

# Market transformation for energy efficient road vehicles

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## Keywords

Carbon, CO<sub>2</sub>, cars, fuel economy

## Abstract

This paper sets out the need to reduce CO<sub>2</sub> emissions from road transport in the context of UK national and international climate change targets. The paper focuses on cars, which are the major contributor of CO<sub>2</sub> emissions within the road transport sector. The paper examines whether UK and European targets for more efficient cars are likely to be met on current trends. The paper then describes key existing and future UK policies to incentivise low-carbon cars (fuel duty, car taxation and congestion and road user charging) and examines their effectiveness. Finally the paper describes Energy Saving Trust programmes to help bring about market transformation for more energy-efficient vehicles.

## Introduction: The Need for Energy Efficient Road Vehicles

In 2002, the UK was responsible for about 2 per cent of the world's carbon dioxide (CO<sub>2</sub>) emissions<sup>1</sup>. The UK is on course to meet its target under the Kyoto Protocol (12.5 per cent below base year levels by 2008-12), however it will be more difficult to meet the UK national target of 20 per cent below 1990 levels by 2010. Road Transport accounted for

about 22 per cent of UK carbon emissions in 2002 (around 32 million tonnes), the second largest source of UK end-user emissions, after the business sector at about 28 per cent<sup>2</sup>. A recent study indicated that in order for the UK to reduce its CO<sub>2</sub> emissions in line with a global stabilisation target of 550 ppm, transport emissions would have to reduce to between 13.3-22.6 MtC from a 1997 baseline of 39 MtC (with transport contributing 26.4% and 41.3% of total UK carbon, respectively)<sup>3</sup>.

## Recent Trends in Road Transport Carbon Emissions

While transport CO<sub>2</sub> overall has grown (due to increased aviation emissions), CO<sub>2</sub> emissions from the road transport sector have actually remained broadly static for the last five years- growing by just 0.7% between 1997-2002 compared to 4.7% between 1992 and 1997<sup>4</sup>. Cars contributed 59% of the total in 2002, with heavy trucks and buses contributing 28% (64% and 24% respectively in 1992)<sup>5</sup>. This paper focuses on passenger cars, first taking a more detailed look at CO<sub>2</sub> trends, and presenting an analysis of the effectiveness of policy tools aimed at reducing CO<sub>2</sub> from this sector.

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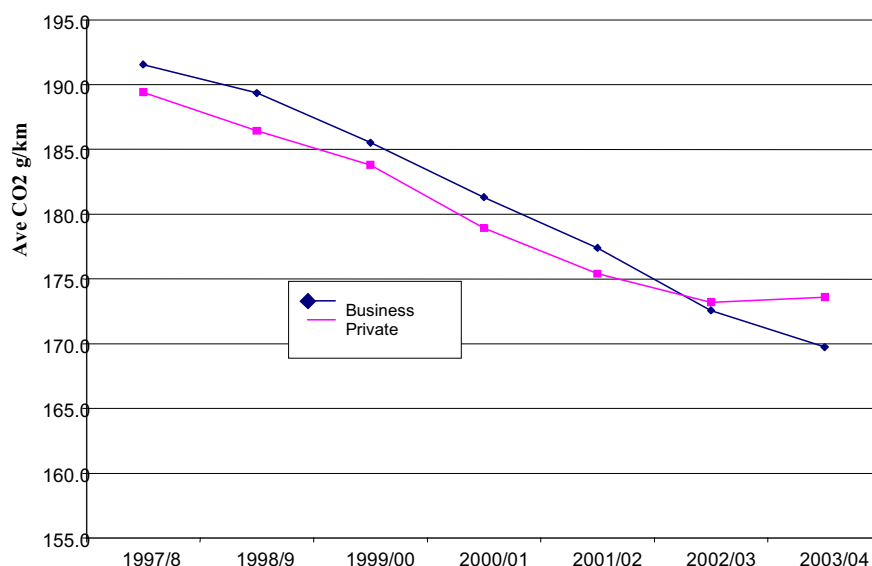
1. HM Government (2004), Review of the UK Climate Change Programme Consultation Paper

2. Ibid.

3. Bristow, A et al, (2004), How can we reduce carbon emissions from transport?, Tyndall Centre Technical Report 15

4. National Atmospheric Emissions Inventory, 2002 Emissions Data

5. Ibid.



**Figure 1.** Average New Car CO<sub>2</sub> Emissions: Private and Business Customers (g/CO<sub>2</sub>). Source: EST.

### CO<sub>2</sub> EMISSIONS FROM CARS

Overall, CO<sub>2</sub> emissions from passenger cars have fallen by around 3.5% from 1997-2002. Over the same time the average CO<sub>2</sub> emissions of new cars sold in the UK fell by 8.3%, due to the Voluntary Agreements between the European Commission and the major automotive manufacturing associations<sup>6</sup>. Since 2000, total carbon emissions from passenger cars have decreased at a faster rate than the decrease in average new car CO<sub>2</sub>, despite slightly increased car vehicle kilometres<sup>7</sup>.

### DETAILED TRENDS IN NEW CAR CO<sub>2</sub> EMISSIONS

The overall average CO<sub>2</sub> emissions from cars sold in the UK decreased by just 1.2% from 2002-2003<sup>8</sup>. To explore this slowing down in CO<sub>2</sub> improvement, EST commissioned research to examine the passenger car market in more detail. The analysis included a calculation of the CO<sub>2</sub> 'burden' of each vehicle class by giving the product of the number of sales per class and the average CO<sub>2</sub> in a given year. This gives a reasonable indication of the total CO<sub>2</sub> impact of different parts of the fleet. Type of sale (business or private) was also included.

In the business segment, the total burden is virtually unchanged over the past five years, with sales growth almost exactly offset by steady improvements in average CO<sub>2</sub>. In contrast private sales have seen high growth in low-carbon cars, but little change in the number of high-carbon cars being sold. This, combined with greater overall sales, means that the total CO<sub>2</sub> burden from private sales is rising fairly steadily. The net result is that while business purchases continue to show a steady downward trend in average CO<sub>2</sub> progress on the average emissions of private purchases has

now stalled and even reversed, such that the average is now for the first time above that for company cars<sup>9</sup> (Figure 1).

## UK and European Targets for Low Carbon Cars

### EU: VOLUNTARY AGREEMENTS (VAS)

The VAs are bilateral agreements between the European Commission and the European, Japanese, and Korean automotive manufacturing associations (ACEA, JAMA and KAMA respectively) to reduce CO<sub>2</sub> emissions from new vehicles sold to an average out 140 gCO<sub>2</sub>/km by 2008 (ACEA) and 2009 (JAMA and KAMA). The EC has reserved the right to regulate if the voluntary commitments are not met<sup>10</sup>. In 2002 the average specific CO<sub>2</sub> emissions of the fleets are 165 g/km for ACEA, 174 g/km for JAMA and 183 g/km for KAMA<sup>11</sup>.

Although the EC is broadly happy with the progress being made the average annual reduction rate of all three associations needs to be increased to meet the targets, and KAMA appears to be in danger of missing the 2009 target. Moreover The EC has acknowledged that the VAs are unlikely to deliver the EU's 2010 target of an average CO<sub>2</sub> of 120 g/km by 2010<sup>12</sup>. Going forward, there is scope for significant progress beyond the current 140 g/km target, and it is important to set post-2008 targets now to influence future technology. The year 2015 would be a sensible date for the next target, with an intermediate target at 2012.

### UK: POWERING FUTURE VEHICLES

The Government's Powering Future Vehicles (PFV) strategy has set a target for 10% of new cars sold to be

6. SMMT (2004), UK New Car Registrations by CO<sub>2</sub> Performance: Annual Report

7. EST analysis: NAEI 2002 emissions data, SMMT UK New Car Registrations 2004, DfT Transport Trends 2004

8. SMMT (2004), UK New Car Registrations by CO<sub>2</sub> Performance: Annual Report

9. EST (2004), Passenger Cars: CO<sub>2</sub> Emissions and Vehicle Excise Duty

10. European Commission Agreement with ACEA, 1999, ref (1999/125/EC)

11. EC: VA Joint Monitoring Report 2003, [http://europa.eu.int/eur-lex/en/com/cnc/2004/com2004\\_0078en01.pdf](http://europa.eu.int/eur-lex/en/com/cnc/2004/com2004_0078en01.pdf)

12. EC: VA Joint Monitoring Report 2003

**Table 1. 2003 Car Sales by CO<sub>2</sub> Vehicle Excise Duty Band.**

CO <sub>2</sub> Emissions (g/km)	No. Sold 2003
<100	590
101-120	77 372
121-150	804 664
151-165	546 759
166-185	459 071
185	691 185
SMMT (2004), UK New Car Registrations by CO <sub>2</sub> Performance: Annual Report	

<100 g CO<sub>2</sub>/km (tailpipe) by 2012<sup>13</sup>. This target is vitally important to ensure that very low-carbon cars enter the market, and to reduce the overall CO<sub>2</sub> from road transport. However, it is also extremely ambitious, and, if sales of new cars remain at 2003 levels, around 250 000 new vehicles will have to be low-carbon if it is to be met. Sales figures indicate the scale of the challenge – only 590 vehicles emitting less than 100 g CO<sub>2</sub>/km were sold in the UK in 2003<sup>14</sup> (table 1). Although this paper does not discuss alternative fuels explicitly, it is also interesting to note that in 2003, 6 379 LPG cars, 1 079 Hybrid cars and 37 Electric cars were sold (0.25%, 0.04% and 0.001% of all new cars sold in the UK in 2003, respectively).

## KEY UK POLICIES TO INCENTIVISE LOW-CARBON CARS

### Fuel Duty Escalator

In 1993 the then-Conservative Government announced an environmental tax on fuel at 3% above inflation (the “fuel tax escalator”); partly as a measure to help meet climate change emissions targets. This policy instrument remained in some form until 2000, when the Labour Government froze duty<sup>15</sup>. As a result (and because of improving average fuel economy) motoring costs in the UK are 4.8% lower in real terms now than in 1997. In contrast, bus travel is 8.2% more expensive and rail travel 3% more expensive<sup>16</sup>.

### Vehicle Excise Duty

A graduated system of VED was introduced in March 2001, with six CO<sub>2</sub> bands and three fuel types<sup>17</sup>. This was a progressive step, which placed CO<sub>2</sub> emissions at the heart of private car ownership taxation for the first time. However the differentials between the Bands are small – ranging from £10 to £30, and averaging £19 (all per year). Analysis for EST suggests that VED may be having an impact on vehicle choices at the margin between Band “AA” (101-120 gCO<sub>2</sub>) and Band A (121-150), which is the band has the highest differential (£30). However there are no indications of bound-

ary effects occurring at other VED band limits, suggesting that the tax is having little impact elsewhere in the vehicle market.

This finding is borne out by research by the research organisation MORI for DfT, which concluded that VED is not currently providing a substantial incentive for the purchase of lower-carbon cars<sup>18</sup>. This study suggested that a differential of £150 between bands would persuade 55% of consumers to change to a lower emission car to benefit from the saving. Further, the highest band is set for any vehicle with CO<sub>2</sub> higher than 185 gCO<sub>2</sub>/km, yet this encompasses fully 61% of cars offered for sale in the UK<sup>19</sup>. This offers very little consumer choice within the higher-CO<sub>2</sub> end of the market. Analysis of sales data for EST suggests that an additional band set at 220 g/km would provide a more realistic choice for consumers<sup>20</sup>.

### Company Car Tax

In 2002, the UK Government reformed Company Car Tax (CCT) to be based on CO<sub>2</sub> emissions<sup>21</sup>. Under the old system the charge was based on the list price of the car and the annual level of business mileage done by the company car driver, with lower tax the further the car was driven. Alongside VED reform, this was a progressive step, placing CO<sub>2</sub> emissions at the centre of decisions on company cars choice. The Inland Revenue (IR) estimate<sup>22</sup> that due to this reform, around 300 – 400 million fewer business miles were traveled in UK company cars in FY 2002/03 compared to the previous year, saving 25 000 to 35 000 tonnes of carbon in 2002/03 (around 0.1% of all CO<sub>2</sub> emissions from road transport in the UK).

The IR also estimate that CO<sub>2</sub> emissions of new company cars have decreased significantly from around 196 g/km in 1999, to around 182 g/km in 2002, although it is unclear whether this reduction is due to generally increasing fuel efficiency, or the reform of the company car tax. Analysis for EST supports this conclusion<sup>23</sup>. The 2004 Budget announced that the level of emissions qualifying for the mini-

13. The Powering Future Vehicles strategy is available online at [www.dft.gov.uk](http://www.dft.gov.uk)

14. SMMT (2004), UK New Car Registrations by CO<sub>2</sub> Performance: Annual Report

15. AA Motoring Trust (2004), Taxation and Investment

16. Data from House of Commons Written Answer, 17th March 2004

17. For details on the VED CO<sub>2</sub> banding system, and charges applied, see DVLA website, <http://www.dvla.gov.uk>

18. MORI (2004), Assessing the Impact of Graduated Vehicle Excise Duty - Quantitative Research

19. EST analysis of Vehicle Certification Agency, Registered Vehicles May 2004, <http://www.vcicarfueldata.org.uk>

20. EST (2004), Passenger Cars: CO<sub>2</sub> Emissions and Vehicle Excise Duty

21. See Table A1, Appendix for current CCT rates

22. Inland Revenue (2004) Report on the Evaluation of the Company Car Tax Reform

23. EST (2004), Passenger Cars: CO<sub>2</sub> Emissions and Vehicle Excise Duty

mum charge in 2006-2007 will be frozen at 140 grams per kilometre<sup>24</sup>. While this will ensure that CCT continues to influence the mid-range CO<sub>2</sub> cars (which are the main type of car bought by Company Car Drivers) it will fail to incentivise car purchasers to move to lower-CO<sub>2</sub> cars.

### London Congestion Charge

Congestion charging, introduced in central London in February 2003, in one year reduced traffic entering the zone during charging hours by 18 per cent and improved traffic congestion by around 30 per cent<sup>25</sup>. The scheme also encourages drivers to switch to cleaner vehicles, as many vehicles on the PowerShift register<sup>26</sup> receive a 100 per cent discount. Approximately 4 300 vehicles are registered for the discount, and the number of Alternative Fuel Vehicles registered in the London area increased by 98% and the number of Hybrid vehicles increased by 117% after just the first year of the scheme<sup>27</sup>. The discount criteria should be regularly reviewed and the emissions limits tightened so that the discount scheme does not endanger the congestion benefits of the scheme.

### Longer-term: National Road Pricing

The UK Government is seriously considering proposals to introduce national road user charging. Although it believes that this would not be realistically possible for all cars until 2014, it could be preceded by local charging schemes such as the London charge<sup>28</sup>. However, there is a concern over the impact that road pricing could have on CO<sub>2</sub> emissions. If charging is based solely on car use, then in principle, higher-CO<sub>2</sub> cars could be charged at the same rate as low-CO<sub>2</sub> cars. Moreover if road user charging was to replace fuel duty then a major incentive for low-CO<sub>2</sub> cars would be lost. A solution could be to vary road user charges by vehicle energy efficiency, so that high-CO<sub>2</sub> cars would pay more than low-CO<sub>2</sub> cars. However there is a risk that a reduced road user charge for efficient vehicles may increase car usage and reduce the congestion benefits of the road pricing scheme.

## Energy Saving Trust TransportEnergy Programmes

### BACKGROUND AND OBJECTIVES

The EST was established in 1993 following the Rio summit to help the UK reduce CO<sub>2</sub> emissions. EST operates programmes for the UK Government promoting energy efficiency and small – scale renewables to the domestic market, and since 1996 has run various programmes to promote cleaner, lower-carbon transport, operated by the Trans-

portEnergy business unit. The Goals of TransportEnergy are

- to achieve the sustainable and efficient use of energy in transport
- to cut vehicle carbon dioxide emissions which are a key contributor to climate change
- to improve air quality specifically in our urban areas where vehicle emissions are a major contributor to air pollution
- TransportEnergy has an annual budget of around £24 million, from the UK Department for Transport. The grant programmes have saved 35 127 tonnes of CO<sub>2</sub>, 14 502 tonnes of oxides of nitrogen (NO<sub>x</sub>) and 2 212 tonnes of particulate matter since their launch<sup>29</sup>.

### TRANSPORTENERGY PROGRAMMES: MARKET TRANSFORMATION

EST view market transformation for energy-efficient vehicles consisting of three broad “stages” (Figure 2). This section briefly explores EST activity at each stage of the market transformation curve.

#### Stage One: Market Entry

TransportEnergy programmes part-fund the demonstration of clean, low-carbon vehicles. Projects are selected by an independent expert panel, and DfT and EST officials. Recent successful demonstrations include an Electric Delivery Van, a Hybrid London Taxi<sup>30</sup>, and Fuel Cell Buses as part of the CUTE programme<sup>31</sup>. Going forward EST hopes to introduce demonstrations of small Fleets of vehicles, to aid their market introduction.

#### Stage Two: Market Adoption

Clean, low-carbon vehicles face a number of market barriers<sup>32</sup>. EST programmes offer both purchase grants and advice, both of which help overcome these barriers. Grants have been available to the cleanest Alternative Fuel (LPG, Natural Gas, Hybrid and Electric) vehicles, to both company fleets and private individuals<sup>33</sup>. Going forward EST plans to continue with grants for vehicles, but move to a “technology neutral” approach, to incentivise the lowest-carbon cars regardless of fuel or technology type, provided they meet strict regulated emissions standards as well<sup>34</sup>.

#### Stage Three: Market Growth

EST offers advice to fleet-car operators from the public and private sector on both purchase decisions and fuel-efficient fleet management<sup>35</sup>. Going forward EST aims to increase advice services to the broader consumer market through

24. HM Treasury (2004) Budget 2004, paragraph 7.38

25. Transport for London (2004), Environment Report 2004

26. PowerShift is a programme to incentivise cleaner vehicles, run by EST. For details of the Register and how it relates to the Congestion Charge discount scheme, see <http://www.transportenergy.org.uk>

27. Personal Communication: SMMT analysis of new car sales data for the Greater London Area

28. DfT (2004), Feasibility study of road pricing in the UK – Report

29. Press Release, “Energy Saving Trust welcomes DfT commitment to TransportEnergy programmes”, 21.12.05

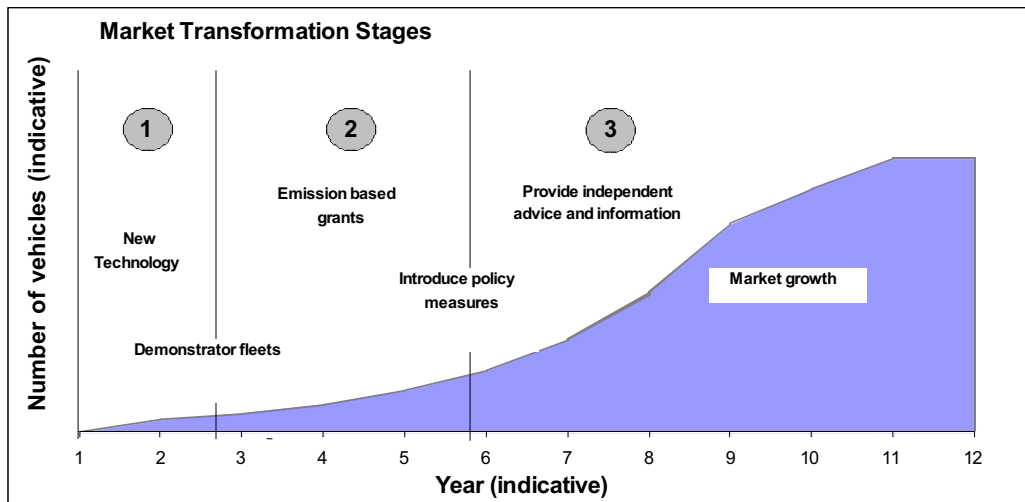
30. See New Vehicle Technology Fund website for more information: <http://www.transportenergy.org.uk/grantsavailable/vehicletechnologyfund/>

31. For more information on CUTE (Clean Urban Transport for Europe) see <http://www.fuel-cell-bus-club.com/>

32. For a summary of market barriers see “Deployment Strategies for Hybrid, Electric and Alternative Fuel Vehicles”, International Energy Agency 2003

33. Current PowerShift grant criteria can be found <http://www.transportenergy.org.uk/grantsavailable/powershift/>

34. See EST response to the TransportEnergy Consultation for further details of EST proposals



**Figure 2.** Market Transformation Diagram.

public information and advice campaigns. EST also aims to persuade high-level executives at major companies in the UK to sign-up to improve the environmental performance of their transportation operations<sup>36</sup>.

#### Future of TransportEnergy: UK Government Consultation

TransportEnergy grant programmes have recently undergone a formal process of review by the UK Government, involving a value-for-money evaluation and a stakeholder consultation<sup>37</sup>. Following this review the UK Government announced that the programmes will move to a technology neutral approach to would incentivise the cleanest cars regardless of the technology or fuel type<sup>38</sup>. The Government committed £24 million to TransportEnergy for the coming year.

35. See Fleet Advice web site <http://www.transportenergy.org.uk/moreefficient/>

36. See EST response to the TransportEnergy Consultation for further details of EST proposals

37. Consultation closed October 29, 2004

38. Press Release, "DfT Reviews TransportEnergy Grant Programmes" 21.12.04