BWG-P-09-07a

Defining a Low Carbon Emission Bus for the purposes of BSAG

This paper is provided as a supplementary paper to BWG-P-09-07. Members of the BWG are asked to comment on the suitability of this paper to feedback to BSAG as the definition of a Low Carbon Bus.

This paper provides a definition of and the testing and accreditation process for a Low Carbon Emission Bus for use in determining eligible vehicles for a Low Carbon Emission Bus BSOG rate.

Definition of a Low Carbon Bus

The definition of a Low Carbon Bus is as follows:

"A Low Carbon Bus produces at least 30% fewer Greenhouse Gas Emissions than a current Euro 3 equivalent diesel bus of the same total passenger capacity. The Greenhouse Gas (GHG) emissions will be expressed in grams of carbon dioxide equivalent measured over a standard test, and will cover "Well-to-Wheel" (WTW) performance, thereby taking into account both the production of the fuel and its consumption on board".

The Low Carbon Bus target line is expressed below and shown in Appendix 1. Green House Gas emissions are defined against total passenger capacity by the following linear relationship:

$$\mathbf{CO_2\ (WTW) = 7.25 \times \text{total number of passengers} + 480}$$

The Greenhouse Gases (GHG) of interest are Carbon Dioxide (CO_2) Methane (CH_4) and Nitrous Oxide (N_2O). The relative "global warming potentials" for these 3 gases are 1:21:310 respectively.

Well-To-Wheel Emissions

To determine whether a bus meets the criteria of a Low Carbon Bus a two step procedure is used. Firstly, a whole vehicle test is undertaken to measure the tank-to-wheel emissions and energy consumption. Secondly, the results of the whole vehicle test will be used to calculate the well-to-wheel emissions. This will then be used to compare with the target line.

Tank-To-Wheel Emissions and Energy consumption

The Millbrook London Transport Buses (MLTB) test cycle, based on Route 159 in London, will be used to measure tank-to-wheel emissions and energy consumption. The gas values of methane and nitrous oxide, if measured, will be converted to carbon dioxide equivalent by applying the weightings given above.

The whole vehicle emissions results will be used to calculate the GHG emissions performance of the vehicle on a WTW basis appropriate to the fuel as used in the approval test and as used in service. In the case of B5

biodiesel the fuel pathway used will be that of diesel to avoid BSOG providing an incentive over and above the incentive provided by the RTFO.

Well-to-Tank Emissions and Energy Consumption

"Well-to-Tank" (WTT) emissions and energy consumption will be determined using an appropriate analysis such as those carried out by CONCAWE or by L-B-Systemtechnik GmbH or similar body, subject to approval by the Fuels Working Group of LCVP. The results are expressed in grams of carbon dioxide equivalent per MJ of fuel delivered. Knowing the fuel consumption of a vehicle in MJ/km, the WTT GHG figure can be expressed in g/km.

WTW emissions and energy consumption will be determined from the sum of TTW and WTT performance with greenhouse gas emissions expressed as grams of carbon dioxide equivalent per kilometre and energy consumption expressed as MJ per kilometre. Both measures will be assessed against maximum passenger carrying capacity.

Accreditation

In order to be accredited as a "Low Carbon Bus", vehicles must have GHG emissions either on the target line, or below that determined for their passenger carrying capacity. The target line will be used to accredit the bus in "worse case" condition i.e. at the minimum payload corresponding to its CO_2 equivalent emissions performance. Buses found to have CO_2 equivalent emissions higher than that corresponding to its passenger capacity will not be afforded Low Carbon Bus status.

To qualify as a Low Carbon Bus, the vehicle must be certified as a PCV and have a Certificate of Fitness. The whole vehicle emissions when tested, on an appropriate chassis dynamometer to LCVP Low Carbon Bus test requirements, must be reported.

Low Carbon Vehicle status will be conferred on all vehicles similar to those presented for test, as long as the vehicles use similar fuels and energy management strategies

For further details on test procedures for low carbon buses please refer to the following LowCVP documents:

- BWG-P-05-03 The accreditation of Low Carbon Buses - update note
- BWG-P-05-04 Low Carbon Bus Vehicle Accreditation v2.0
- BWG-P-05-05 Annex A2 test CSH 270205

Appendix 1 – Low Carbon Bus Target Line