

**BWG-P-09-20**

## **Recommended Treatment of Biofuels**

*This paper is provided for information only. It sets out in detail the recommendation made by LowCVP to the DfT regard the treatment of biofuels.*

This paper considers the role biofuels and in particular biodiesel can play in delivering Low Carbon Emission Buses (LCEB) and potential for overlap between the RTFO and the policies to incentivise LCEBs in influencing biofuel take-up. It concludes that excluding biofuels from the definition of a LCEB would present a barrier to the role out of LCEBs, in particular where the bus and fuel together provide sufficient green house gas (GHG) savings to meet the target, and that the potential for the policies to overlap is limited and there are practical means of preventing this from occurring.

### **The Issue**

The LCEB definition, developed by the LowCVP and on which the Bus Service Operators Grant (BSOG) LCEB supplement and the Green Bus Fund (GBF) are based, was developed to be technology neutral in order to ensure future technologies beyond hybrids were not prevented from playing a role in reducing GHG emissions from buses. As a consequence the LCEB definition is based upon a life cycle, or well-to-wheel (WTW), analysis of the GHG emissions of buses and of the fuel supply chain. Therefore biofuels are included in the definition and calculation of GHG emissions of LCEBs.

The DfT are keen to ensure that the RTFO drives aggregate biofuel take-up and that the BSOG LCEB supplement or the GBF, which are aimed at the additional capital cost of LCEBs, don't provide an additional incentive for biofuels. The main risk of this is if a normal diesel bus could qualify as a LCEB simply through the use of a biofuel, without incurring additional capital costs from modifications to the driveline or fuel systems of the bus.

### **Background**

It should be noted that the fuel duty incentive for biofuels will be removed in 2010 and that no other incentive will be provided to replace this. This therefore time limits the period in which the policies to promote LCEBs could duplicate the incentive for biofuels.

The removal of the fuel duty incentive for biofuels in conjunction with the RTFO is expected to result in the supply of low blend biodiesel and bioethanol in the UK as there will be no incentive for a high blend market. Current fuel specifications allow biofuels to be blended up to 7%. However the Renewable Energy Directive will require biofuels to have a market share of 10% by energy content (or approximately 14% by volume) by 2020. Therefore at some point a market for higher blend biofuels may need to be created.

## **Types of Biofuel**

There are broadly three types of biofuels; biodiesel, bioethanol and biomethane. Biomethane is an extremely low carbon fuel and requires a bus to have a completely different engine and fuel system to a normal diesel bus. As a consequence the DfT have explicitly allowed these buses to qualify as a LCEB simply on the basis of the fuel used. However, evidence that the bus is running on biomethane must be provided in claiming the BSOG LCEB supplement.

In the case of bioethanol, again the vehicle will have a completely different engine than a normal diesel bus would. As buses running on biomethane or bioethanol are not produced in significant volumes they will suffer from a significant capital cost premium, as do hybrid buses. The BSOG LCEB supplement and the GBF were designed specifically to help overcome the additional capital cost of LCEBs. These costs are incurred in order to benefit from the lower GHG emissions of bioethanol and biomethane, therefore it is appropriate for these buses to be able to take account of the full GHG savings in the fuel supply in addition to the efficiencies delivered by the bus itself.

However, in the case of biodiesel it is possible for this fuel to be used in a normal diesel buses with only minor changes to the engine and fuel system. It is possible that a normal diesel bus running on high blend biodiesel might achieve the LCEB target. The current approach of requiring diesel to be used to calculate the GHG emissions of a bus capable of using biodiesel prevents this occurring. However, medium blends of biodiesel could also be used in conjunction with a number of technologies, such as retrofit mild hybrids or stop-start systems, to achieve the LCEB target. This could allow a greater uptake of the GBF, get more LCEBs on the road in the UK and create job opportunities in the UK supply chain. The current approach would prevent these additional benefits accruing to the UK.

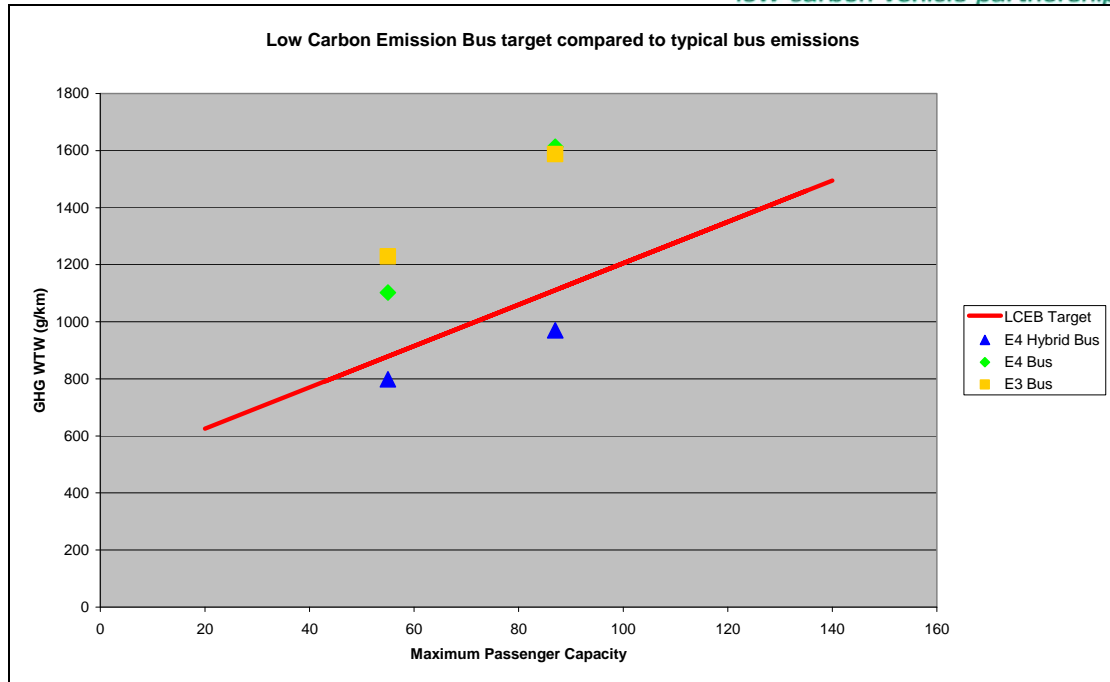
The remainder of the paper looks at the potential for biodiesel to qualify a bus as a LCEB without any further intervention and proposes a basis for defining the extent to which biofuels should be incorporated into the definition of a LCEB in order to avoid an overlap with the RTFO.

## **Low Carbon Emission Bus Target**

The definition of a LCEB is based on well-to-wheel GHG emissions as a function of maximum passenger capacity, for buses tested on the MLTB test cycle. The maximum target line which buses must achieve in order to be eligible to be certified as a LCEB is given by the function;

$$\text{GHG WTW} = 480.02 + 7.25 \times \text{max passenger capacity}$$

This is shown in figure 1 below, which also shows the emissions of typical single and double deck buses with hybrid, Euro 4 and Euro 3 engines. The LCEB target was developed to be 30% lower than the GHG emissions of a range of Euro 3 buses.

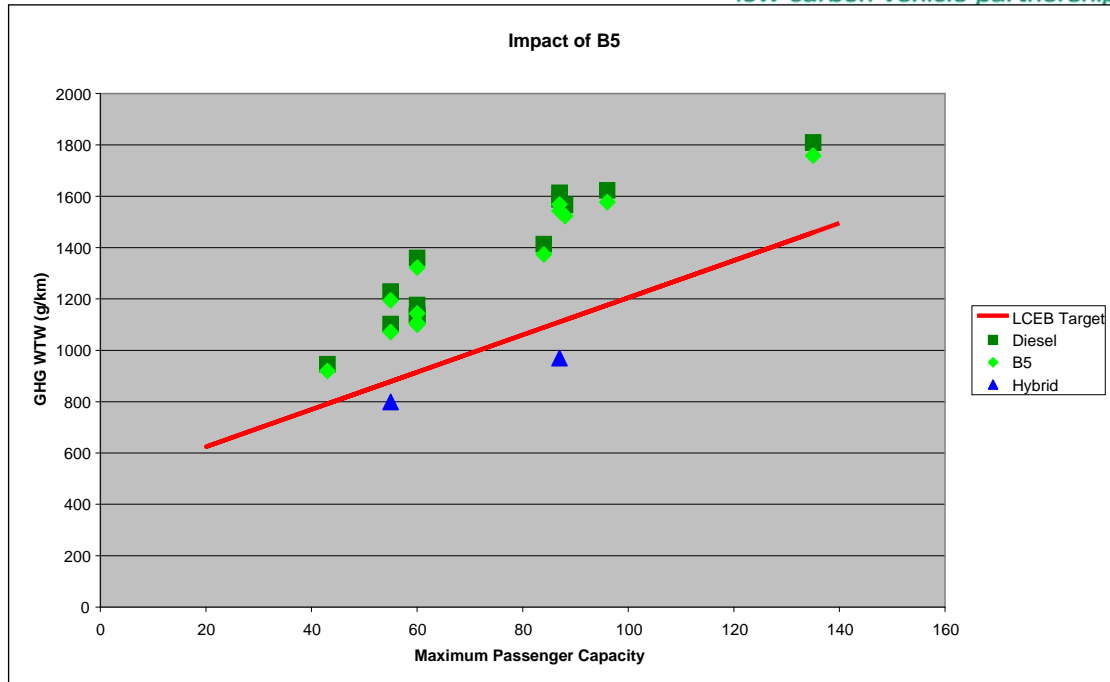


**Figure 1**

### Impact of biodiesel

The Renewable Transport Fuels Obligation (RTFO) places an obligation on fuel suppliers to sell a proportion of biofuels. In the Financial Year 2008-09 biofuels accounted for 2.6% of total transport fuels. This is expected to rise to 5% by 2014 and 14% by volume by 2020 as a result of the Renewable Energy Directive. The RTFO also places a requirement to record the GHG emissions of the fuel which is monitored by the Renewable Fuels Agency (RFA). The RFA has just reported the first year's results and the biofuels supplied in the UK achieved a reduction in GHG of 47% against a Government target of 40%, with biodiesel achieving 42%, bioethanol 70% and biogas 69%. In the following analysis it is assumed that biodiesel achieves GHG savings equal to the Government target for the RTFO and that B5 is the benchmark fuel rather than diesel.

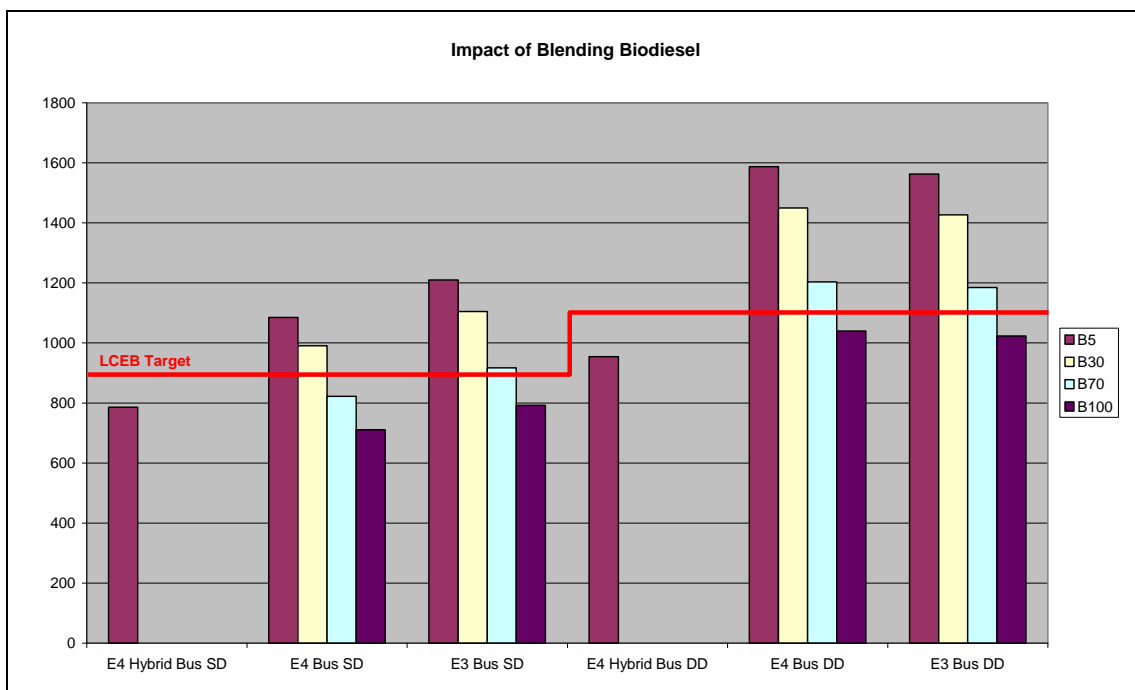
The LCEB target was developed with reference to Euro 3 buses which still represent a large proportion of buses in operation today. Figure 2 shows GHG for a number of these buses which have been tested on the MLTB test cycle using diesel, and the impact of running these buses on B5, which is effectively the standard diesel available in the UK as a result of the RTFO. The impact of using B5 is limited and none of these buses achieved the LCEB target as a result. The existing LCEB target is still challenging, however it raises the issue of whether the LCEB target should be revised from time to time in the future to take account of changes in the proportion of biofuel supplied in the UK.



**Figure 2**

### High Blend Biodiesel

The impact of using a variety of biodiesel blends in typical Euro 3 and 4 diesel buses was calculated and compared with the LCEB target. This is shown in figure 3 which includes the LCEB target for the two sizes of buses considered, a 55 passenger single deck bus and an 87 passenger double deck bus. The use of pure biodiesel (B100) would on the face of it achieve the LCEB target for GHG's, and in one instance B70 would also achieve the target. This assumes a deterioration in fuel consumption as a result of blending the fuel which in the case of B100 would result in fuel consumption increasing by 7%.



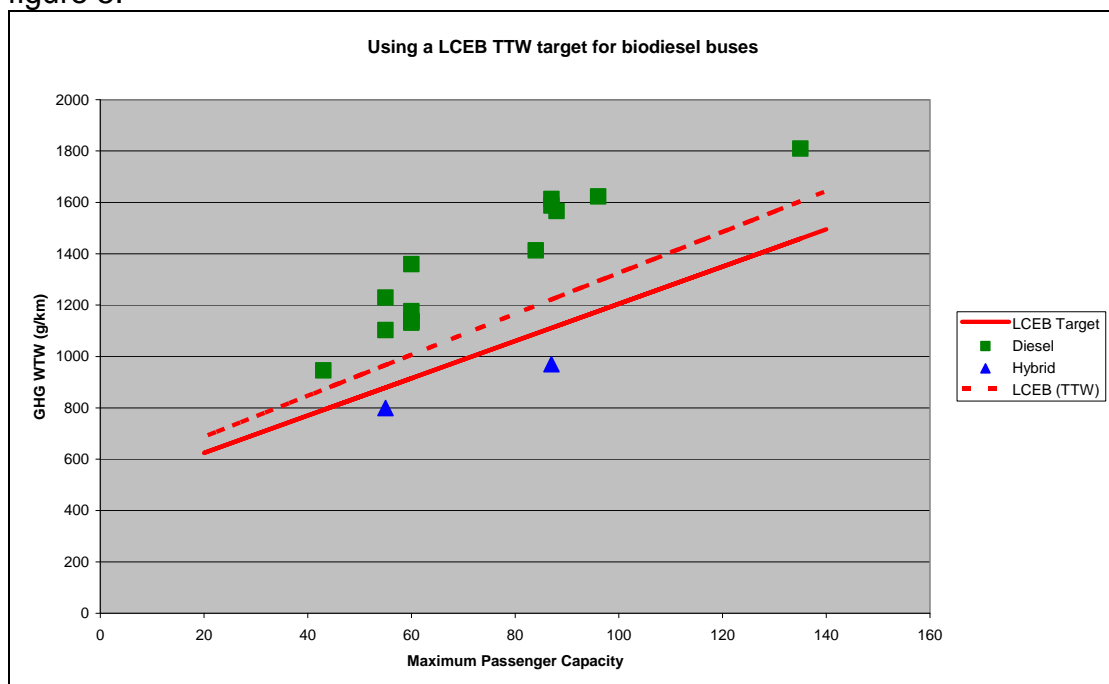
**Figure 3**



The current regulation for heavy duty engines is Euro 4, with Euro 5 coming into force in October of this year. The GBF requires buses to have Euro 5 certified engines, whereas the BSOG LCEB supplement can be back dated to 1 April 2009 and so it's assumed that the intention was to allow Euro 4 buses to benefit also. Therefore, in order to prevent older vehicles being certified as LCEBs, so that they can benefit from the BSOG LCEB supplement, it could be restricted to vehicles which are Euro 4 or better. This would prevent the BSOG LCEB supplement from creating a market for high blend biodiesel amongst older buses. However, this would prevent the possibility of a retrofit option being developed and would do nothing to prevent Euro 4 and 5 diesel buses from qualifying as LCEB using a high blend biodiesel.

Alternatively, a maximum blend for biodiesel could be imposed when calculating the GHG emissions of a bus for e.g. B30. This would limit the impact of the policies to incentivise LCEBs on the market for high blend biodiesel by limiting the benefit of using high blend biodiesel. This would be achieved by limiting the potential to use biodiesel as the sole basis for achieving the LCEB target and effectively requiring the bus to provide an efficiency improvement in addition to the GHG saving provided by the fuel. However this restricts the technology neutral approach and may hinder the introduction of buses capable of using high blends of biodiesel which may be required to achieve the RED targets in the future.

An alternative approach would be to introduce a LCEB tank-to-wheel (TTW) target in addition to the existing target to be used when biodiesel is used in the calculation of the GHG savings. This would be set relative to the LCEB target and would therefore ensure a minimum efficiency of the bus. The equivalent LCEB TTW target to using B30, in the example above, would be to use a LCEB TTW target of 10% more than the LCEB target. This is shown in figure 5.



**Figure 5**

## Conclusion

The RTFO has created a market for low blend biofuels, in particular biodiesel. The introduction of the RED will create a market for biofuels of approximately 14% by volume. This can not be accommodated within existing fuel specifications and so may create a market for high blends of biodiesel. The BSOG LCEB supplement and the GBF by supporting the procurement of buses requiring high blend fuels, will create niche markets for high blend biofuels including biodiesel. This is unlikely to increase aggregate level of biofuel use in the UK but is more likely to displace biofuel from being used in low blend fuels. Therefore the impact of the RTFO and the policies incentivising LCEBs are extremely unlikely overlap.

Biomethane and bioethanol cannot be used in a normal diesel bus and in these cases the bus and the biofuel are an inseparable package which delivers the GHG saving. Therefore these fuels should be included in the BSOG LCEB supplement and the GBF, and the full GHG savings coming from these fuels should be taken into account. DfT has already explicitly recognised this in the case of biomethane.

There is a potential for very high blend biodiesel, over 50%, to allow normal diesel buses to achieve the LCEB target without any change to the vehicle. This should not be permitted and could be prevented by;

- Not allowing the GHG savings of biodiesel to be taken into account. This would limit the effectiveness of the GBF.
- Restricting eligibility to buses with Euro 4 or better engines. This would not prevent Euro 5 buses achieving the LCEB by using B50.
- Not allowing biodiesel of greater than B30 to be used in calculating the GHG emissions of the bus. This would not be technology neutral.
- Introducing a LCEB tank-to-wheel target for biodiesel buses 10% greater than the LCEB target.

There are a number of technologies which could be used in conjunction with high blends of biodiesel which might achieve the LCEB target through GHG savings by the vehicle and the fuel. These should not be excluded from the BSOG LCEB supplement or the GBF by excluding biodiesel entirely from the GHG WTW calculation.

Therefore, it is recommend that;

- Bioethanol and biomethane are taken into account in calculating the GHG emissions in order to determine whether a bus is a LCEB.
- Introduce a TTW target for use with biodiesel requiring a 20% reduction in GHG in addition the existing Well-To-Wheel LCEB target.

Finally, the LCEB target should be reviewed in light of increasing blends of biodiesel prevailing in the UK over time.

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