

# HOW CLEAN ARE EUROPE'S CARS?

An analysis of carmaker progress towards EU CO<sub>2</sub> targets in 2010



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***Editeur responsable***

Jos Dings, Director

**T&E – European Federation for Transport and Environment AiSBL**

Rue d'Edimbourg, 26 | B-1050 Brussels | Belgium

[www.transportenvironment.org](http://www.transportenvironment.org)



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## Summary

This report is the sixth T&E has published on the annual progress Europe's major car manufacturers have made in reducing CO<sub>2</sub> emissions and fuel consumption of new cars. As in previous years, we assess how each carmaker is positioned to hit the mandatory CO<sub>2</sub> standards that the European Union has set for 2015. And we assess progress per EU Member State.

In this year's report, we included two additional pieces of analysis:

- An analysis of estimates made in the past of what it would cost to arrive at today's CO<sub>2</sub> emission levels.
- An analysis of what the impact would be if Europe stopped making CO<sub>2</sub> standards for manufacturers dependent on the weight of the cars they produce, and instead move to size-based standards;

## Main conclusions

### Progress of Europe's largest 15 carmakers in cutting CO<sub>2</sub>

- The industry as a whole reduced average CO<sub>2</sub> emissions by 3.7% last year continuing the trend of much faster reductions since adoption of the EU's mandatory CO<sub>2</sub> targets for cars. The industry reached an average CO<sub>2</sub> emission of 140 g/km;
- Progress was more evenly spread across carmakers than before; Europe's eight largest carmakers by sales all reduced CO<sub>2</sub> within 2% of the average i.e. between 2 and 6%. Volvo was an outlier with a 9% reduction; Mazda and Honda were both negative outliers, with small increases in emissions;
- The top four in terms of fleet-average CO<sub>2</sub> emissions remains unchanged. Fiat leads with 126 g/km, followed by Toyota, PSA and Renault. Daimler remains last on the list, having reduced CO<sub>2</sub> in 2010 by a below-average 3%;
- The industry as a whole is only 7% away from hitting its 130 g/km target for 2015, last year it still had a 11% gap to close
- Toyota is again closest to hitting regulatory CO<sub>2</sub> targets; the company is virtually there, five years ahead of time. PSA and Fiat are very close too with 3 and 5% cuts left to make respectively. Daimler is still furthest away with a 15% gap yet to close
- The distance-to-target figures do not allow for loopholes such as 'eco-innovations', 'supercredits' and provisions for carmakers below 300,000 sales. Carmakers are therefore even closer to meeting targets than these figures suggest.

The headline conclusion of last year's report therefore remains unchanged: all available evidence points towards carmakers in Europe heading for very significant 'over-compliance' with the CO<sub>2</sub> regulation and are hence likely to hit the 130 g/km CO<sub>2</sub> target for 2015 several years in advance.

### **On compliance costs**

Studies conducted ten and five years ago predicted that reducing CO<sub>2</sub> emissions from new cars to an average level of 140g CO<sub>2</sub>/km would make cars €2,400 and €1,200 more expensive, from 1995 and 2002 baselines respectively.

This implies that these studies estimated the marginal costs of one percent of CO<sub>2</sub> emissions reductions towards 140 g/km at around or likely above €100, which is about 0.5% of a car's retail price.

Meanwhile new cars have become 13% cheaper on average in real terms over the past eight years, which means a €20,000 car in 2003 would sell for €17,400 now. Probably coincidentally, car prices have fallen more quickly since CO<sub>2</sub> reductions began in earnest, from an average of 0.7% per year over the 2002-2006 period to 2.4% per year on average over the 2007-2010 period.

We are aware of the complex set of factors that make up a car's retail price, and that regulatory compliance costs is just one of these factors. Nevertheless the analysis shows that fears that reduction of CO<sub>2</sub> emissions would make cars unaffordable have been unfounded.

In addition, the absence of any relationship between reduction of CO<sub>2</sub> and higher retail prices – if anything an inverse relationship was found – and the significance of the estimated cost figures (every % of CO<sub>2</sub> reduction would cost about 0.5% of a car's retail price) strongly suggest that the costs of reducing CO<sub>2</sub> to an average of 140g CO<sub>2</sub>/km were considerably overestimated.

### **On the consequences of a move towards 'footprint'-based CO<sub>2</sub> standards**

T&E has long argued that weight-based CO<sub>2</sub> standards make reduction targets harder to achieve because they discourage lightweighting. T&E has long advocated 'footprint' (the area between the four wheels) -based standards instead.

A change to footprint-based CO<sub>2</sub> standards would hardly change the relative positions of carmakers towards their regulatory targets. For most, in particular the volume carmakers like Volkswagen Group, PSA, GM, Toyota and Hyundai, the change would be in the 0-1% range.

## Introduction

This report is the sixth T&E has published on the annual progress Europe's major car manufacturers have made in reducing CO<sub>2</sub> emissions and fuel consumption of new cars.<sup>1</sup>

As usual, the main objective of this report is to assess the progress that major car manufacturers in Europe are making towards cutting their average CO<sub>2</sub>. We also assess how each carmaker is positioned to hit the mandatory CO<sub>2</sub> standards that the European Union has set for 2012-2015.

This year's report contains two additional pieces of analysis.

Firstly, now that the car industry has reached the emissions level of 140 g CO<sub>2</sub>/km it promised to achieve in 1998 under the voluntary CO<sub>2</sub> commitment, we look back at estimates made on the costs to achieve such emissions levels.

Secondly we look at what difference it would make for carmakers if Europe stopped making CO<sub>2</sub> standards for manufacturers dependent on the weight of the cars they produce, and instead move to size-based CO<sub>2</sub> standards.

T&E and others have criticised weight-based standards because they do not reward reductions in car weight which is one of the most promising ways to cut CO<sub>2</sub> and fuel consumption. The legislation's provisions imply that if a carmaker reduces average car weight by 100 kg, the CO<sub>2</sub> target for its fleet would be tightened by 4.6 g/km.

Therefore we look at what the impact would be if CO<sub>2</sub> standards were instead based on so-called 'footprint' which is the area between the four wheels. Footprint is a proxy for a car's interior space, and footprint-based standards would hence fully reward weight savings.

T&E began this series of annual reports to bring public attention to the progress of carmakers on delivering CO<sub>2</sub> reductions based on voluntary commitments agreed by the industry in 1998/9. The monitoring programme set-up for these agreements contained a non-disclosure clause which prevented company-specific information being published by the EU. Fortunately, the EU CO<sub>2</sub> legislation adopted in 2009 demands that progress by carmaker be officially published starting with sales data for the year 2010.

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2006 report: [www.transportenvironment.org/Publications/prep\\_hand\\_out/lid:442](http://www.transportenvironment.org/Publications/prep_hand_out/lid:442)

2007 report: [www.transportenvironment.org/Publications/prep\\_hand\\_out/lid:481](http://www.transportenvironment.org/Publications/prep_hand_out/lid:481)

2008 report: [www.transportenvironment.org/Publications/prep\\_hand\\_out/lid:513](http://www.transportenvironment.org/Publications/prep_hand_out/lid:513)

2009 report: [www.transportenvironment.org/Publications/prep\\_hand\\_out/lid:549](http://www.transportenvironment.org/Publications/prep_hand_out/lid:549)

2010 report: [www.transportenvironment.org/Publications/prep\\_hand\\_out/lid:610](http://www.transportenvironment.org/Publications/prep_hand_out/lid:610)

# Transport in EU climate and energy policy

## Trends in transport greenhouse gas emissions

CO<sub>2</sub> emissions from the transport sector have increased by 29% since 1990, whereas those of other sectors decreased by 22%<sup>2</sup>. The contribution of the transport sector to the EU's CO<sub>2</sub> emissions now stands at 30%, up from 20.5% in 1990.

The real picture is even worse, mainly because transport greenhouse gas (GHG) emissions statistics do not include lifecycle emissions, only 'tailpipe' emissions – those that come from burning fuel. In the case of oil this leads to an underestimation of 20%. And biofuels are counted as zero CO<sub>2</sub> – while in reality they are, at present, likely to be higher than those of oil<sup>3</sup>. Accounting for both of these effects takes the GHG contribution of transport to well over a third.

The recent economic crisis caused overall emissions to drop. Transport CO<sub>2</sub> emissions in 2009 were 5% below their 2007 peak, while those of other sectors fell 12%.

Despite these recent drops in emissions, none of the future scenarios developed over the past years foresee sustained decreases in transport emissions unless decisive policy action is taken. The main reasons are that volume growth in sectors such as road freight transport, aviation and shipping are expected to keep on outpacing improvements in energy efficiency, and because transport fuels are not 'decarbonising' at a significant rate.

Transport is also critical in the debate on Europe's energy dependence. At current oil prices Europe imports approximately €250 billion worth of oil every year, or €700m every day. For comparison - this is roughly the same amount as the Greek, Irish and Portuguese bailouts combined – every year. Transport is responsible for about two thirds of oil use. Cars are the single biggest consumer of oil in the EU, responsible for using around half of transport sector demand and hence a third of all oil<sup>4</sup>.

The European Environment Agency estimates that cars are responsible for 14% of the EU's total CO<sub>2</sub> emissions<sup>5</sup>, and they are the single largest source of transport emissions, representing around half of the total.

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<sup>2</sup> See: [www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2011](http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2011)

<sup>3</sup> See: [www.transportenvironment.org/News/2010/11/Member-state-biofuel-plans-will-cause-higher-emissions-than-fossil-fuels](http://www.transportenvironment.org/News/2010/11/Member-state-biofuel-plans-will-cause-higher-emissions-than-fossil-fuels)

<sup>4</sup> Precise statistics on the split of road transport fuel consumption between cars, vans and trucks are not available because diesel is sold in all three categories

<sup>5</sup> See: [www.eea.europa.eu/publications/towards-a-resource-efficient-transport-system](http://www.eea.europa.eu/publications/towards-a-resource-efficient-transport-system)

## Policy and targets for 2020

EU Member States have committed themselves to reducing greenhouse gas emissions (GHG) in 2020 by 20%, increasing the share of renewables in the EU's energy mix to 20%, and achieving a 20% energy efficiency target by 2020. While the first two of these targets are enshrined in legislation, the last (energy efficiency) target is merely aspirational and off track<sup>6</sup>. Reducing fuel consumption of cars is one of the most effective strategies to help achieve this target.

## The 2030-2050 timeframe

In October 2009 EU leaders said that the Council '*supports an EU objective, in the context of necessary reductions according to the IPCC by developed countries as a group, to reduce emissions by 80-95% by 2050 compared to 1990 levels.*'<sup>7</sup> This commitment has since then be regularly reaffirmed, lastly in February 2011.

### **Transport White Paper: 60% lower emissions for transport by 2050**

The 80-95% reduction commitment described above was recently translated into a target specifically for transport.

In March 2011 the European Commission published its White Paper 'Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system'<sup>8</sup>. It said that 'a reduction of at least 60% of GHGs by 2050 with respect to 1990 is required from the transport sector.' It also said a 20% reduction target compared with 2008 would be needed by 2030. These commitments are summarised in graph 1.

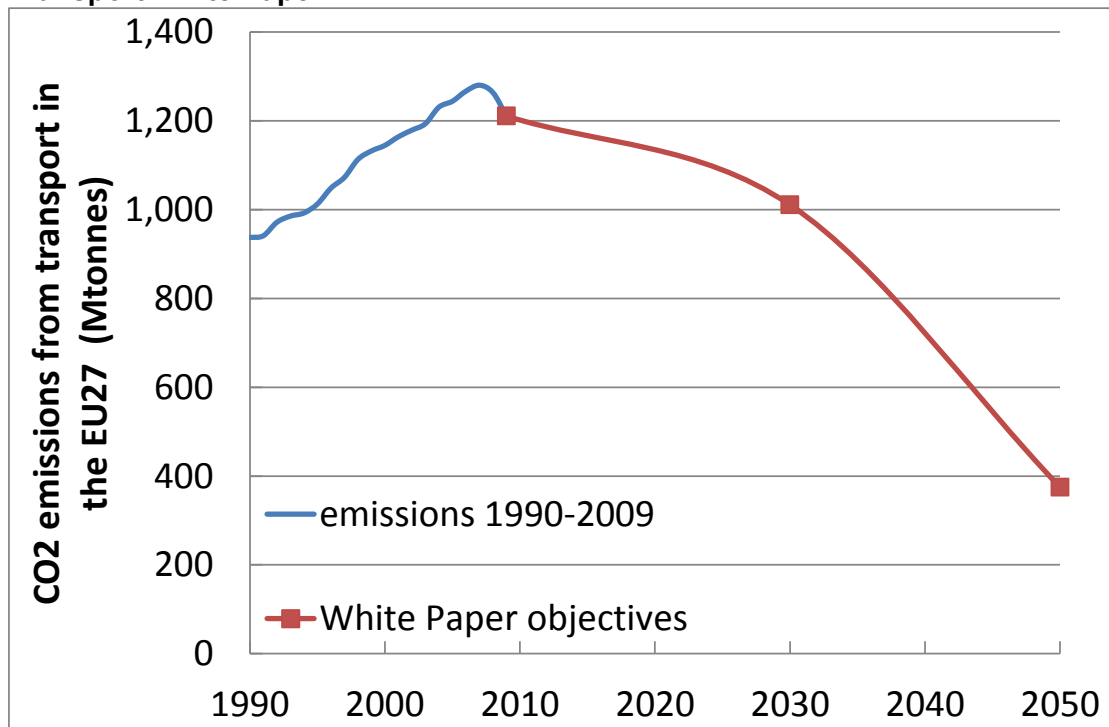
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<sup>6</sup> [http://ec.europa.eu/clima/policies/roadmap/index\\_en.htm](http://ec.europa.eu/clima/policies/roadmap/index_en.htm)

<sup>7</sup> [www.consilium.europa.eu/uedocs/cmsUpload/ST15838\\_09.pdf](http://www.consilium.europa.eu/uedocs/cmsUpload/ST15838_09.pdf)

<sup>8</sup> [http://ec.europa.eu/transport/strategies/2011\\_white\\_paper\\_en.htm](http://ec.europa.eu/transport/strategies/2011_white_paper_en.htm)

**Graph 1: trends in EU27 transport CO<sub>2</sub> emissions 1990-2009, combined with reduction targets as set out in the March 2011 European Commission Transport White Paper.**



The 60% reduction target for 2050 represents a 69% decrease compared with 2009 levels. In order to achieve this level of cuts a 2.8% reduction of GHG emissions per year is needed. The historical trend has been a 1.4% *increase* per year.

## A short history of EU cars and CO<sub>2</sub> policy

The EU target to reduce average new car emissions to 120 g/km was first proposed by Germany at a meeting of European environment ministers in October 1994. It was presented as the ambition to lower fuel consumption of new petrol cars to 5 litres per 100 km and new diesel cars to 4.5 litres per 100 km. The target was formally announced in a 1995 European Commission communication (COM(95)689) and represented a 35% reduction over the 1995 level of 186 g/km.

Originally the target date was set for 2005. But before it became legally-binding, the target was postponed or weakened four times.

The first postponement occurred in 1996 when the Environment Council introduced the term 'by 2005, or 2010 at the latest'.

The second postponement took place in 1998 when the European Automobile Manufacturers Association (ACEA) committed to the EU to reduce the average CO<sub>2</sub> emissions from new cars sold in the EU to 140 g/km by 2008. The Commission agreed to postpone the deadline for delivery of the '120' target to 2012.

The third weakening was in December 2007 when the European Commission proposed to move the target for 2012 from 120 to 130 g/km. The Commission said that the missing 10 g/km should be taken up by non-car-related measures such as the use of biofuels, tyres and by emission reductions in vans.

The fourth weakening took place when the law was finally adopted, in December 2008. The law further postponed full compliance with '130' from 2012 to 2015, and added several loopholes that would even allow a fleet average CO<sub>2</sub> figure of approximately 140 g/km to go unsanctioned.

In total, all these steps have resulted in a 10-year delay and a weakening of the target by approximately 20 g/km (15%).

On the upside, the law now adopted does offer a legally binding framework, including penalties, to deal with CO<sub>2</sub> emissions from cars. Significantly, it also added a new 95 g/km target for 2020. See next section.

## The 130g/km legislation and target

The 2009 law nominally strives to reduce the average CO<sub>2</sub> emissions from new cars to 130 g/km by 2015 (approx. 5.6 litres per 100 km for petrol cars and 5.0 litres per 100km for diesel cars). That is 18% below the average in 2007 and some 7% below the average of 2010.

For the 2012-14 period, a so-called 'phase in' is provided for, in which 65% (2012), 75% (2013) and 80% (2014) of cars from each manufacturer will have to comply. Carmakers are free to select 'compliance vehicles' and will therefore leave out the cars farthest from the target, i.e. the worst gas guzzlers such as SUVs. The effect is a postponement of the 130 target to 2015<sup>9</sup>.

Significantly, the law adds a 95 g/km target for 2020, the 'modalities' and 'aspects of implementation' of which will have to be reviewed by the Commission by January 2013.

The target is an average for all cars sold, not a fixed limit that no car may exceed. Manufacturers can average the CO<sub>2</sub> emissions from all cars they sell.

Individual manufacturers' targets are differentiated on the basis of the weight of the cars they produce in the target year. For example, if a manufacturer's cars by 2015 are 100 kg heavier than the industry average, they are allowed a 4.6 g/km higher CO<sub>2</sub> target (134.6 instead of 130 g/km CO<sub>2</sub> on average). Conversely, if their cars are lighter than average they get a tougher target. The disadvantages of weight-based standards are discussed on page 22.

Manufacturers can also file for joint-compliance with other manufacturers, in order to average their emissions over a larger pool of vehicles. This flexibility mechanism is called 'pooling'.

Enforcement will take place through a system of fines. For every g/km a manufacturer exceeds its company target, it has to pay a €95 fine per vehicle sold, in principle.

The law also includes several loopholes:

- Up to 7 g/km credits for 'eco-innovations', off-cycle credits of unmeasured CO<sub>2</sub> that can be exchanged for measured reductions on the official test cycle;
- 'Supercredits' for very low-emission cars, which allow manufacturers to count each low emission vehicle as more than one car and would hence water down the overall CO<sub>2</sub> reductions because they are based on fleet averages;
- Much lower penalties for missing the target by a few grammes (until 2018). The penalties for the first, second and third g/km over the target are only €5, 15 and 25 per g/km respectively instead of €95;
- Exemptions for carmakers with between 10,000 and 300,000 sales in the EU. They can apply for a default target of a 25% reduction compared with 2007 (Tata, the owner of Jaguar/Land Rover, is a likely applicant, and some Japanese marques like Mazda and Suzuki could apply too);
- Exemptions for carmakers with less than 10,000 sales in the EU, who can negotiate their own target with the Commission.

All these loopholes together in practice mean that the target for 2015 is closer to 140 g/km, rather than 130 g/km.

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<sup>9</sup> See: *The Impact of Phaseing in Passenger Car CO<sub>2</sub> Targets on Levels of Compliance*, [www.transportenvironment.org/Publications/prep\\_hand\\_out/lid:515](http://www.transportenvironment.org/Publications/prep_hand_out/lid:515)

## Methodology and data

We analysed sales and CO<sub>2</sub> information in the European Environment Agency (EEA) database that forms the basis of the official European Commission 'monitoring mechanism' on cars and CO<sub>2</sub><sup>10</sup>.

This database includes figures for cars sold in the EU27 in 2010 including weight, footprint, and CO<sub>2</sub> emissions. On the basis of this data we were able to produce the rankings published in this report.

The EEA also analysed the data and reported on them earlier this year<sup>11</sup>. The EEA focuses on overall trends and data per Member State. This report strives to complement the EEA's report by focusing on the position of manufacturers, distance to regulatory targets, and the impact of possible regulatory changes, and the impact of the regulation on carmakers and real-world emissions.

It is important to note that all the data is sales-weighted i.e. based on the actual number of cars sold by each manufacturer in each country. This is relevant because the CO<sub>2</sub> law also does not apply to individual vehicles nor the average of the range of vehicles on offer but rather to sales-weighted averages.

Only the volume car manufacturing groups (those that sold over 150,000 vehicles in the EU27 in 2010) were included in the study. These were the same 14 manufacturers that were included in our previous reports, plus one new entrant: Volvo. Volvo was previously owned by Ford so included in the parent company's figures. Volvo was sold to Geely in 2010 and sold enough cars in 2010 to warrant inclusion in our analysis.

### Note on data quality

It is important to note that the database contains preliminary data (provided by the administrations responsible for car registrations in each of the 27 Member States), which are currently under review by the carmakers.

The preliminary data are already significantly better than the database collected under the voluntary commitment. The database contains over 0.15% aberrant data on CO<sub>2</sub> and over 0.5% on weight. Data quality is rather uneven as collection methods vary by Member State.

However, 17% of footprint data is still missing. In order to present an accurate estimate of the EU-27 market, the footprint calculations we present here are based only on 18 countries with less than 3% aberrant data, representing 75% of volumes registered in the EU-27. Countries with no or very poor quality footprint figures are Bulgaria, Ireland, Italy, Luxembourg, Malta, Poland, Portugal and Slovakia (Belgium and Greece also have datasets with high rates of aberrant data making them unusable for statistical study).

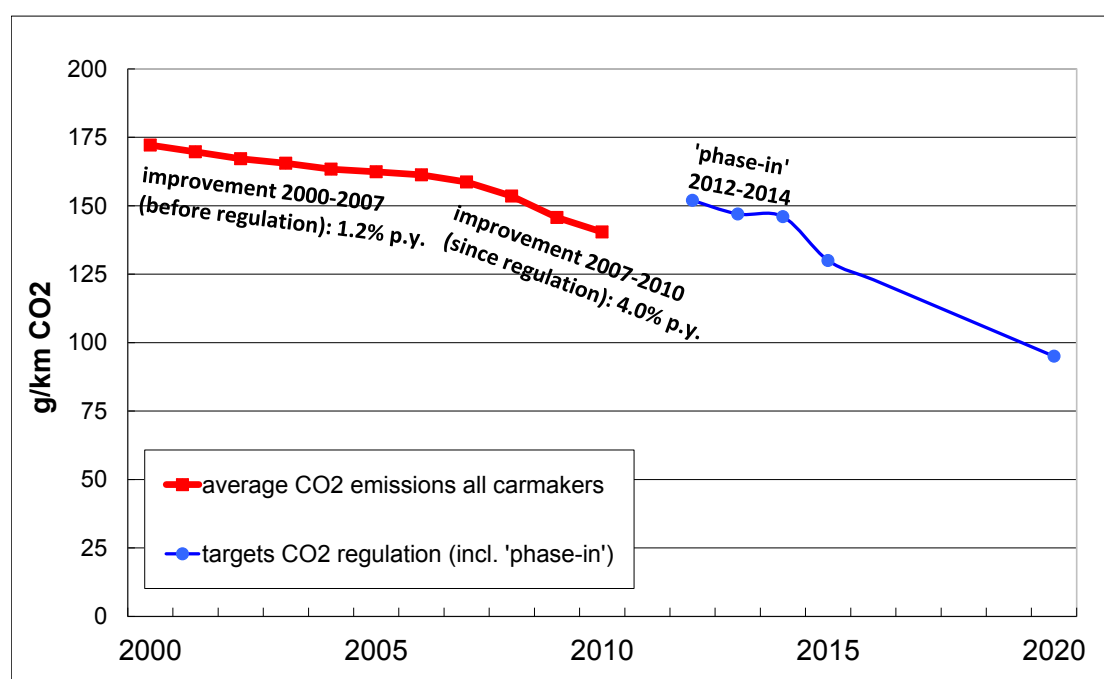
For our analyses we restricted the calculations to points where data was present and reliable (e.g. excluding cars with zero weight from weight calculations).

## Overall developments in CO<sub>2</sub> emissions, costs and retail prices

In this chapter we present the progress of the industry as a whole in cutting CO<sub>2</sub> and look at industry cost estimates for reaching targets, followed by an examination of actual retail price developments.

The graph below depicts historical progress of the industry and future targets as set by the EU's regulation on CO<sub>2</sub> from cars.

**Graph 2: fleet-average CO<sub>2</sub> emissions of new cars in the EU versus regulatory CO<sub>2</sub> targets**



The car industry reduced CO<sub>2</sub> emissions from 145.7 g/km in 2009 to 140.3 g/km in 2010. This is a rate of progress of 3.7%. Progress in 2009 was 5.1%, and progress in 2008 was 3%. The average rate of progress over the 2007-2010 period was 4.0% per year.

Before that, progress was much slower – the average rate from 2000 to 2007 was 1.2% per year.

140 g/km was the target ACEA (European carmakers) promised to reach by 2008, and JAMA and KAMA (Japanese and Korean carmakers) in 2009 under the terms of voluntary commitments agreed with the European Commission in 1998-9.

Therefore the rest of this chapter summarises earlier assessments of the costs associated with reaching a 140 g/km target, and then examines trends in average new car retail prices since CO<sub>2</sub> targets became legally binding.

## 2001 estimate of costs to achieve 140 g/km

Surprisingly the 140 g/km target of the 1998/9 voluntary commitments between the car industry and the EU was never formally assessed for its costs and benefits. It was the result of a political negotiation between the European Commission and the car industry.

Nevertheless a study for the Commission allows such a cost estimate. In 2001 a consortium led by AEA Technology prepared a study<sup>12</sup> for the Commission's Environment department in order to assess the costs of reducing greenhouse gas emissions from transport. A significant part of the report was dedicated to the costs of reducing CO<sub>2</sub> emissions from cars. The report assessed a range of technologies, such as improved transmissions, improved combustion engines and hybrid engines.

The main conclusions were:

*'The costs and fuel efficiency of the improved and advanced technology are related to the average cost and fuel efficiency of the existing vehicle technology (in each Member State) in 1995. For example, an 'improved' petrol car is estimated to be 25% more efficient and 15% more expensive than the existing technology'. (p50)*

The table below summarises the main results for these 'improved' cars, taken from table 4.7 on p50 of the report.

	Costs 'average' car 1995 baseline	Costs 'improved' technology (25% more efficient)	Extra costs of 'improved' car
<b>Petrol car</b>	15,000	17,250	€ 2,250
<b>Diesel car</b>	17,250	19,837	€ 2,587
<b>Average (50/50 split)</b>			<b>€ 2,419</b>

The 1998-9 voluntary commitments represented a 25% reduction of CO<sub>2</sub> emissions compared with the 1995 level of 186g/km. Implicitly therefore the report put the cost of reaching 140 g/km at over €2,400 per car (assuming a 50/50 petrol/diesel split).

Average reduction costs therefore amount to around €100 per percent of CO<sub>2</sub> reduction. The costs of the last few per cent of emissions reductions will be well above €100; the marginal cost of the last few per cent is higher because car companies always make the cheapest changes first.

## 2006 estimate of costs to achieve 140 g/km

In 2006 a consortium led by TNO published a report for the European Commission into the costs of reducing CO<sub>2</sub> emissions from cars<sup>13</sup> which subsequently served as a

<sup>12</sup> Economic Evaluation of Sectoral Emission Reduction Objectives for Climate Change; Economic Evaluation of Emissions Reductions in the Transport Sector of the EU, Bottom-up Analysis, UPDATED, March 2001, Bates, J. et al., AEA Technology Environment, Ecofys Energy and Environment, AEA Technology Environment and National Technical University of Athens, [http://ec.europa.eu/environment/enveco/climate\\_change/pdf/transport\\_update.pdf](http://ec.europa.eu/environment/enveco/climate_change/pdf/transport_update.pdf)

<sup>13</sup> Review and analysis of the reduction potential and costs of technological and other measures to reduce CO<sub>2</sub>-emissions from passenger cars, Smokers, R. et al., Delft, October 31, 2006, [http://ec.europa.eu/enterprise/sectors/automotive/files/projects/report\\_co2\\_reduction\\_en.pdf](http://ec.europa.eu/enterprise/sectors/automotive/files/projects/report_co2_reduction_en.pdf)

basis for the '130 g/km' legislation. The baseline chosen for vehicle technology was 2002; in that year average emissions were 167 g/km.

The main conclusion on the costs of reaching 140 g/km (which represented a 16% CO<sub>2</sub> cut compared with the baseline) was:

*'The costs of reaching an average CO<sub>2</sub>-emission of new vehicles of 140 g/km in 2008 will involve additional manufacturer costs of €832 per vehicle compared to the 2002 baseline. This translates into an additional retail price of €1200 per vehicle.'* (p6)

This €1,200 price increase is half the €2,400 price increase estimated five years earlier (see above), but for a CO<sub>2</sub> reduction of 16% rather than 25%. Average reduction costs therefore amount to €75 per % of CO<sub>2</sub> reduction. The costs of the last few per cent likely exceed €100.

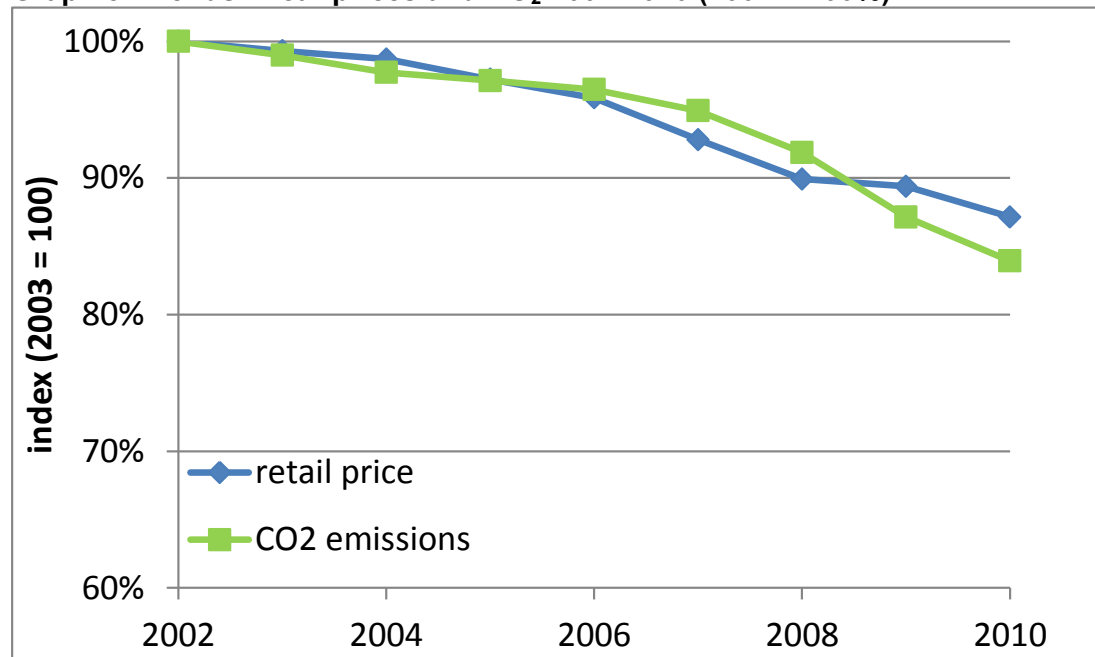
### Trends in real car prices

Every year the European Commission's competition department publishes a study comparing car prices in the EU. In order to check whether competition in the market is vigorous, the report analyses both differences between member states (since 1993) and average changes in car prices in member states (since 2003).

Price trends are available for an eight-year period, from November 2002 to December 2010. The study corrects prices for inflation and records them on a car-by-car basis (every year it asks prices of the same car models). Changes in the fleet mix hence don't influence the result; the study filters out the effects of, for example, the recent economic crisis which led to a shift towards smaller, cheaper cars.

Trends in car prices are depicted in the graph below.

**Graph 5: Trends in car prices and CO<sub>2</sub> 2002-2010 (2002 = 100%)**



### **Trends 2002-2010**

Overall cars have become 13% cheaper – after inflation – in the eight years from late 2002 to late 2010. The average annual price decrease was 1.7% and varied from 0.6% to 3.1%. On a typical €20,000 car this 13% reduction means a reduction of €2,600.

### **Trends before announcement of legally binding CO<sub>2</sub> targets (2002-2006)**

Before the CO<sub>2</sub> regulation started to have an impact on the CO<sub>2</sub> emissions from cars, the annual average reduction of car prices was 0.6%, and the annual reduction of CO<sub>2</sub> emissions was 0.7%.

### **Trends since legally binding CO<sub>2</sub> reduction targets (2007-2010)**

After the CO<sub>2</sub> regulation started to have an impact, prices started to fall much more quickly. Average price decreases in the 2007-2010 period were 2.5% and average reductions of CO<sub>2</sub> emissions were 3.0%.

As mentioned previously, the price trends are not the result of fleet mix changes (e.g. carmakers selling smaller cars for reasons of lower CO<sub>2</sub>, or the economic crisis shifting demand away from luxury models). The fact that the drop in average prices was lower in 2009 (the depth of the crisis) than in 2008 or 2010 confirms this.

### **Prices are not costs**

Clearly retail prices for cars depend on a wide range of factors, of which production costs is one. It is not possible to distil regulatory compliance costs from car retail prices.

What can be shown from this analysis though is that over the past decade legislative requirements, of which CO<sub>2</sub> reductions is one example, have not stopped the trend of cars becoming ever more affordable – lower CO<sub>2</sub> (and other) emissions and lower prices have gone hand in hand.

The complete lack of any relationship between CO<sub>2</sub> reductions and price increases – if anything we found an inverse relationship – strongly suggests that the earlier-mentioned €2,400 (1995 baseline) and €1,200 (2002 baseline) costs to hit 140 g/km CO<sub>2</sub> were overestimated.

## How can cost overestimation be explained ?

A wide range of studies<sup>14</sup> has concluded that 'ex ante' (pre-regulation) cost estimates of environmental policy tend to systematically overestimate. These studies also look at the reasons why this is the case, and the reasons tend to fall in two categories:

The first group of arguments has to do with innovation: the dynamics of technological development are often ignored in part, or completely. As technology matures and develops from niche to mass-market, depreciation of capital and R&D investments, mass-production effects, and learning effects (incremental improvements in technology and production methods) usually ensure a steep fall in costs, particularly for new technologies. Take DVD players, laptop computers, etc. that cost only a fraction today of what they cost in the past.

In the automotive world, the three-way catalysts for cutting exhaust pollution now cost around ten times less than the figures predicted in the late 1980s. In addition, costs of environmental technologies are typically assessed as 'add-ons' to existing vehicles, while in reality such improvements are often fully integrated in vehicle and engine concepts. Such integration, particularly after comprehensive redesign, makes it very difficult to single out cost increases of separate technologies.

The second group of arguments has more to do with political economics. Typically the best insight into likely compliance cost is available only from the affected industry and its suppliers. In the case of the car industry, cost estimates are typically prepared with the help of questionnaires sent to the car industry and its suppliers.

Carmakers have few incentives to be optimistic about compliance costs when talking to public regulators. Even carmakers that might foresee competitive advantages from stricter legislation are not likely to come forward with lower cost estimates because it might alert competitors to their product plans. Toyota, for example, was the first company to mass-produce hybrid power. Under no circumstance would the company wish to share the real production costs of its technology – because that would have been, and still is, a closely guarded commercial secret.

Often it is trade associations such as ACEA rather than individual companies that provide cost estimates. And trade associations are duty-bound to represent the interests of both their technologically advanced members, as well as those who have failed to make investments in fuel-saving research and therefore lag their competitors.

Suppliers of clean technologies, in theory, have an interest in communicating low cost figures for their technologies to the regulators because they would benefit from legislation that boosted demand for parts such as start/stop systems and bigger batteries. But sensitive customer relationships discourage such behaviour. Parts makers who give regulators optimistic cost estimates also put themselves at a disadvantage when negotiating trade prices with carmakers.

In summary, unless major changes are applied to correct for these two sources of upward bias, cost estimates are bound to be overly pessimistic.

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<sup>14</sup> Examples include *Ex-post estimates of costs to business of EU environmental legislation* (IVM 2006), *Evaluation of the air quality strategy* (AEA, 2004) and *Determining the costs to industry of environmental regulation* (Haq et al, 2001)

## Conclusions

Studies conducted ten and five years ago predicted that reducing CO<sub>2</sub> emissions from new cars to an average level of 140g CO<sub>2</sub>/km would make cars €2,400 and €1,200 more expensive, from 1995 and 2002 baselines.

This implies that they put the marginal costs of one percent of CO<sub>2</sub> emissions reductions towards 140 g/km at around or above €100, which is about 0.5% of a car's retail price.

Meanwhile new cars have become 13% cheaper on average in real terms over the past eight years, which means a €20,000 car in 2003 would sell for €17,400 now.

Probably coincidentally, car prices have fallen more quickly since CO<sub>2</sub> reductions began in earnest, from 0.7% over the 2002-2006 period to 2.4% over the 2007-2010 period.

We are aware of the complex set of factors that make up a car's retail price, and that regulatory compliance costs is just one of these factors.

Nevertheless this analysis clearly shows that the fear that reduction of CO<sub>2</sub> emissions would make cars unaffordable have been unfounded.

In addition, the absence of any relationship between reduction of CO<sub>2</sub> and higher retail prices – if anything an inverse relationship was found – and the significance of the estimated cost figures (every % of CO<sub>2</sub> reduction was estimated to cost about 0.5% of a car's retail price) strongly suggest that the costs of reducing CO<sub>2</sub> to an average of 140g CO<sub>2</sub>/km were considerably over-estimated.

## Progress and position per carmaker

In this chapter we present two rankings of the 15 largest carmakers, based on performance in 2010:

**Table 1: ranking of fleet-average CO<sub>2</sub> emissions of each carmaker**

Manufacturer group	Ranking 2009	Sales 2010	2010	2009	Reduction in %
1 Fiat	1	982,002	126	130	3.5%
2 Toyota	2	584,857	130	131	1.3%
3 PSA	3	1,791,176	131	135	2.9%
4 Renault	4	1,378,234	136	139	2.1%
4 Ford	7	1,079,078	137	144	4.9%
6 Suzuki	6	192,121	137	140	2.6%
7 Hyundai	5	580,802	138	141	1.7%
8 GM	9	1,148,845	139	148	6.0%
9 Volkswagen Group	12	2,813,854	143	152	6.2%
10 Honda	8	174,559	147	146	-0.6%
11 Nissan	13	390,376	147	153	4.1%
12 BMW	11	718,422	148	151	2.2%
13 Mazda	10	170,114	149	149	-0.3%
14 Volvo	-	206,787	157	173	9.3%
15 Daimler	14	648912	161	166	3.0%

**Table 2: ranking of improvement in fleet-average CO<sub>2</sub> emissions**

Manufacturer group	Ranking 2009	Sales 2010	2010	2009	Reduction in %
1 Volvo	-	206,787	157	173	9.3%
2 Volkswagen Group	10	2,813,854	143	152	6.2%
3 GM	11	1,148,845	139	148	6.0%
4 Ford	6	1,079,078	137	144	4.9%
5 Nissan	8	390,376	147	153	4.1%
6 Fiat	5	982,002	126	130	3.5%
7 Daimler	7	648,912	161	166	3.0%
8 PSA	12	1,791,176	131	135	2.9%
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10 BMW	13	718,422	148	151	2.2%
11 Renault	14	1,378,234	136	139	2.1%
12 Hyundai	4	580,802	138	141	1.7%
13 Toyota	1	584,857	130	131	1.3%
14 Mazda	3	170,114	149	149	-0.3%
15 Honda	9	174,559	147	146	-0.6%
Average*			140.3	145.7	3.7%

\*Average of all carmakers

The following conclusions can be drawn regarding the progress of the 15 largest carmakers in the EU:

- The industry as a whole achieved 3.7% progress, less than last year's record rate of 5.1% but significantly higher than the typically 1-2% progress recorded under the voluntary commitment and the second-highest since records began in 2000;
- Volvo achieved by far the most progress, with over 9%.
- Europe's eight largest carmakers by sales are all in the 2-6% range. The range in performance amongst volume carmakers is less wide than in previous years;
- Asian carmakers occupied the last four positions in terms of progress in 2010. Honda and Mazda actually increased their average CO<sub>2</sub> emissions. Toyota recorded only a minor change after last year's record 10% improvement;
- The two American groups, Ford and GM, caught up in 2010 with better-than-average improvement. Ford's performance was partly due to its sale of Volvo to Geely; were Volvo still part of Ford, the company's fleet average emissions would have been 140 g/km, only a 3% improvement;
- As a result of relatively even performance amongst major carmakers, the top-4 in terms of average CO<sub>2</sub> remained unchanged. Fiat remains in the lead with respect to average CO<sub>2</sub> emissions from new cars with a 126 g/km average. The company cut average CO<sub>2</sub> emissions by 3.5% in 2009 which contributed to this. Toyota, PSA and Renault filled positions 2-4;
- Volkswagen did better than in the past with a 6% improvement. But the company still ranks worse than other European large volume manufacturers.
- Daimler remains the volume carmaker with the highest emissions; the company also recorded below-average progress in 2010, with just 3%.

## Distance to CO<sub>2</sub> targets, by carmaker

The regulation on cars and CO<sub>2</sub> strives to achieve a 130 g/km average figure by 2015. This average target does not apply to individual carmakers. Carmaker targets for 2015 are differentiated on the basis of the weight of the vehicles they produce in 2015 compared with the average weight of the vehicles the entire industry will produce over the 2011-13 period.

This chapter first assesses how far carmakers are away from the regulatory targets for 2015.

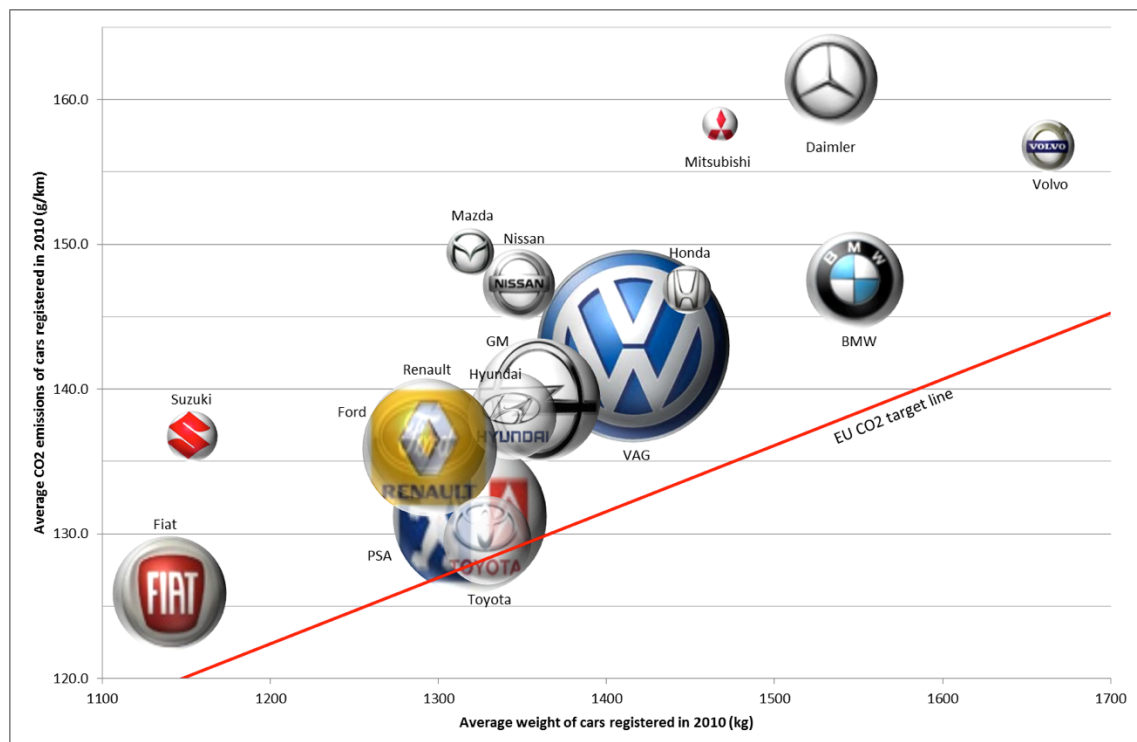
It then discusses why 'weight' is a bad parameter to base CO<sub>2</sub> standards on, and proposes a better alternative – to base CO<sub>2</sub> standards on size, not weight, of a car, more precisely on the surface area between the four wheels. This is how the US regulates CO<sub>2</sub> emissions from different vehicles.

It then assesses what a change to this parameter would mean for the efforts each carmaker would have to make.

### Distance-to-target

This section presents how Europe's top-15 carmakers are placed with respect to hitting the 130 g/km target for 2015, which is based on vehicle weight.

**Graph 3: fleet-average weight and fleet-average CO<sub>2</sub> emissions by carmaker, compared with EU target line**



**Table 3: ranking on the basis of the percentage reduction in CO<sub>2</sub> each carmaker now has to make in order to hit its 2015 EU CO<sub>2</sub> target.**

		Year 2010			Year 2009		
		Weight (kg)	CO <sub>2</sub> emission (g/km)		Distance to 2015 target (g.km)	Weight (kg)	Distance to target
			2010	2015 target			
<b>1</b>	Toyota	1,329	129.6	128.3	<b>1%</b>	1,265	4%
<b>2</b>	PSA	1,318	131.2	127.8	<b>3%</b>	1,309	5%
<b>3</b>	Fiat	1,140	125.9	119.7	<b>5%</b>	1,136	8%
<b>4</b>	BMW	1,548	147.5	138.3	<b>6%</b>	1,526	8%
<b>5</b>	Hyundai	1,344	138.2	129.0	<b>7%</b>	1,305	9%
<b>6</b>	Renault	1,295	135.9	126.8	<b>7%</b>	1,285	9%
<b>7</b>	GM	1,359	139.3	129.7	<b>7%</b>	1,310	13%
<b>8</b>	Ford	1,293	136.6	126.7	<b>7%</b>	1,312	11%
<b>9</b>	Volkswagen Group	1,416	143.0	132.3	<b>7%</b>	1,410	13%
<b>10</b>	Volvo	1,663	156.8	143.6	<b>8%</b>	-	-
<b>11</b>	Honda**	1,448	146.9	133.8	<b>9%</b>	1,354	11%
<b>12</b>	Suzuki	1,153	136.7	120.3	<b>12%</b>	1,138	15%
<b>13</b>	Nissan	1,348	147.2	129.2	<b>12%</b>	1,348	15%
<b>14</b>	Mazda	1,319	149.5	127.9	<b>14%</b>	1,251	16%
<b>15</b>	Daimler	1,533	161.3	137.7	<b>15%</b>	1,495	18%
	Average***	1,365	140.3	130.0	7.3%	1,337	11%

\* Assuming the average weight of the company's new cars in 2015 will be the same as in 2010, and the average weight of cars sold by the entire industry in 2011-13 will be 1,365 kg

\*\* We have less confidence in the accuracy of weight figures from Honda where a high share of weight data was missing, similarly for footprint data on Fiat

\*\*\* Average of all carmakers

The following conclusions can be drawn from the graph and table:

- Toyota remains in the top spot when it comes to hitting regulatory targets. The company is virtually there, five years ahead of time;
- PSA and Fiat are also very close, with 3 and 5% cuts left to make respectively;
- Progress was more evenly spread across manufacturers than in previous years; virtually all carmakers are rapidly approached their targets;
- Daimler is still furthest away with a 15% gap yet to close. Four Japanese carmakers, Mazda, Nissan, Suzuki, and Honda, follow with 14, 12, 12 and 9% respectively;
- Mazda may benefit from a loophole in the EU legislation that enables carmakers with sales below 300,000 units to apply for a 25% reduction target compared with 2007 levels. In Mazda's case the target would be 129 g/km instead of the 128 g/km in the table above.

The 3.7% progress carmakers achieved in 2010 again brings them much closer to the 2015 target. In 2009 they were 11% away from the target, now only 7%.

This 7% figure does not even take earlier-described loopholes like ‘eco-innovations’ and ‘supercredits’ into account, which in effect water down the 130 g/km target to values closer to 140 g/km. Precise calculation is difficult as the size and nature of the ‘eco-innovations’ depends on how intensively carmakers will apply for them, while the size of the ‘supercredits’ loophole depends on future sales of cars below 50g/km (likely to be mostly electric cars).

Our headline conclusion of last year’s report therefore remains unchanged: all available evidence points towards carmakers in Europe heading for very significant ‘over-compliance’ with the CO<sub>2</sub> regulation and are hence likely to hit the target for 2015 several years in advance.

## Why weight based standards are bad and ‘footprint’-based standards are better

EU policymakers felt that car CO<sub>2</sub> standards should take account of the ‘utility’ or purpose of the vehicle. While the average car in the real world only carries one to two people at a time, it is indeed true that some cars have the *capacity* to carry seven people and others only two.

However, the EU’s solution to the utility question was to base CO<sub>2</sub> standards on the weight of the vehicle. In many ways this was a bizarre choice as weight is not linked to utility in any meaningful sense. There are two-seaters on the market that weigh 2 tonnes and seven-seaters that weigh 1.5 tonnes. Consumer car reviews tend to see weight as a negative rather than a positive. Clearly then, weight fails as a proxy for the utility of a car.

T&E has always opposed linking CO<sub>2</sub> standards to vehicle weight, arguing that it takes away important incentives for vehicle lightweighting<sup>15</sup>.

Research commissioned by T&E found that basing CO<sub>2</sub> standards on the car’s ‘footprint’ is likely to allow cheaper and deeper CO<sub>2</sub> reductions, and likely to lead to safer vehicles than weight based standards<sup>16</sup>.

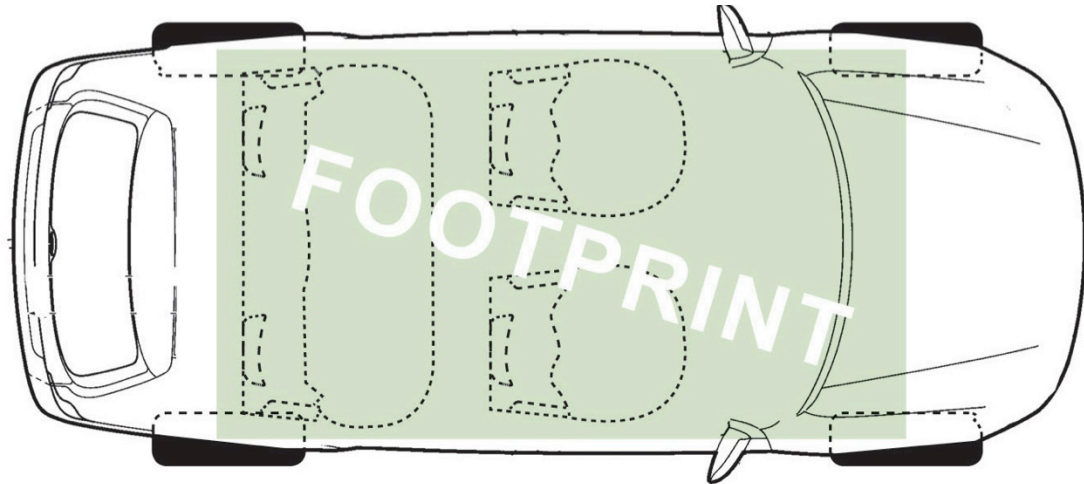
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<sup>15</sup> T&E briefing: [www.transportenvironment.org/Publications/prep\\_hand\\_out/lid:500](http://www.transportenvironment.org/Publications/prep_hand_out/lid:500)

<sup>16</sup> TNO/IEEP study: [www.transportenvironment.org/Publications/prep\\_hand\\_out/lid/512](http://www.transportenvironment.org/Publications/prep_hand_out/lid/512)

Figure 1 illustrates the concept of the 'footprint' of a car. Technically it is the average track width multiplied by the wheelbase of a car, which is roughly speaking the area between the four wheels. This is typically the space in which the passenger compartment is built, and hence a good proxy for the utility of a passenger car.

**Figure 1: footprint**

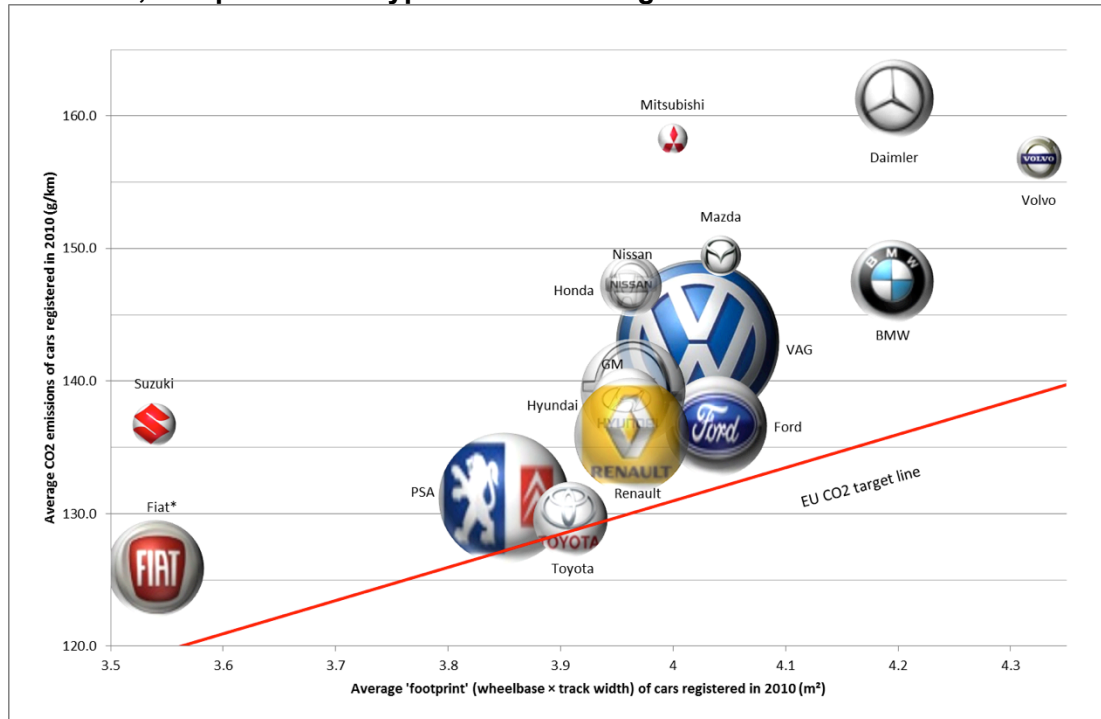


The US already bases its fuel consumption and CO<sub>2</sub> standards for cars on their footprint, for reasons of exploiting lightweighting, and for reasons of safety.

## Distance to target if footprint-based standards were used

We analysed how carmakers would be placed to hit regulatory targets in case the standards were footprint-based. We calculated the targets for a 'slope' of the CO<sub>2</sub> target curve of 60% - in other words the same slope that is used for weight.

**Graph 4: fleet-average 'footprint' and fleet-average CO<sub>2</sub> emissions by carmaker, compared with hypothetical EU target line**



\* NB Footprint data for Fiat is less statistically reliable and may be more affected by further data corrections

The data in the two graphs above are summarised in the table on the next page.

**Table 4: comparison of distance to 2015 targets for a weight-based versus a 'footprint'-based set of CO<sub>2</sub> standards. Ranking based on distance-to-target under a weight-based system**

		Weight (kg)	CO <sub>2</sub> emission (g/km)		Distance to 2015 target (%)*			
			2010	2015 target (weight)	2015 target (footprint)	Weight-based	Footprint-based	Difference
<b>1</b>	Toyota	1,329	129.6	128.3	128.6	1%	1%	<b>0%</b>
<b>2</b>	PSA	1,318	131.2	127.8	127.2	3%	3%	<b>0%</b>
<b>3</b>	Fiat	1,140	125.9	119.7	119.4	5%	5%	<b>0%</b>
<b>4</b>	BMW	1,548	147.5	138.3	135.8	6%	8%	<b>2%</b>
<b>5</b>	Hyundai	1,344	138.2	129.0	129.9	7%	6%	<b>-1%</b>
<b>6</b>	Renault	1,295	135.9	126.8	130.0	7%	4%	<b>-2%</b>
<b>7</b>	GM	1,359	139.3	129.7	130.0	7%	7%	<b>0%</b>
<b>8</b>	Ford	1,293	136.6	126.7	131.9	7%	3%	<b>-4%</b>
<b>9</b>	Volkswagen Group	1,416	143.0	132.3	131.5	7%	8%	<b>1%</b>
<b>10</b>	Volvo	1,663	156.8	143.6	139.1	8%	11%	<b>3%</b>
<b>11</b>	Honda**	1,448	146.9	133.8	129.9	9%	12%	<b>3%</b>
<b>12</b>	Suzuki	1,153	136.7	120.3	119.4	12%	12%	<b>0%</b>
<b>13</b>	Nissan	1,348	147.2	129.2	130.0	12%	12%	<b>-1%</b>
<b>14</b>	Mazda	1,319	149.5	127.9	132.0	14%	12%	<b>-3%</b>
<b>15</b>	Daimler	1,533	161.3	137.7	135.9	15%	16%	<b>1%</b>
	Average***	1,365	140.3	130.0		7.3%	7.3%	<b>0%</b>

\* Assuming the average weight of the company's new cars in 2015 will be the same as in 2010, and the average weight of cars sold by the entire industry in 2011-13 will be 1,365 kg

\*\* We have less confidence in the accuracy of weight figures from Honda where a high share of weight data was missing, similarly for footprint data on Fiat

\*\*\* Average of all carmakers

A change towards 'footprint'-based standards would hardly change the relative positions of carmakers towards their regulatory targets. For most, in particular the volume carmakers like Volkswagen Group, PSA, GM, Toyota and Hyundai, the change would be in the 0-1% range. In short, the distributional consequences of such a change would be minor. This conclusion is in line with a recent study by ICCT<sup>17</sup> and the IEEP/TNO study mentioned before<sup>18</sup>;

<sup>17</sup> <http://www.theicct.org/2011/07/evaluating-parameter-based-vehicle-standards-in-the-eu/>

<sup>18</sup> [www.transportenvironment.org/Publications/prep\\_hand\\_out/lid/512](http://www.transportenvironment.org/Publications/prep_hand_out/lid/512)

## Status and progress by Member State

This chapter provides an overview of progress by EU Member State in reducing average new car CO<sub>2</sub> emissions. Countries are able to influence sales of low CO<sub>2</sub> vehicles in many ways including CO<sub>2</sub>-based registration and circulation taxes, company car taxation and through regulation of labelling and car advertising.

**Table 5: average CO<sub>2</sub> figures of new cars sold in EU Member States as well as the percentage improvement made over the last year.**

		Registrations 2010	Average CO <sub>2</sub> 2010	Average CO <sub>2</sub> 2009	Improvement 2009-2010	Rank 2009
1	Denmark	133,309	127	139	-8.9%	5
2	Portugal	222,780	127	134	-5.0%	2
3	France	2,250,395	131	134	-2.6%	1
4	Malta	4,471	131	136	-3.5%	3
5	Italy	1,954,123	133	136	-2.4%	4
6	Ireland	88,637	133	144	-7.4%	8
7	Belgium	551,385	133	142	-6.0%	6
8	Netherlands	479,515	136	147	-7.6%	10
9	Spain	975,933	138	142	-2.8%	7
10	Greece	140,418	144	157	-8.4%	21
11	Austria	328,261	144	150	-4.0%	12
12	UK	2,026,120	144	150	-3.8%	11
13	Slovenia	60,033	144	152	-5.0%	14
14	Luxembourg	48,381	146	153	-4.6%	15
15	Poland	219,120	146	152	-3.7%	13
16	Hungary	43,283	148	153	-3.5%	16
17	Romania	94,116	149	157	-5.4%	19
18	Czech Republic	164,619	149	156	-4.5%	18
19	Slovakia	64,859	149	147	1.3%	9
20	Finland	108,547	149	157	-5.1%	20
21	Lithuania	7,326	151	166	-9.1%	24
22	Germany	2,873,269	151	154	-1.8%	17
23	Sweden	277,203	151	165	-8.2%	23
24	Cyprus	14,962	156	161	-3.2%	22
25	Bulgaria	13,908	159	172	-7.5%	26
26	Latvia	6,119	162	177	-8.5%	27
27	Estonia	10,242	162	170	-4.7%	25
	<b>EU-27</b>	<b>13,161,334</b>	<b>140.3</b>	<b>145.7</b>	<b>-3.7%</b>	

## Denmark leaps to the top

This table shows that Denmark has taken the top spot from France, the country that led the ranking last year. Denmark saw its fleet-average CO<sub>2</sub> emissions drop by almost 9% to 126.6 g/km, followed by Portugal which had 127.3 g/km average emissions and again finished a close second. Both countries have steep differentiation of vehicle taxes on the basis of CO<sub>2</sub> emissions. France operates a bonus-malus system, the effectiveness of which is declining given the below-average progress of only 2.4%. Both Denmark and Portugal have new car CO<sub>2</sub> emissions below 130 g/km, the EU target for 2015.

## Germany holding Europe back

Germany, the biggest market, with 22% of EU27 sales in 2010, recorded disappointing progress with only 1.8% improvement, half the EU average. Germany is 22 of 27 in terms of average CO<sub>2</sub>, and 26 out of 27 in terms of progress in 2010. Only Slovakia recorded a worse performance; it actually saw fuel efficiency of new cars get worse in 2010.

One explanation is that the CO<sub>2</sub> differentiation of Germany's vehicle taxes is weak. There is no CO<sub>2</sub> tax below 120 g/km, and every g/km above that is taxed at just €2. This means a car with 200 g/km CO<sub>2</sub> only costs €160 more in vehicle tax to own per year than a car with 100 g/km, half the level.

Another explanation is that its scrappage scheme, Europe's most generous (see last year's report) ended in 2009, thereby ending the historically high sales of cheap, typically small and low-CO<sub>2</sub>, vehicles.

It is questionable whether Germany will become a frontrunner in coming years. The country is introducing a new CO<sub>2</sub> labelling for cars that makes it easier for heavy cars to get a 'green' label than for light cars. The result is that an Audi Q7 SUV with 189g CO<sub>2</sub>/km gets a green 'B' rating, while a 97g Smart Mhd gets a 'D'.

## Success stories in smaller states

Many other countries at the bottom of the CO<sub>2</sub> league table actually improved their performance remarkably. The two Baltic states Lithuania and Latvia made strides, as well as Sweden.

The UK is the only one of the big markets doing (if only slightly) better than average.

2010 truly was the year where progress came from small countries. The best performing 'big' car market was the UK (#12) which recorded progress marginally above the EU average. It is remarkable that four of the five worst countries in terms of progress belong to the five biggest car markets: besides Germany, also Italy, France and Spain disappointed, all with less than 3% progress compared with 3.7% for the EU as a whole.