste oils. The biodiesel industry has made much progress in the last ten years with regard to fuel quality and performance. Its use has now been warranted for use in Euro VI heavy diesel engines, by Cummins and Volvo.

The Mayor wants to grow London's biodiesel infrastructure so it can produce biodiesel made from London the South East's Used Cooking Oil (UCO) and Fats, Oils and Greases (FOGs), right here in the city. This will help to create jobs, support the low carbon economy, de-clog our drains, and save our city thousands of tonnes of CO₂ every year.

We support the use of up to 20%, or B20 as it is known, biodiesel blend. This is because it can be put into directly into diesel vehicles with no modifications and if needs be, a switch back to regular diesel can be made. Its use will have no worse impact on air quality than standard diesel, and at this percentage we estimate that we have enough UCO in London and the south east to provide the required feedstock.

2 Vehicle Considerations

2.1 Compatibility

- All diesel fuel in the UK has some biodiesel. Officially up to B7 (a mix of seven per cent biodiesel and 93 per cent standard fuel). This can range from 0-15 per cent when fuel is analysed. That means all vehicles run on a biodiesel blend.
- Vehicle manufacturer statements typically mention B5 compatibility increasingly more manufacturers are warranting up to B30 provided the fuel meets EN14214 standard.
- Across the world, many different vehicles and engine types already run on biodiesel with no ill effects. The UK produces around 125 million litres of biodiesel meeting the sustainability standard each year. Around 26 million litres, or 10 per cent of biodiesel produced in the UK is derived from used cooking oil.¹
- Compatibility can be an issue with some materials. This includes some polymers used in seals and fuel supply lines. These can usually be fixed by giving the vehicle chassis/engine number to the relevant manufacturer and asking an alternative to be fitted.

2.2 Maintenance

- Biodiesel has a cleansing effect on the fuel system. Initially biodiesel cleans the fuel tank and delivery system by purging out all the heavy deposits left behind by mineral diesel. This usually appears in the vehicle's fuel filter as black dirty engine oil like contamination. As a result, when you start using biodiesel, intermediate fuel filter changes are recommended to stop fuel starvation. If there are pre-filters or mesh fuel pickups these should be inspected and cleaned too.
- Aside from an immediate fuel filter change when starting on B10 B20, no change to the maintenance schedule is normally necessary. Table 1 below sets out a general maintenance schedule for different biodiesel blends. If in doubt talk to your manufacturer.
- For higher biodiesel blends manufacturers usually advise that you carry out more fuel and oil filter changes and engine oil changes than with standard diesel. This

¹ 2014/15 UK biodiesel statistics weblink <https://www.gov.uk/government/statistics/biofuel-statistics-year-7-2014-to-2015-report-1> Last accessed 21 May 2015.

is because biodiesel is less volatile than mineral diesel and may collect in the engine oil where mineral diesel would evaporate off. This can cause oil degradation. If the overall level increases dramatically, it can cause engine failure. For B20 blends this is unlikely to happen.

Table 1: Maintenance schedule

Blend	Manufacturers recommended servicing	Fuel filter change
B100	One extra oil change a year	10 week cycle
B80	One extra oil change a year	12 week cycle
B50	No change	14 week cycle
B30	No change	16 week cycle
B20	No change	No change
B10	No change	No change

Source: Simmonds Transport 2015

2.3 Warranty

- Manufacturers warrant components, not fuel. However, the level of support you get can vary. Manufacturers of larger vehicles are generally more supportive of biodiesel. Scania and DAF warrant up to B100 on some vehicles. Cummins and Volvo will warrant many of its engines on B20. You should always get warranty advice directly from the manufacturer.
- Most large industrial engines have options which run on high percentage biodiesel applications, but not necessarily in road vehicles. For instance Mercedes engines in CLAAS agricultural machinery have a warranty for B100 use. When supplied with chassis numbers, manufacturers can make recommendations for vehicles including any tweaks that may be needed.

- In Hackney Council's experience, most truck manufacturers will cover warranty to a B30 blend of biodiesel - but it must meet the European EN14214 grade. Hackney have been operating 42 vehicles on B100, and never had any problems with biodiesel.

2.4 Emissions and performance

- Using biodiesel has a positive effect on net CO₂ emissions as the production of vegetable oil is renewable. The fact it is waste oil being recycled means it is 85 per cent more carbon efficient over standard diesel. A B20 blend achieves a 10-15 per cent CO₂ reduction over standard diesel.
- Particulate, sulphates, carbon monoxide and hydrocarbon emissions are also reduced; exactly how much depends on the type of engine used.
- Biodiesel has a lower caloric value than standard diesel. At 100 per cent blends there may be some reduction in performance at full load conditions (for example motorway driving). At B20 blends, this will not be noticed.
- Emissions reductions previously focused only on CO₂ but now can also include NOx. Euro 6 engine technology may deal with the NOx associated with biodiesel.
- A B20 blend is best. It doesn't require any engine modifications or major vehicle maintenance.
- TfL have carried out testing that demonstrated at a B20 blend or lower, there is no negative air quality impact, compared to standard diesel. See Appendix 1, 'TfL Testing Results' for further details.

Text Box 1: Vehicle maintenance experience of B100, Norman Harding, Fleet Manager, London Borough of Hackney

- No modifications to older vehicles needed
- Specified the biodiesel requirements at time of order when buying Euro 5 HGV's. Mercedes and DAF made tweaks to the vehicles in production
- Check engine oil and replace fuel filters more often. Fuel filters are changed within two weeks when moving from normal DERV to biodiesel
- Carry out regular specialist engine oil checks. No problems found to date
- Investigate any failures
- 2013/14 LB Hackney ran 42 vehicles on B100 – saving 545 tonnes CO₂

3 Fuel Storage

3.1 Fuel tank cleanliness

- Biodiesel will purge the tanks and remove any build-up of deposit. This can even happen when the tank's been cleaned, as biodiesel's cleaning power will remove any residues left. So you should use a filtration system if there isn't one already.
- Before adding any biodiesel to your bulk fuel tanks, you should get them cleaned and checked as most will have some sort of contamination. If you have tank filters, you may not need to make further checks as often. Any contamination will pass through to the filters. These must be monitored for the first month to ensure the tank is clean. This is similar to the vehicle fuel tanks when all contaminants are cleaned out. The higher blends like B50 – B100 will push through the filter quicker until the tanks are clean.
- EN14214 grade biodiesel should be used within six months. Fuel quality and performance can decline if stored for long periods of time

3.2 Settlement

- Fuels can produce some settlement as residues cleaned from the tank will usually go to the bottom. Fitting a drain means this can be easily removed.

3.3 Cold

- Like standard diesel, some biodiesel will wax at cold temperatures. You can fix this by adding biodiesel specific additives to the supplied fuel. Hackney adds Bioboost 1000 and has had no cold start problems.
- If they're above ground, you could insulate fuel tanks and pipes with lagging.

3.4 Trapping moisture

- All fuels can absorb moisture from the atmosphere. If you don't use all your stored fuel quickly, you should fit a vent dryer to prevent moisture being trapped, particularly as air is drawn in as the tank's emptied.

4 Finance and Infrastructure

4.1 Cost

- As minimal or no vehicle modifications are needed, the operational costs associated with biodiesel are very low. Fuel checks, recommended quarterly, cost around £650 per test. Maintenance costs are around £400 per vehicle, and relatively straight forward as switching to biodiesel doesn't require any specialist knowledge or technology, and can be done in-house.
- Cost comparisons can be made with gas conversions which can cost between £4,000 and £5,000 for a small vehicle and higher for an HGV.
- Depending on volumes supplied and the price of virgin oil, biodiesel is comparable or can be slightly more expensive than standard diesel. Using biodiesel can be a cost-effective way for local authorities to save CO₂ and should be considered alongside other fuels in the short term, and compared with the cost of CO₂ reduction measures from non-fleet activities.

4.2 Supply infrastructure

- You don't need anything more than a bunkered tank similar to those already used by most fleet operators. Standard diesel tanks can be cleaned and replaced with biodiesel.
- You can run a trial with relatively small amounts of biodiesel by using small scale temporary tanks.

4.3 Leadership

- Having a successful alternative fuels strategy requires leadership, at a political, corporate and functional level. All must agree and understand how this should happen and what is expected. Those involved should be ready to find and promote the best results. You should also be realistic about costs and achievable targets.

4.4 Safety

- Biodiesel is safe to use. It's not explosive like gas, doesn't need to be stored at high pressure or very low temperatures and is biodegradable. There are also no issues with high voltage or cable trip hazards associated with electric vehicles.

4.5 Procurement

- Public sector procurement rules mean you should use a normal tendering process subject to contract value. Existing framework contracts don't always provide for high blend biodiesel.
- Think about how reliable the supply chain is and what would happen if the fuel becomes unavailable. When tendering for supply, consider using a primary supplier backed up by secondary suppliers.
- Ensure transparent supply chain to demonstrate biodiesel is from waste derived products.
- Ensure that your supplier is International Sustainability and Carbon Certification (ISCC) accredited.
- Carry out quality monitoring and contract management like any other contract. Biodiesel pricing doesn't vary in line with standard diesel. That means you should agree mechanisms for price adjustment with your supplier.
- To maintain quality, ensure that your fuel meets EN14214 standard and BS 590 – ask for the series of test results.
- Carry out a risk assessment - especially if your supplier's small and can't deliver by normal fuel tanker. Make sure you have other plans in place.
- When buying, some vehicle manufacturers are slow to support the use of biodiesel so explore options for biodiesel use in older vehicles. At Hackney Council the first trials were on 'out of warranty' Euro IV vehicles. After talking to manufacturers, Hackney bought Euro V vehicles from DAF and Mercedes specifically to run on B100. Citroen supported a B30 blend.

5 Manufactures' Views

Text Box 2: Adrian Wickens Marketing Communications Manager, Volvo

- Volvo bus – There are 78 Euro VI hybrid double decker buses in London. We have two engine specifications – one for regular B7 and one for B100 fuel. For any fuel with higher bio content than the regular seven per cent, like the proposed B20 in London, we would choose the B100 specification engine. This is available now. We have made the hybrid bus a priority for this engine as it's what we'll be supplying to TfL.
- In our truck range, we have a similar B100 capable 8 litre engine option for all non B7 fuels.
- We expect that B20 can be accommodated without undue impact on maintenance.
- We caution on the need for a consistent B20 specification. The 'recipe' should not vary too widely. Working to the accepted fuel standards should cover this risk.
- We expect a detailed 'pathway' of the B20 fuel to be measured so that the 'cost' per megajoule of the fuel in CO₂ is clearly established. This is the Well-to-Tank part of the Well-to-Wheel carbon dioxide performance of the fuel. It is an important part of what makes a bus 'low carbon'. This status means that the bus operator gets an extra payment per km of BSOG (Bus Service Operator's Grant). On TfL routes, the BSOG payment is built into the route contract.
- The promotion of ultra -low emission vehicles under the OLEV programme includes buses and the use of a Well-to-Wheel CO₂ standard to determine ultra -low emission performance would further develop the Green Bus Fund experience. That's another reason to audit the Well-to-Tank emissions of the proposed B20 fuel.

Text Box 3: Peter Williams, Product Environmental Management Director,
Cummins

- Cummins views BioDiesel (up to B20) as a standard fuel
- No hardware or software changes needed
- Some operational considerations apply
- Extra admin requirements in Euro VI type approval
- B7 is standard reference diesel fuel
- Other fuel types covered by 'universal fuel-range' provisions – requires proof of emissions impact before fuel can be included in certificate
- Cummins now working to add B20 to Euro VI type approval

6 Acknowledgements and Additional Support

- Greater London Authority: Doug.simpson@london.gov.uk – Strategic support and advice
- Greater London Authority – nicola.murphy-evans@london.gov.uk – Operational note coordination
- TfL: FinnCoyle@tfl.gov.uk – Technical support
- Hackney Council: Norman.harding@hackney.gov.uk – Local authority advice
- Simmonds Transport: mark@simmondstransport.co.uk – Commercial fleet advice
- Cummins: emea.customerassistance@cummins.com - Engine warranty advice
- Volvo: adrian.wickens@volvo.com - Engine warranty advice
- Regensis: mike.redford@regensisbioenergy.com – Biofuel advice



**MLTB CYCLE DIESEL
EMISSIONS TEST SUMMARY SHEET**

Customer:	Transport for London		
Customer Address:	11th Floor G6 Palestra, 197 Blackfriars Road, Southwark, London		
Test Purpose:	ADL E400 MLTB tests using B20 biodiesel		
Vehicle No:	LK12 CSK	Site No.	2
Vehicle Type:	ADL EV400	DYNAMOMETER SETTINGS	
Engine:	Cummins ISB6.7EV250 Euro V	INERTIA	14147 kg
Transmission:	Auto	F°	345.97 N
Fuel Type:	B20 Biodiesel	F ¹	15.100 N/kmh
Fuel Batch No:	EN590 Compliant	F ²	-0.14796 N/kmh ²
Millbrook Project No:	PT0034-056-01	F ³	0.0035290 N/kmh ³

Test No. ML02013159		09-Jul-13							Fuel Cons
Odo	54350	UNITS	HC	CO	NOx	CO2	PM	(Carb Bal)	
Phase 1	<i>Outer London</i>	g/km	0.000	1.157	9.736	1257.4	0.023	47.55	
Phase 2	<i>Inner London</i>	g/km	0.000	1.283	17.134	1746.1	0.030	66.01	
Combined result		g/km	0.000	1.192	11.812	1394.5	0.025	litres/100km	
								53.60	


Test No. ML02013160		09-Jul-13							Fuel Cons
Odo	54365	UNITS	HC	CO	NOx	CO2	PM	(Carb Bal)	
Phase 1	<i>Outer London</i>	g/km	0.000	1.039	10.139	1204.5	0.021	45.55	
Phase 2	<i>Inner London</i>	g/km	0.000	0.952	18.032	1690.7	0.025	63.90	
Combined result		g/km	0.000	1.015	12.334	1339.7	0.022	litres/100km	
								51.48	

Test No. ML02013161		09-Jul-13							Fuel Cons
Odo	54385	UNITS	HC	CO	NOx	CO2	PM	(Carb Bal)	
Phase 1	<i>Outer London</i>	g/km	0.013	1.157	10.434	1179.6	0.021	44.61	
Phase 2	<i>Inner London</i>	g/km	0.011	0.948	17.667	1691.8	0.030	63.94	
Combined result		g/km	0.013	1.099	12.439	1321.5	0.023	litres/100km	
								50.79	

Average of Combined Tests (g/km)	0.004	1.102	12.195	1351.9	0.024	51.96
Standard Deviation/Mean x100	141.32	6.56	2.25	2.29	4.60	2.30

Comments: **DATA TO BE TREATED AS INVALIDATED BY MBK AT THIS POINT**

Fuel Consumption calculated using carbon balance method (B100 properties: CWF 76.2%, density 0.876 kg/litre)

Compiling Engineer:	Date:	Approving Engineer:	Date:
	10-Jul-2013		

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**MLTB CYCLE DIESEL
EMISSIONS TEST SUMMARY SHEET**



Customer:	Transport for London		
Customer Address:	11th Floor G6 Palestra, 197 Blackfriars Road, Southwark, London		
Test Purpose:	ADL E400 MLTB test using pump diesel		
Vehicle No:	LK12 CSK	Site No.	2
Vehicle Type:	ADL EV400	DYNAMOMETER SETTINGS	
Engine:	Cummins ISB6.7EV250 Euro V	INERTIA	14147 kg
Transmission:	Auto	F°	345.97 N
Fuel Type:	Pump Diesel	F ¹	15.100 N/kmh
Fuel Batch No:	EN590 Compliant	F ²	-0.14796 N/kmh ²
Millbrook Project No:	PT0034-056-01	F ³	0.0035290 N/kmh ³

Test No.	ML02013162	09-Jul-13							Fuel Cons (Carb Bal)
Odo	54388	UNITS	HC	CO	NOx	CO2	PM		
Phase 1	Outer London	g/km	0.000	2.551	10.406	1243.2	0.028		47.10
Phase 2	Inner London	g/km	0.000	2.648	16.852	1765.5	0.040		66.83
Combined result		g/km	0.000	2.578	12.211	1389.4	0.031		litres/100km
									52.62

Conclusion: PM emissions are, as expected, lower on B20 than pump diesel. There is no statistically significant difference in NOx emissions between B20 and pump diesel.

Comments: **PROVISIONAL DATA**

Compiling Engineer:		Date:	10-Jul-2013	Approving Engineer:		Date:	
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