Monitoring CO_2 emissions from new passenger cars in the EU: summary of data for 2013

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European Environment Agency

Abstract

This year, the European Environment Agency (EEA) has collected EU Member States' data on new passenger car registrations, in accordance with Regulation (EC) No 443/2009 ([1]). This regulation sets a CO_2 'specific emission' target of 130 g CO_2/km as an average for the new fleet. Because different manufacturers produce cars in different weights and different categories, each manufacturer has an individual emission target that they must meet. These individual manufacturer-specific targets are binding: if the average CO_2 emissions of a manufacturer's fleet exceed its specific emissions target, the manufacturer has to pay an excess emissions premium for each new car registered.

This is the fourth year that the EEA has collected these data. All Member States ([2]) reported information on the carbon dioxide (CO_2) emissions and mass of cars, together with other vehicle characteristics. These data were used to evaluate the performance of the new vehicle fleet, and the progress of the new vehicle fleet toward meeting the CO_2 emissions target of 130 grams of CO_2 per kilometre (g CO_2/km) by 2015.

The current dataset presented in this report is provisional, and will now be sent for verification to all car manufacturers responsible for cars registered in the EU in 2013. The EEA, together with the European Commission, will take account of errors noted by manufacturers, and correct the dataset as appropriate, before setting the final specific emissions targets for each manufacturer in the second half of 2014.

The provisional dataset on which this report is based indicates that manufacturers have once more improved their performance in terms of CO_2 emissions from passenger cars: the average CO_2 emissions from the new car fleet in 2013 ([3]) were 127.0 g CO_2/km. This was 5.2 g CO_2/km less than in the previous monitoring year (132.2 g CO_2/km in 2012) and 13.3 g CO_2/km less than the first monitoring year (2010). This is the first year when the average CO_2 emissions of the European fleet are below the 2015 emissions target.

Some of the key changes observed in the new vehicle fleet this year are:

- the share of diesel vehicles in the new fleet remains high but has been decreasing slightly since 2011. Dieselisation of the fleet is continuing, with 52.3 % of the vehicles registered in 2013 in Europe being diesel, whereas petrol vehicles accounted for 45.3 %;
- the efficiency gap between new diesel and new petrol vehicles has been decreasing in recent years. In 2013 an average diesel vehicle emitted 127.2 g CO_2/km, only 1.5 g CO_2/km less than a petrol vehicle (in 2000 the emissions difference between diesel and petrol vehicles was 17.1 g CO_2/km);
- the average vehicle mass remains at a high level, although a slight decrease has been observed in the last year (– 9.2 kg);
- the average engine capacity (measured in cm^3) has decreased by 6.7 % since 2007.

In spite of the increase in mass, dieselisation and improved vehicle technology have led to greater fuel efficiency and lower average CO_2 emissions per kilometre travelled.

Member States report CO_2 emission levels determined as part of the type approval test procedure. These levels are measured under laboratory conditions using a legislative driving cycle (i.e. the New European Driving Cycle (NEDC)). This should make the measurements comparable between manufacturers, but not necessarily representative of real-world conditions. In fact, NEDC cycles represent an artificial driving

([1]) Regulation (EC) No 443/2009 of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles.
([2]) Croatia joined the EU on 1 July 2013. The Croatian data will be used for the target calculation from 2014 onwards.
([3]) The average CO_2 emission is calculated considering all the vehicles submitted, excluding individual vehicle approvals (IVAs) and (national small series vehicles) NSS. IVAs are made on vehicles imported from third countries or on own-build vehicles that have to be individually approved. NSS vehicles are vehicles that are approved nationally in very small numbers, typically because they are made by smaller manufacturers.

speed pattern with low accelerations, constant speed cruises, and many idling events. As a result, the measured emissions levels can be different from those in real world conditions. The driving cycles influence not only CO_2 emissions but also air pollutants, such as NO_x. Although not discussed further in this document ([4]), differences between test cycle and real world NO_x emissions have proved particularly problematic for air quality policy. While vehicle emission standards for NO_x have been increasingly strengthened (based on NEDC cycles) in recent years, the reductions from this sector have not been as large as originally anticipated due to the higher real-world emissions that have occurred.

([4]) See also: http://www.eea.europa.eu/highlights/eleven-countries-exceed-air-pollutant.

1 Introduction

CO_2 emissions from road transport have increased by 17.2 % between 1990 and 2012 in the EU-28, and they account for about one fifth of the EU's total CO_2 emissions. In order to ensure that the EU meets its greenhouse gas emission targets under the Kyoto Protocol, a comprehensive strategy to reduce CO_2 emissions from new cars and vans sold in the European Union was adopted in 2007.

As part of that strategy, Regulation (EC) No 443/2009 aims at reducing the average CO_2 emissions of new passenger cars. The Regulation sets a short-term target of 130 g CO_2/km by 2015, to be phased in from 2012, and a longer term target of 95 g CO_2/km by 2021, to be phased in from 2020 ([5]).

According to Article 8 of Regulation (EC) No 443/2009, Member States shall record and annually transmit to the Commission information for each new passenger car registered on their territory. In particular, the following details are required for each new passenger car registered:

- manufacturer name: the person or body responsible for all aspects of the EC type-approval procedure, i.e. the manufacturer that is responsible for meeting a specific CO_2 emission target;
- type approval number, type, variant, version: these entries allow the identification of the vehicles as registered in type-approval documentation and certificates of conformity;
- specific emissions of CO_2: the CO_2 emissions of a passenger car in terms of grams of CO_2 emitted per kilometre, and measured in accordance with Regulation (EC) No 715/2007. The specific CO_2 emissions of a vehicle version are determined using a type-approval test cycle (NEDC) in laboratory conditions;
- mass in running order: the mass of the car with bodywork in running order, i.e. including the driver (75 kg), fuel (90 % filled), liquids (for cooling), and standard equipment as foreseen in the Directive 2007/46/EC;
- wheel base (the distance between the centre of the front and rear wheels);
- track width (the distance between the centre of the wheel on one side of the vehicle and the centre of the wheel on the opposite side);
- fuel type and fuel mode;
- CO_2 emission reductions from innovative technologies, where applicable.

Additional information, such as engine capacity, and engine power were also submitted.

The data now published and used for this report are provisional. As a first step, it must therefore be verified by manufacturers to prevent specific emissions targets being calculated with incorrect data. Manufacturers have three months within which to notify the Commission of any errors. The EEA, in cooperation with the Commission, will correct the dataset as appropriate, and publish the final dataset and specific emissions targets, including the distance between each manufacturer's average emissions and their individual target emissions, in the fourth quarter of 2014.

It should be noted that in April 2014 new provisions entered into force. According to these new provisions, a manufacturer which, together with all of its connected undertakings, is responsible for fewer than 1 000 new registered vehicles will be exempt from meeting a specific CO_2 emissions target. Manufacturers that may fall within this category will be asked, as part of the verification process, to submit a declaration to the Commission on their ownership structure to prove their eligibility for the exemption.

Some values included in the provisional dataset may therefore change following the verification by the manufacturers. However, based on the experience from the verifications made of the 2010–2012 data, it is expected that the changes made will have only limited impact on the analysis of the aggregate data given in this document.

([5]) Regulation (EU) No 333/2014 of the European Parliament and of the Council amending Regulation (EC) No 443/2009 to define the modalities for reaching the 2020 target to reduce CO_2 emissions from new passenger cars.

The provisional database provides the detailed data without taking into account other factors required for the calculation of both the specific emissions and the manufacturer targets, such as phase-in percentages, super-credits or CO_2 reductions due to eco-innovations ([6]).

([6]) Additional information on the calculation of the target by manufacturers is available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0657:FIN:EN:PDF and http://www.eea.europa.eu/publications/co2-emissions-performance-of-car.

2 2013 monitoring exercise

2.1 Data submission and processing

For the reporting year 2013, the majority of Member States submitted the data by the deadline of 28 February 2014 in accordance with Article 8 of Regulation (EC) No 443/2009. The remaining Member States delivered the data within two weeks after the deadline.

Data was submitted to the Central Data Repository (CDR) managed by the EEA. Several quality checks were performed in order to evaluate the accuracy and the quality of the dataset. These checks covered various areas, listed in bullet points below.

- The completeness rate. This is comprised of two main components. The first component concerns numerical data such as vehicle mass and emissions rates for each vehicle. The second component measures the extent to which more granular data — such as model type — are available for each vehicle that has been registered.
- Data plausibility and outliers.
- Assignment to a specific manufacturer using a harmonised denomination. Identical vehicles are often sold under different brand or model names in different countries. For the purposes of this study, one naming system was used to ensure correct manufacturer attribution.
- Data variability (for the same vehicle, an estimate of the variability of the mass, emissions and engine capacity were developed).
- Fuel type classification.
- Handling of unknown, individual vehicle approvals (IVAs) and national small series vehicles (NSS).

2.2 Monitoring and data quality

Member States have made significant efforts during the last few years to improve the monitoring and quality of the data. The use of official documents, such as type approval documentation (TAD) and Certificates of Conformity (CoC) has resulted in more accurate values being recorded and reported. Accuracy has also been improved through the continuous collaboration between manufacturers, Member States, the EEA and the Commission.

As regards the completeness of the data sets, Member States have, with very few exceptions, provided values for all mandatory parameters. Those values may be revised following the verification by the manufacturers.

The completeness rate (defined as the ratio between the number of registrations having a value for a specific entry and the total number of registrations) is a good indication of the improvements in the monitoring systems achieved over the years. The completeness rate for the mandatory parameters is particularly high:

- The *entries for mass and CO_2 emissions* have been completed in 99.98 % of the total registrations.
- The *entries for type, variant and version* have been completed in 99.4 % of the total registrations.
- The *type approval number* has been completed in 99.2 % of the total registrations. Two Member States (Cyprus and Slovakia) did not report this entry.

It is important to stress the importance of Member States providing accurate data and ensuring that their entries are correctly completed.

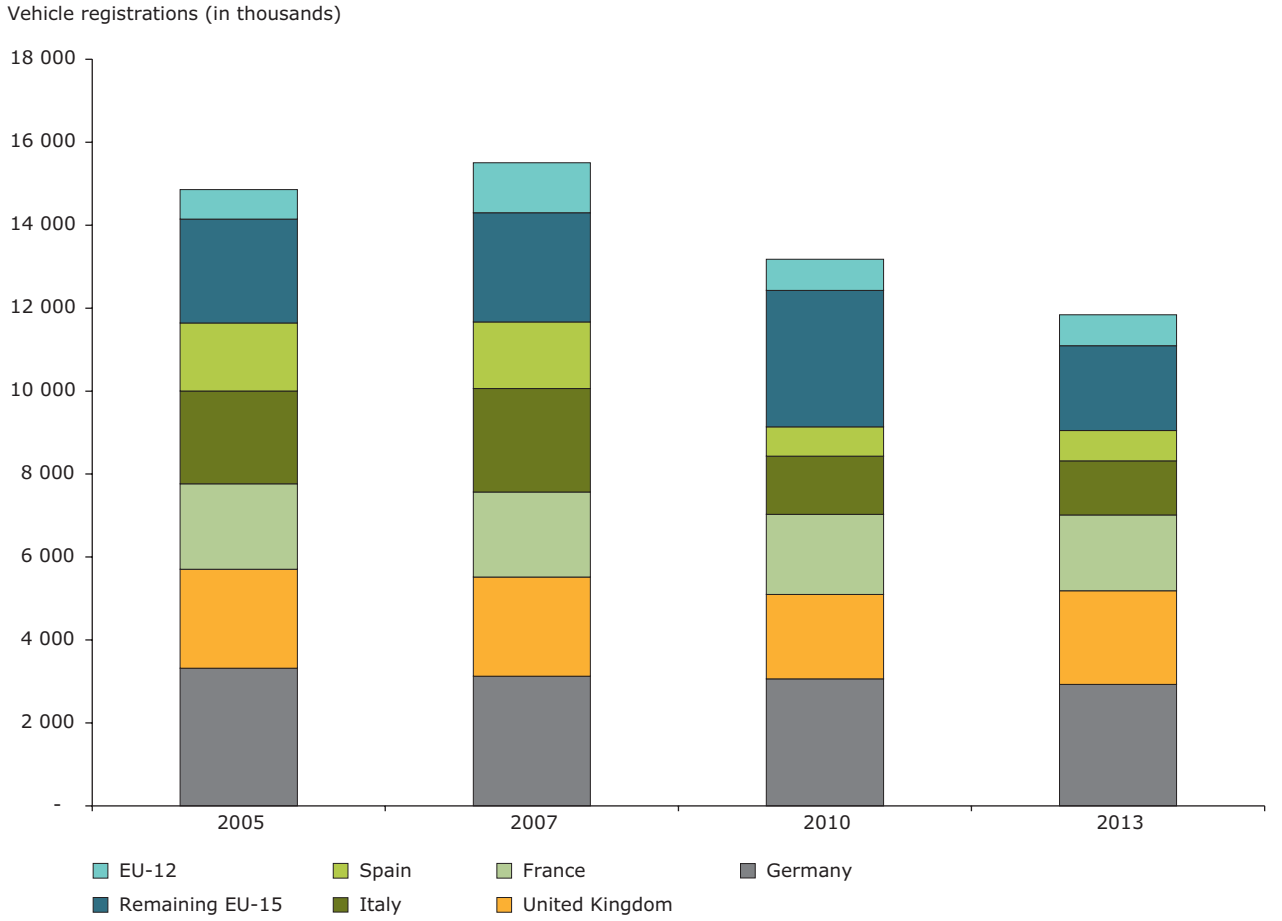
3 Trends in new passenger cars

3.1 Average CO_2 emissions from new passenger cars

The provisional 2013 EU database contains around 12 million individual vehicles. This includes 3 144 individually approved vehicles (IVA), 673 vehicles approved under national small series rules (NSS), around 19 900 unknown vehicles, and around 3 000 unidentified vehicles. Unknown vehicles are vehicles where the entries for the manufacturer name are missing in the database for unknown reasons. Those vehicles cannot be attributed to a manufacturer and are therefore not included in the provisional calculation of targets. If identified by the manufacturers, they may be included for the final target calculation. Unidentified vehicles are vehicles where the entries for the mass in running order or the CO_2 emissions are missing in the database for unknown reasons. Unidentified vehicles will not be considered for the calculation of the average specific emissions or the specific emissions targets for manufacturers, unless these vehicles are identified and noted by the manufacturer as part of their verification of the data.

The number of registrations in the EU-27 has increased constantly between 2001 and 2007 (when 15.5 million vehicles were registered, calculated on the basis of available Member States' data, see Table A.1 in the annex) but decreased thereafter. In 2013, there were 11.8 million registrations compared to 12.0 million registrations in 2012. For half of the Member States the number of registrations decreased in 2013 compared to 2012, while for the other half

Figure 3.1 Number of vehicles registered in the EU-27 in 2005, 2007, 2010 and 2013



Note: Remaining EU-15: Denmark, Finland, Greece Ireland, Luxembourg. Only from 2007 onwards, data on all EU-12 countries are available.

registrations increased over the same period. The biggest declines in new vehicle registrations were observed in Cyprus (– 37 %), the Netherlands (– 17 %), Romania (– 14 %), whereas the largest increases were seen in the United Kingdom (+ 11 %), Bulgaria and Portugal (+ 10 %). Compared to 2007 the number of new vehicle registrations has decreased by 24 %, reflecting the link between vehicle sales and the economy. This decrease was significant in the southern European Member States, where vehicle registrations have decreased by 80 % in Greece, 54 % in Spain, and 48 % in Italy and Portugal.

The EU-15 ([7]) still accounts for the vast majority of registrations of new passenger cars in the Union, with a share of almost 94 % of total registrations. It is important to note that only new cars are covered, i.e. second-hand vehicles are not included in the database. Among the EU-15, France, Germany, Italy, Spain and the United Kingdom accounted for 82 % of the registrations in 2013. The three largest countries for registrations (Germany, the United Kingdom and France) accounted for 59 % of the total. Compared to 2012, the number of vehicles registered in the EU-12 ([8]) has decreased by 1 %, while the number of newly registered vehicles in the EU-15 has decreased by 2 % ([9]).

According to the provisional data, the average CO_2 emissions from the new car fleet in the EU in 2013 were 127.0 g CO_2/km (Table 3.1). Average specific emissions of CO_2 in 2013 have decreased by some 5.2 g CO_2/km, or 4.0 %, compared to the previous year (132.2 g CO_2/km in 2012). This is the second biggest decrease since the entry into force of the legislation.

Diesel vehicles represented 52.3 % of the newly registered vehicle fleet in 2013 as against 55.2 % in 2011 ([10]) the year in which the percentage of diesel vehicle reached the maximum (Table 3.2). The average CO_2 emissions of diesel and petrol vehicles decreased by 4.4 g CO_2/km and 5.1 g CO_2/km respectively, compared to 2012, meaning that the efficiency gap between new diesel and new petrol vehicles has continued on its decreasing path (Figure 3.2). In 2013 an average diesel vehicle emitted 127.2 g CO_2/km, only 1.46 g CO_2/km less than a petrol vehicle (in 2000, the emissions difference between diesel and petrol vehicles was 17.1 g CO_2/km).

Compared to 2011, the share of alternative fuel vehicles (AFVs) has again increased, following the considerable decrease observed in 2011. In addition, specific emissions of CO_2 from AFVs have decreased by 14.4 g CO_2/km, or 12.2 %. This is related to the increased contribution of very low emitting vehicles (i.e. electric vehicles and plug-in hybrid vehicles).

On the basis of the monitoring data, it is possible to report CO_2 emissions for different fuel types used by AFVs (Table 3.3). It is noteworthy that the mix of vehicles considered in the AFV categories has changed over the years (natural gas vehicles, liquefied petroleum gas vehicles, biodiesel vehicles, ethanol E85 vehicles, electric vehicles and plug-in hybrid vehicles are included in this category). This helps explain the high variability in the trend of emissions and other characteristics of the AFV fleet (see Section 3.2).

Table 3.1 Average CO_2 emissions from new passenger cars by fuel (EU-27 [a])

g CO_2/km	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010 [b]	2011 [b]	2012 [b]	2013 [b]
All fuels	172.2	169.7	167.2	165.5	163.4	162.4	161.3	158.7	153.6	145.7	140.3	135.7	132.2	127.0
Petrol	177.4	175.3	173.5	171.7	170	168.1	164.9	161.6	156.6	147.6	142.5	137.6	133.7	128.6
Diesel	160.3	159.7	158.1	157.7	156.2	156.5	157.9	156.3	151.2	145.3	139.3	134.5	131.5	127.2
AFV [c]	208.0	207.4	179.2	164.7	147.9	149.4	151.1	140	137	125.8	126.0	124.7	118.5	104.1

Note:
[a] The geographical scope of the data changes over time from EU-15 to EU-25 and EU-27, see Annex 1 for details.

[b] The calculation for the years 2010, 2011, 2012 and 2013 was done without considering IVAs and NSS. Note that 2013 data are provisional.

[c] For the calculation of the average CO_2 emissions of AFVs, pure electric, LPG, NG-biomethane, E85, biodiesel, hybrid and plug-in vehicles are included.

([7]) EU-15 includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.
([8]) EU-12 includes Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia, Bulgaria and Romania.
([9]) Croatia joined the EU on 1 July 2013. The Croatian data will be used for the target calculation from 2014 onwards.
([10]) Fuel type is available for 93 % of the vehicle registrations in 2013.

Table 3.2 Share of fuel type in new passenger cars (EU-27 [a])

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010 [b]	2011 [b]	2012 [b]	2013 [b]
Petrol	68.9	64.0	59.2	55.5	51.9	50.7	49.4	47.3	47.4	51.1	45.3	43.4	43.0	45.3
Diesel	31.0	35.9	40.7	44.4	47.9	49.1	50.3	51.9	51.3	45.1	51.3	55.2	54.9	52.3
AFV incl. electric	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.7	1.3	3.8	3.5	1.4	2.2	2.4

Note: [a] The geographical scope of the data changes over time from EU-15 to EU-25 and EU-27, see Annex 1 for details.

[b] The calculation for the years 2010,2011,2012 and 2013 was done without considering IVAs and NSS . Note that 2013 data are provisional.

Table 3.3 AFV data [a]: registrations, CO_2 emission (g CO_2/km), mass (kg) and engine capacity (cm^3)

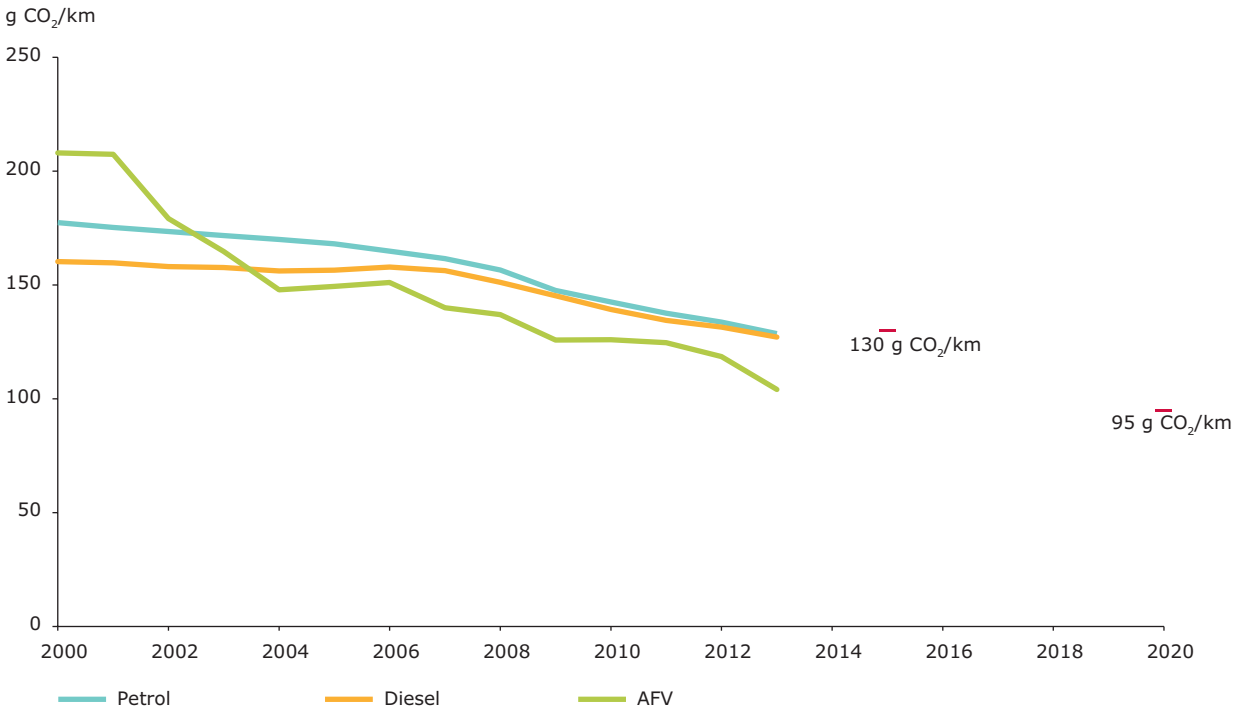
	Registration (#)	Average CO_2 emission (g CO_2/km)	Average mass (kg)	Average engine capacity (cm^3)
E85	4 372	156.8	1 492	1 649
Electric [b]	24 173	-	1 461	–
LPG	130 433	125.5	1 206	1 331
NG-biomethane	81 574	112.6	1 288	1 134
Plug-in hybrid (petrol)	22 622	70.5	1 478	1 693
Plug-in hybrid (diesel)	8 483	54.3	1 951	2 350
Biodiesel	3	122.3	1 297	1 720

Note: Note that 2013 data are provisional.

[a] Only exhaust emissions are considered. For electric monofuel vehicles the emission is null. For Petrol-E85, the petrol CO_2 emission is reported, for Biodiesel, the diesel CO_2 emission is reported, for LPG and NG (natural gas) the respective LPG and CNG CO_2 emissions are reported.

[a] Electric vehicles are vehicles for which end-of-pipe emission is 0 g CO_2/km.

Figure 3.2 Evolution of CO_2 emissions from new passenger cars by fuel (EU-27 [a])



Note: [a] The geographical scope of the data changes over time from the EU-15 to the EU-25 and the EU-27, see Annex 1 for details.

Table 3.4 Average CO_2 emissions (g CO_2/km) from new passenger cars by region

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
EU-27								158.7	153.6	145.7	140.3	135.7	132.2	127.0
EU-15	172.2	169.7	167.2	165.5	163.7	162.6	161.5	158.8	153.3	145.2	139.9	135.1	131.6	126.3
EU-12								157.8	156.8	154.2	148.1	144.1	140.9	137.1

Note: EU-15 includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

EU-12 includes Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia.

EU-27 includes EU-15 and EU-12.

Croatia joined the EU in July 2013 and will be included in the data collection from 2014 (full calendar year data are needed).

Pure electric vehicles are propelled by electric motors, using electrical energy stored in batteries or another energy storage device. The emissions of this kind of vehicle are considered to be 0 g CO_2/km. It is important to mention that only tail-pipe ([11]) emissions are included in the dataset. In 2013 there were 10 000 more registrations of electric vehicles compared to 2012. Plug-in hybrid vehicles are also included in the database. These vehicles have both an internal combustion engine and an electric motor, but the power to the wheels is only provided by the electric motor. The combustion engine is only used to power a generator that drives the electric motor. The emissions of those vehicles are in general below 80 g CO_2/km. Registrations of plug-in hybrid vehicles are comparable to the ones of pure electric vehicles. Hybrid vehicles are included in the dataset under the category of petrol or diesel vehicle, so it is not possible to distinguish them on the basis of fuel types. Of the other types of AFVs, natural gas vehicles (NG-biomethane), biodiesel vehicles, and liquefied petroleum gas vehicles (LPG vehicles) have the lowest CO_2 emissions (below 125.5 g CO_2/km), whereas ethanol-fuelled vehicles (E85) have the highest specific emissions (156.8 g CO_2/km).

In 2013, the average new passenger car in the EU-15 emitted 10.8 g CO_2/km less than the average newly registered vehicle in the EU-12 (Table 3.4). The last four years (2010–2013) were the first years in which significant progress was made in the EU-12: in the period 2007–2009 the emissions in the EU-12 dropped by 3.6 g CO_2/km, but in the last four years average emissions decreased by 17.1 g CO_2/km. For the EU-15, the average reduction of CO_2 emissions in the last five years (– 27.0 g CO_2/km) is substantially higher compared to the reduction in the previous eight years (– 18.9 g CO_2/km for the period 2000–2008).

The percentage of newly registered vehicles with emissions lower than 100 g CO_2/km has increased significantly in the last year. Almost 15 % of newly registered vehicles emit less than 100 g CO_2/km — a huge increase compared to the 8.6 % of last year (Figure 3.3). The number of new passenger cars emitting 101–120 g CO_2/km has remained stable compared to the previous year, representing 34 % of the total registrations. The number of vehicles emitting less than 140 g CO_2/km represents 77 % of the registrations in 2012 (compared to 27.8 % of the registrations in 2005).

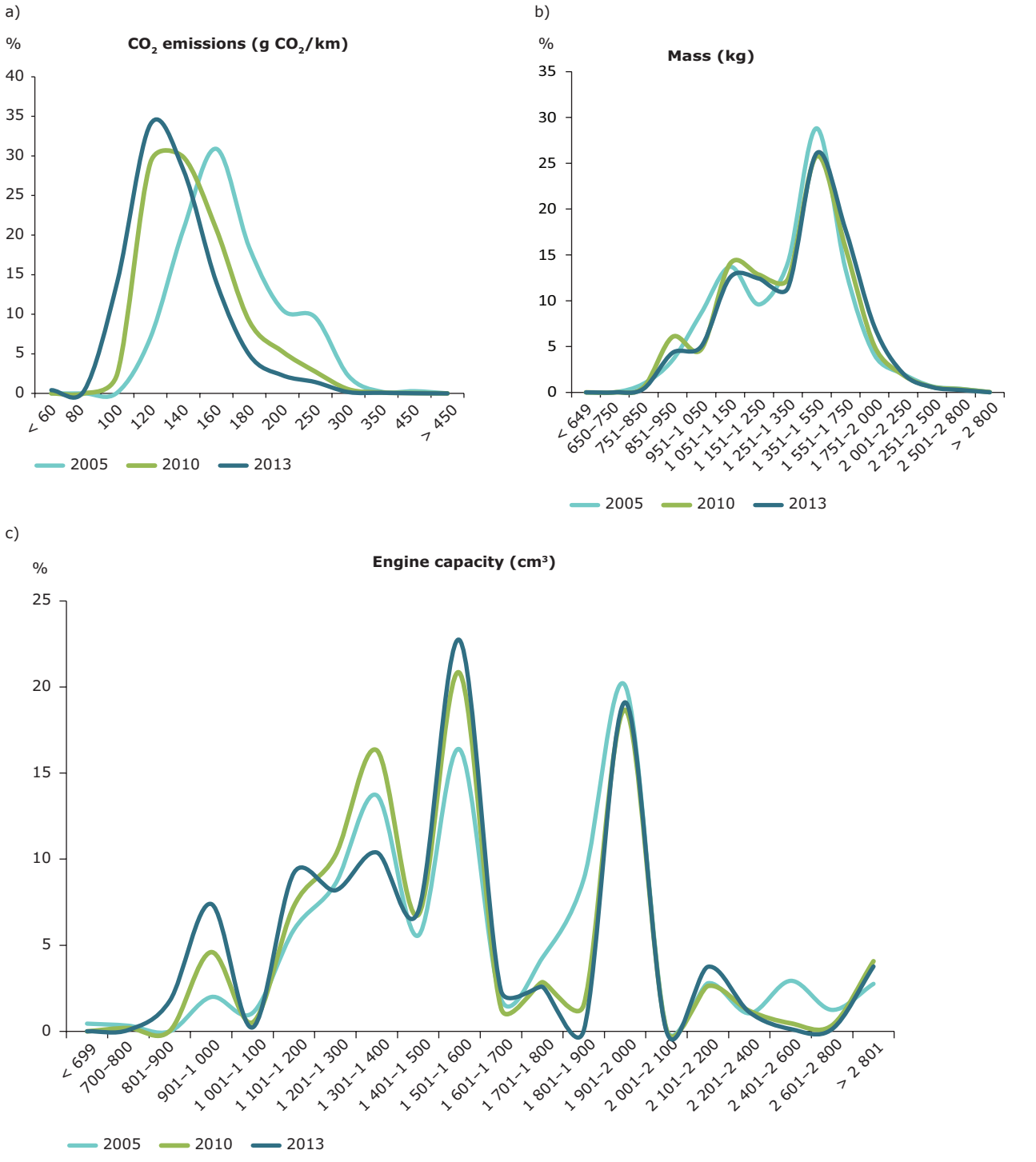
The distributions of emissions, mass and engine capacity for four years (2005, 2010 and 2013) are shown in Figure 3.3. While there has been a big difference in terms of emissions performance of the vehicles between 2000 and 2013, there have been few changes for the other vehicle characteristics in the same period.

With the exception of Poland, for which the average CO_2 emissions in 2013 are comparable to the ones in 2012, in all other countries CO_2 emissions from newly registered passenger cars fell in 2013 compared to 2012 (Figure 3.4). The blue bars in Figure 3.4 show the absolute reduction by Member States between 2013 and 2012, while the blue diamonds represent the percentage variation between the same two years.

Twelve Member States have average CO_2 specific emissions from newly registered cars already below the 130 g CO_2/km EU target set for 2015 (Figure 3.5). Six of them have emissions values below 120 g CO_2/km.

([11]) End-of-pipe emissions are the exhaust emissions of the vehicles. There are no end-of-pipe emissions for pure electric vehicles. However, pure electric vehicles produce indirect emissions when they are plugged in into the electricity grid. The indirect emissions are not taken into account in this report and in the regulation.

Figure 3.3 Frequency distributions of (a) emissions, (b) mass, (c) engine capacity, and of the vehicles registered in Europe in the years 2005 (data based on Decision 1753/2000), 2010, and 2013 (data based on Regulation (EC) No 443/2009)



For some of these Member States (Malta, Denmark, Greece, the Netherlands), the low average emissions are mainly related to the registration of relatively small cars: the average mass of the new fleet of these countries is below 1 300 kg. Denmark, Greece and Malta have the lowest engine capacity in Europe. Denmark also has the lowest average engine power value, followed by Italy, France, the Netherlands and Portugal (only 18 EU Member States reported engine power, the remaining nine countries did not submit engine power data). The economic crisis is most probably the main driving force for the shift to smaller, less powerful, and hence cheaper cars in Greece and Malta. In Denmark, however, this trend is most probably attributed to new vehicle taxation, which is the highest in the EU.

The share of diesel vehicles can have an effect in lowering average CO_2 specific emissions in the newly registered vehicle fleet (Figure 3.5). The percentage of diesel vehicles in the fleet varies among Member States: in Belgium, France, Ireland, Luxembourg and Portugal the percentage of diesel vehicles is higher than 65 %. On the opposite side, only 17 % of vehicle registrations in Cyprus in 2013 were diesel vehicles. However, it is not always the case that a diesel fleet creates fewer emissions than a petrol fleet as is shown in Figure 3.6. For example, in Germany, diesel vehicles emit 2.8 g CO_2/km more than petrol vehicles. This is related to the mass of the vehicles: in a national fleet where diesel vehicles are relatively heavy and petrol vehicles are relatively light there can be little difference in emissions between the two types of vehicles and the diesel fleet may on average emit more than the petrol fleet. In a national fleet with lighter diesel vehicles and heavier petrol vehicles, the diesel-powered component of the fleet is likely to create fewer emissions than the petrol-powered component.

Greece and the Netherlands recorded the largest annual relative CO_2 emission reductions in newly registered cars, about 8 % on average compared to the previous year. As is the case with Portugal, the

Figure 3.4 Absolute reduction and the percentage reduction by Member State between 2012 and 2013

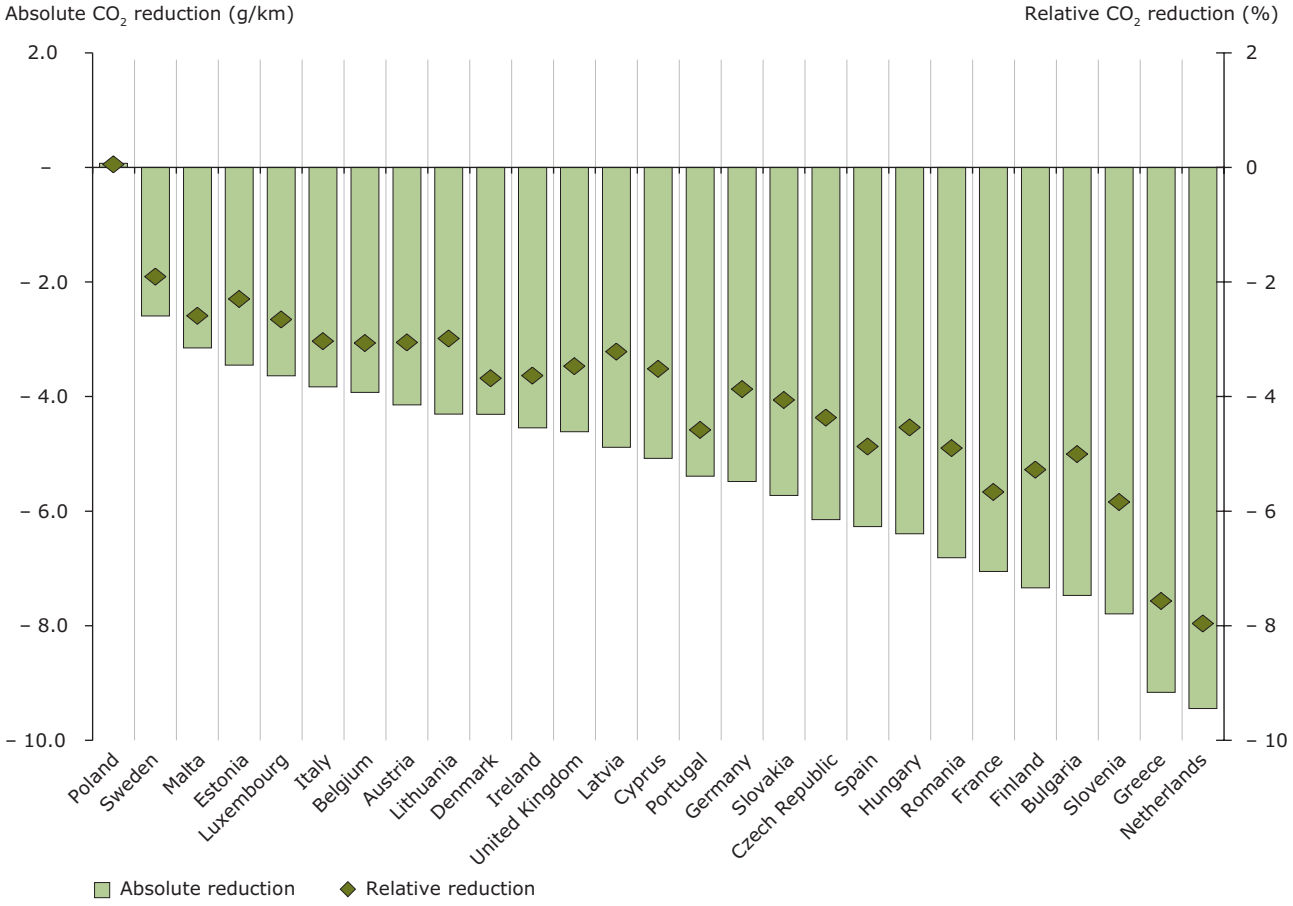
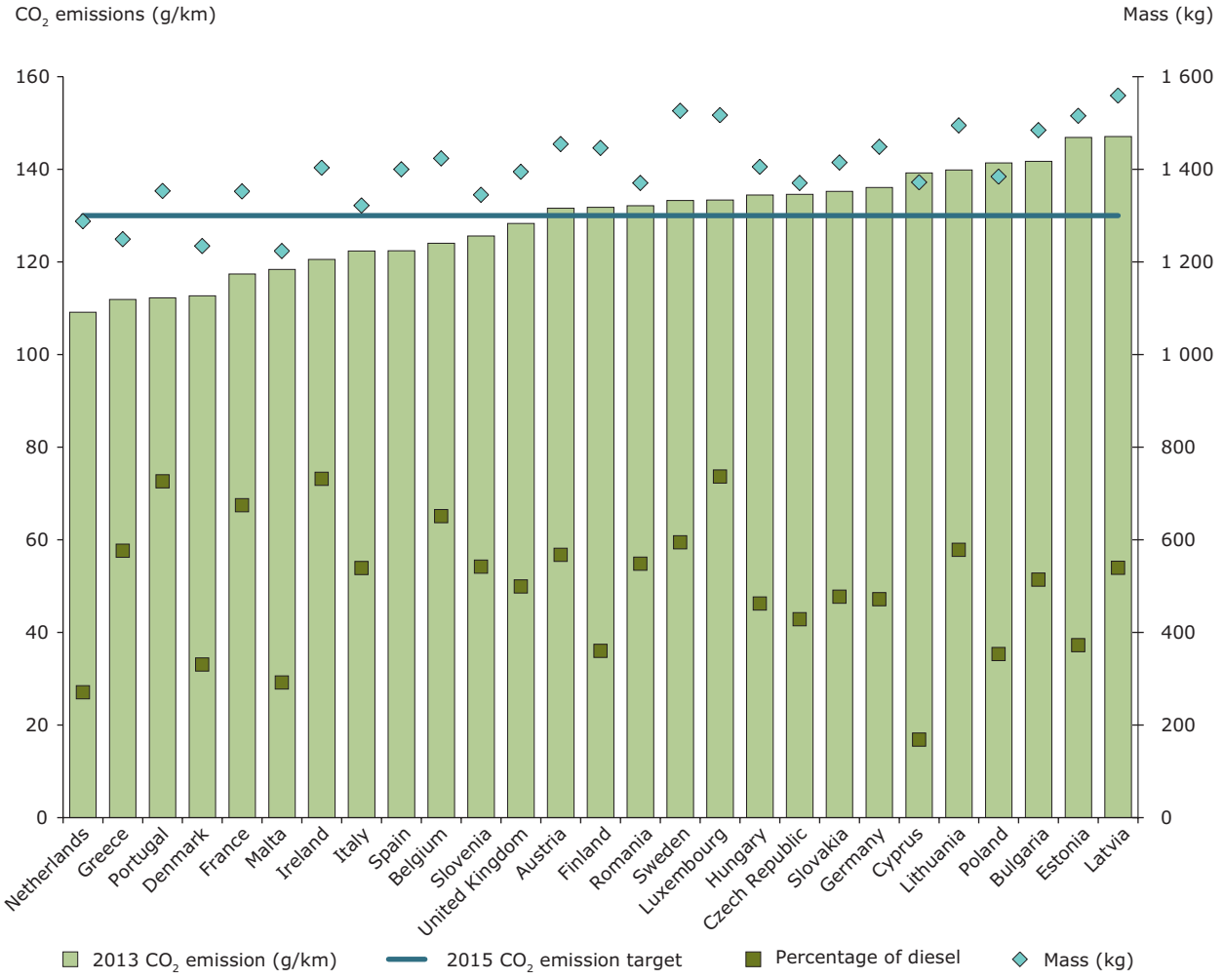


Figure 3.5 Average CO_2 emission and average mass by Member State — 2013 data



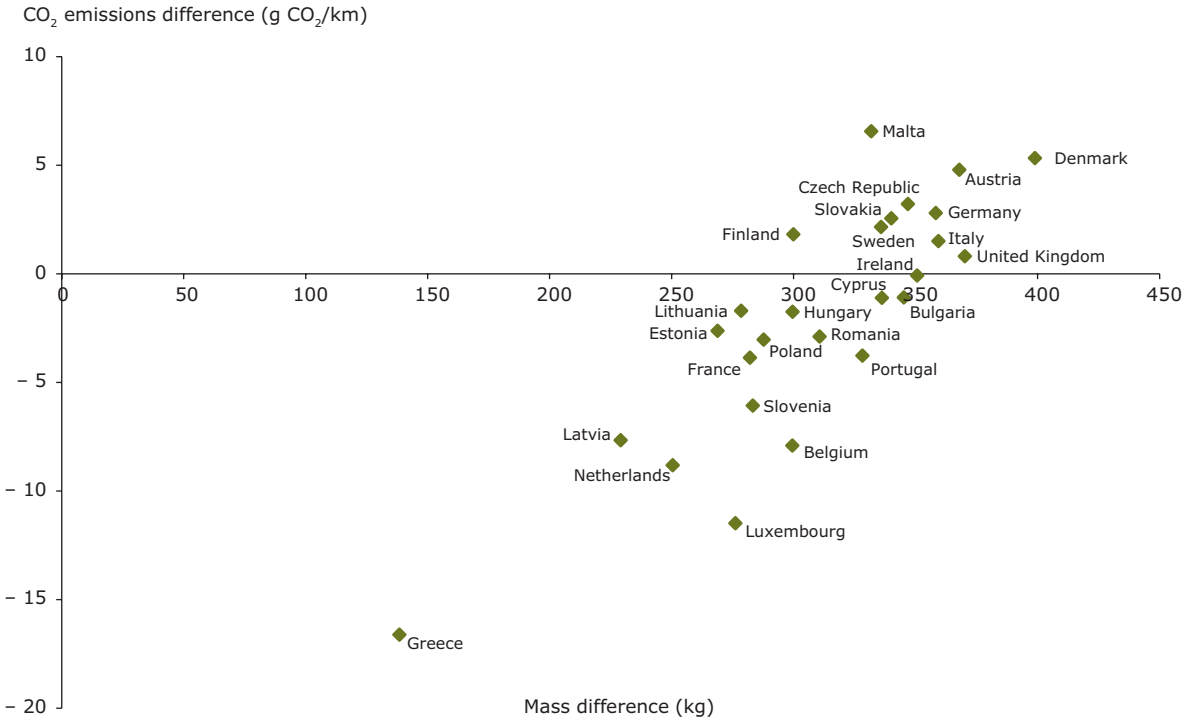
economic crisis is the most probable cause for this drop in Greece.

Due to their size, the Member States with higher vehicle registrations – France, Germany, Italy, Spain and the United Kingdom – are the major drivers of the total reductions in EU-27 CO_2 emissions from newly registered cars. Of these five, France, Italy and Spain have the lowest average CO_2 specific emissions. For Italy, this is due to a combination of reasons. Italy, similar to Denmark and Portugal, has one of the lowest average mass (the fifth lowest among the EU Member States) and engine power (second lowest value among those Member States reporting engine power) values. In addition to this, Italy has a high share of diesel cars (54 %) and by far the highest share of AFVs (15 %). The latter are mainly LPG cars (9 % of all new registrations) with an average CO_2 value of 125 g CO_2/km and NG cars (5 % of all new registrations) with an average CO_2 value of 113 g CO_2/km. For France it seems that dieselisation is the main reason for the low CO_2 specific emissions, with the fourth-highest share of new diesel cars (67 %) among the EU Member States. France also has a relatively high share of pure electric cars (0.5 %) with zero emissions.

3.2 Other car characteristics: mass, engine capacity and engine power

The average mass of new passenger cars registered in the EU-27 is back to the 2011 level. Compared to 2012 the average mass decreased by 9 kg in 2013 (Table 3.5). This is the first decrease observed since 2009. The difference in mass between petrol and diesel vehicles has been increasing slowly but constantly between 2004 (226 kg) and 2013 (320 kg). While the mass of petrol vehicles has been stable in the last ten years, the mass of diesel vehicles

Figure 3.6 CO_2 emissions and average mass differences between diesel and petrol vehicles by Member State



Note: CO_2 emission difference is the difference between the average emissions of diesel and petrol vehicles; mass difference is the difference between the average mass of diesel and petrol vehicles

has consistently increased. The mass of alternative fuel vehicles varies over the years in relation to the composition of the fleet (see Section 3.3)

Over the years (2004–2013) CO_2 emissions have decreased significantly, even if the average mass has not also decreased (Figure 3.7). The relation between average emissions and average mass changes according to fuel type: the average mass of petrol vehicles overall decreased together with petrol-vehicle emissions, whereas the average mass of diesel vehicles increased despite the decrease of emissions in the same period. Since 2009 the average mass of the fleet has increased for all fuel types: more for diesel vehicles than for petrol ones.

There was a slight decrease in average engine capacity in 2013 compared to 2012 for petrol vehicles (Table 3.6): the average engine capacity of new petrol passenger cars in 2013 decreased by 31.4 cm^3. The difference between new diesel and petrol vehicles is around 434 cm^3, while in 2001 it was 421 cm^3. The engine capacity for AFVs decreased in 2013 by 46 cm^3 (3.3 %) compared to 2012.

Table 3.5 Average mass of new passenger cars by fuel [a]

Kg	2004	2005	2006	2007	2008	2009	2010	2011	2012 [b]	2013 [b]
All fuels	1 347	1 356	1 372	1 379	1 373	1 337	1 364	1 388	1 402	1 393
Petrol	1 237	1 235	1 238	1 235	1 228	1 206	1 214	1 220	1 224	1 223
Diesel	1 463	1 479	1 501	1 510	1 508	1 498	1 507	1 523	1 547	1 543
AFV [c]	1 415	1 404	1 392	1 271	1 237	1 169	1 202	1 270	1 247	1 304

Note: [a] Data before 2004 are not shown due to incomplete dataset.

[b] For the calculation of the average mass of AFVs, pure electric, LPG, NG-biomethane, E85, biodiesel, plug-in hybrid vehicles are included. Note that 2013 data are provisional.

[c] For the calculation of the average mass of AFVs, pure electric, LPG, NG-biomethane, E85, biodiesel, plug-in hybrid vehicles are included.

Figure 3.7 CO_2 emissions versus vehicles mass in EU-27

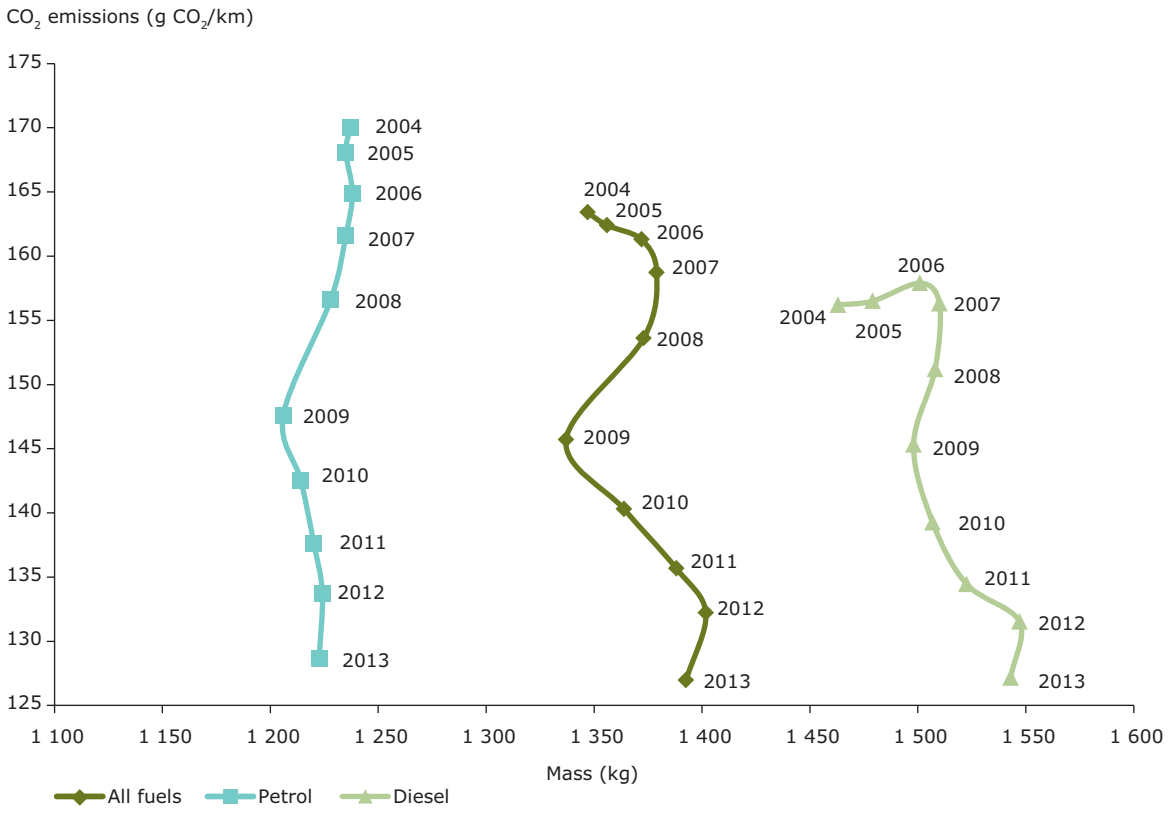


Table 3.6 Average engine capacity of new passenger cars by fuel [a]

Cm^3	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013 [a]
All fuels	1 714	1 731	1 743	1 730	1 726	1 724	1 729	1 703	1 620	1 633	1 641	1 640	1 613
Petrol	1 560	1 570	1 572	1 571	1 573	1 561	1 556	1 531	1 454	1 454	1 434	1 419	1 388
Diesel	1 981	1 961	1 948	1 904	1 886	1 885	1 892	1 869	1 832	1 807	1 806	1 821	1 821
AFV [c]	1 602	1 672	1 628	1 581	1 561	1 562	1 424	1 387	1 328	1 349	1 432	1 386	1 340

Note: [a] The geographical scope of the data changes over time from EU-15 to EU-25 and EU-27, see Annex 1 for details.

[b] For the calculation of the average engine capacity of AFVs, pure electric, LPG, NG-biomethane, E85, biodiesel vehicles are included. Note that 2013 data are provisional.

[c] For the calculation of the average mass of AFVs, pure electric, LPG, NG-biomethane, E85, biodiesel, plug-in hybrid vehicles are included.

In the last 12 years, manufacturers are producing more powerful cars (higher engine power in terms of cm^3) but using smaller engine capacities. There is a more clear correlation between engine capacity and emissions (Figure 3.8): an increase in engine capacity means an increase in CO_2 average emissions.

Not all Member States have reported engine power and hence the corresponding dataset is incomplete. In addition, no data on engine power were collected in 2010. Average engine power in newly registered cars has been increasing steadily over the 2002–2008 period. There was a sudden drop in engine power in 2009, possibly due to the economic and financial crisis. In the period 2011–2013 the average engine power increased to its highest level in the last 10 years. Compared to 2009, the engine power for all fuel types in 2013 increased by 18 kW. However in the last two years the average engine power did not change significantly for any of the fuel type vehicles.

Figure 3.8 CO_2 emissions versus vehicles engine capacity in EU-27

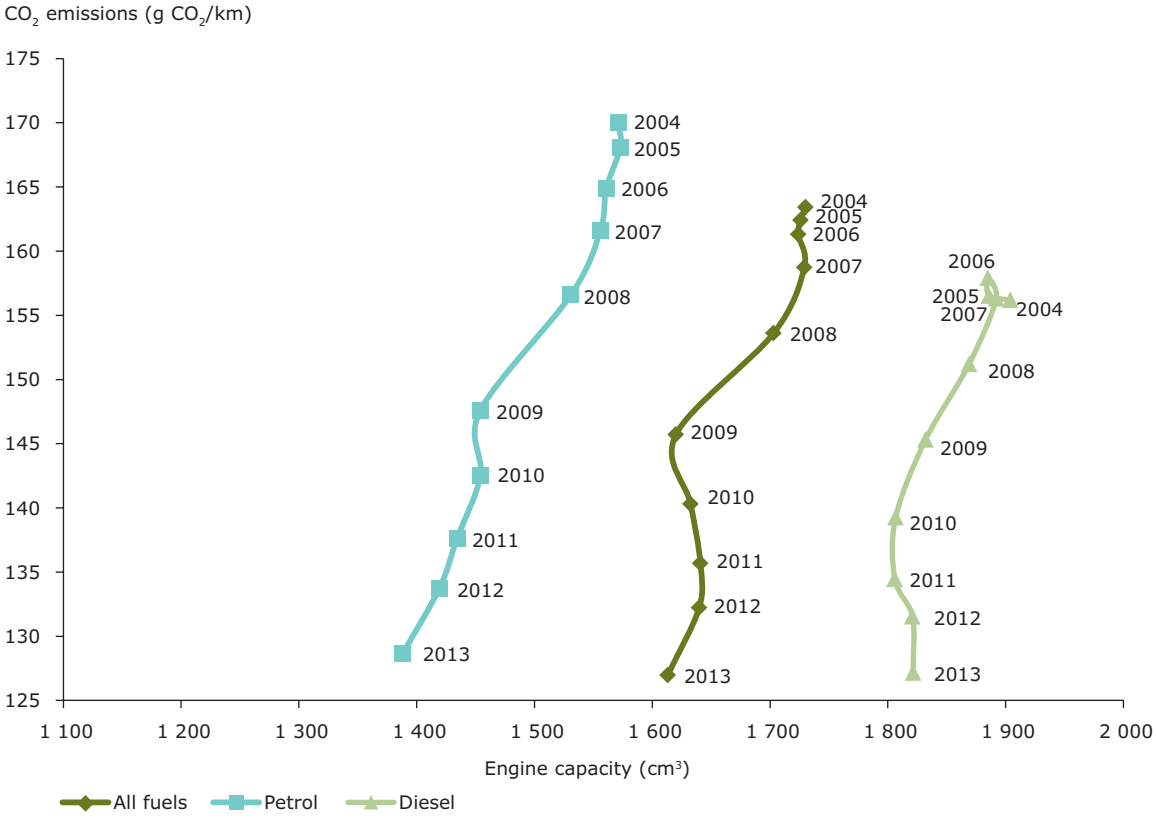


Table 3.7 Average engine power of new passenger cars by fuel

kW	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013 [a]
All fuels	104	70	73	76	77	79	80	83	71	–	86	88	89
Petrol	115	63	67	70	70	71	70	76	62	–	77	79	80
Diesel	86	79	80	82	83	87	88	89	81	–	93	96	97
AFV [b]	75	74	73	68	68	69	61	61	58	–	64	66	67

Note: [a] For the calculation of the average engine power of AFV, pure electric, LPG, NG-biomethane, E85, biodiesel vehicles are included. Note that 2013 data are provisional.

[b] For the calculation of the average mass of AFVs, pure electric, LPG, NG-biomethane, E85, biodiesel, plug-in hybrid vehicles are included.

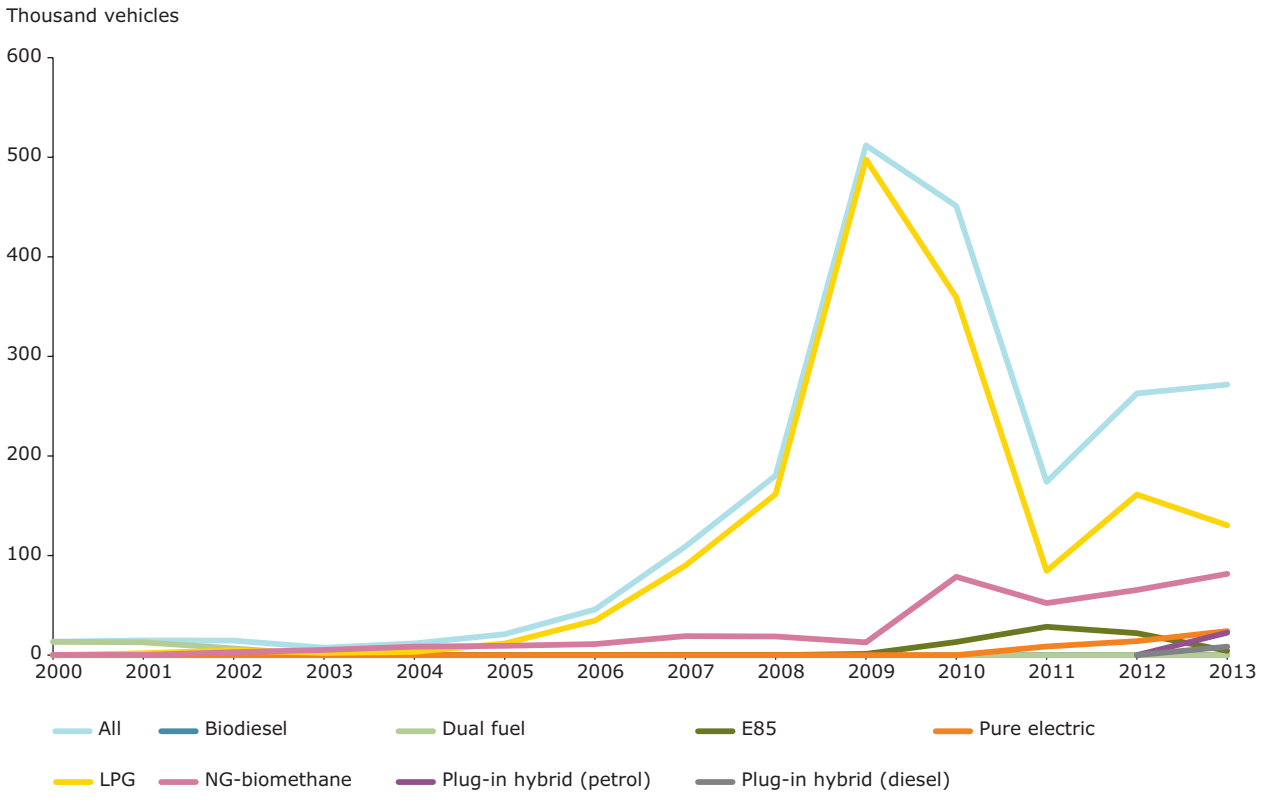
3.3 Alternative Fuel Vehicles (AFV)

The main analysis of the database shows that alternative fuel vehicles (AFVs) have exhibited significant reductions in their CO_2 emissions over the years, falling from 208.0 g CO_2/km in 2000 to about 104.1 g CO_2/km in 2012. The comparative drop in petrol CO_2 emissions is from 177 g CO_2/km in 2000 to 128.6 g CO_2/km in 2012.

The registration of AFVs has been increasing substantially in recent years (Figure 3.9). This category was dominated by a few special vehicles in 2000, but it exceeded half a million new vehicle registrations in 2009, before dropping to slightly less than half a million in 2010. The registration of AFVs increased considerably by 48 % between 2011 and 2013, after a significant drop between 2010 and 2011 (when registrations fell by 62 %). Italy is the country for which the increase of AFVs (mainly LPG and NG) in 2013 has been highest (+ 97 % compared to 2011). The number of pure electric vehicles in the EU-27 has increased in the last four years from around 700 in 2010 till around 25 000 in 2013. The main drivers of this increase are France (more than 8 800 vehicles) and Germany (around 6 000 vehicles). More than 2000 electric vehicles are registered in the United Kingdom and the Netherlands. The number of plug-in hybrid vehicles is comparable to the number of pure electric vehicles: more than 31 000 plug-in vehicles were registered in the EU-27 in 2013.

In the early 2000s, AFVs were dominated by dual-fuel vehicles, i.e. vehicles mostly able to operate on petrol and ethanol blends. This trend gradually changed due to the introduction of LPG-petrol and natural gas–petrol (NG-petrol) cars, which have greatly outnumbered the ethanol cars. LPG cars are particularly popular in Italy and France. Thus the significant reduction in CO_2 emissions from AFVs over the past few years is not necessarily the result of improvements in technology, but is also due to shifts in fuel composition and in engine type. In the last year, pure electric vehicles and plug-in hybrid vehicles contribute to declining emission levels (see also Table 3.3).

Figure 3.9 Evolution of total registrations of AFVs over the years



3.4. Trends within individual capacity classes

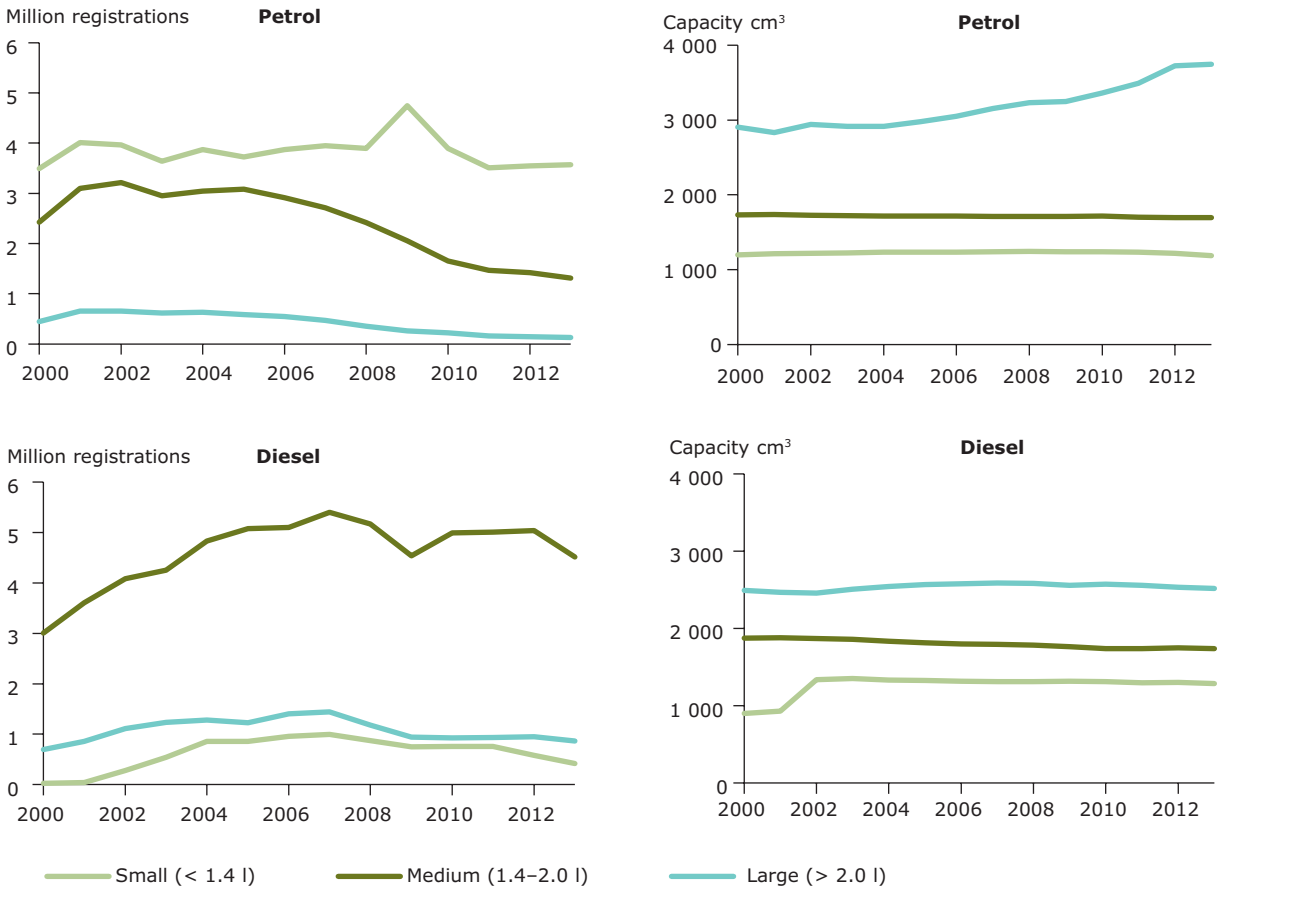
Cars are generally grouped into capacity classes (traditionally three categories: smaller than 1.4 litres, between 1.4 litres and 2.0 litres, and larger than 2.0 litres) in order to better analyse vehicles with similar characteristics. It is therefore interesting to explore whether the average characteristics of these classes have changed over the years. Figure 3.10 shows the number of registrations and the mean capacity per capacity class.

As observed in previous years, the petrol registrations are dominated by small cars, i.e. with engine capacities of less than 1.4 l, followed closely by medium-sized cars. There are far fewer registrations of large cars. The registrations of medium and large petrol cars have exhibited a significant and continuous drop since 2005.

In terms of their capacity, large petrol cars exhibit a notable increase over the years, rising from 2.9 l in 2000 to 3.7 l in 2012. It is worth mentioning that the number of vehicles in this category has consistently decreased over the same period. The small petrol car class also seems to continuously increase in average capacity from 1197 cm^3 in 2000 to 1243 cm^3 in 2008. Only over the four last years, i.e. 2009, 2010, 2011 and 2012, has there been a slight decrease, with capacity dropping to 1 189 cm^3 in 2013.

Although registrations of new petrol cars are dominated by small-sized vehicles, diesel registrations are dominated by medium-sized vehicles. The capacity in the medium-sized diesel class has continuously fallen over time from 1.9 l to 1.74 l. The large diesel category exhibited a small increase during the years 2007–2008, reaching ~ 2.6 l (less than the equivalent petrol one), but it has stabilised or marginally dropped since then.

Figure 3.10 Evolution of capacity classes over the years



Annex 1

Table A.1 Registration of new passenger cars by Member State (in thousands)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013 [a]
Austria	295	280	300	311	308	309	298	294	319	328	356	335	319
Belgium	497	468	459	485	480	526	525	536	475	551	577	490	490
Bulgaria							86	91	21	14	14	14	15
Cyprus				20	18	20	25	24	16	15	15	11	7
Czech Republic				115	105	107	126	134	159	165	169	170	162
Denmark	97	113	102	124	147	154	160	148	111	151	170	171	184
Estonia				17	20	25	31	24	10	10	17	19	20
Finland	106	113	145	141	146	143	123	137	89	109	122	107	100
France	2 228	2 120	1 988	1 996	2 059	1 986	2 050	2 037	2 259	2 250	2 174	1 932	1 827
Germany	3 342	3 122	3 237	3 267	3 319	3 445	3 126	3 067	3 786	2 873	2 933	3 062	2 931
Greece	245	242	203	264	274	279	294	279	221	140	97	57	58
Hungary				230	199	193	167	163	66	43	47	52	55
Ireland	117	152	146	154	171	177	186	151	56	89	90	73	75
Italy	2 430	2 278	2 244	2 264	2 237	2 325	2 494	2 163	2 160	1 954	1 745	1 402	1 304
Latvia				11	16	25	31	19	5	6	10	10	10
Lithuania				9	11	15	21	22	7	7	12	12	12
Luxembourg	22	44	44	48	49	51	51	52	47	50	50	49	46
Malta				4	7	6	6	5	6	4	6	6	6
Netherlands	526	507	487	479	452	478	494	493	396	480	554	500	416
Poland				297	230	223	264	305	221	219	275	274	288
Portugal		232	194	202	208	199	204	215	159	223	154	96	105
Romania							313	286	115	94	82	66	57
Slovakia					45	65	65	57	70	65	69	70	66
Slovenia				37	64	62	69	72	60	60	55	50	51
Spain	400	969	1 319	1 606	1 640	1 622	1 606	1 165	964	976	810	704	733
Sweden	223	249	257	260	269	278	300	248	209	277	289	263	252
United Kingdom	2 232	2 611	2 558	2 512	2 386	2 295	2 390	2 112	1 968	2 026	1 937	2 036	2 254
Croatia [b]													28
Norway [b]													142

Note: [a] Data for 2013 are provisional.

[b] Croatia and Norway are not used for the calculation of 2013 target.

Table A.2 Average mass (kg) of new passenger cars by Member State (in kg)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013 [a]
Austria	1 314	1 335	1 426	1 432	1 435	1 449	1 445	1 431	1 385	1 409	1 442	1 453	1 454
Belgium	1 288	1 319	1 361	1 375	1 396	1 407	1 423	1 425	1 406	1 406	1 416	1 439	1 424
Bulgaria										1 454	1 462	1 485	1 484
Cyprus				1 205	1 277	1 316	1 354	1 372	1 367	1 388	1 377	1 370	1 372
Czech Republic				1 704	1 242	1 247	1 261	1 275	1 335	1 380	1 368	1 368	1 370
Denmark		1 306	1 325	1 327	1 324	1 328	1 370	1 320	1 313	1 335	1 312	1 248	1 234
Estonia				1 349	1 408	1 433	1 465	1 456	1 471	1 473	1 502	1 514	1 515
Finland	1 752	1 759	1 336	1 355	1 381	1 401	1 437	1 442	1 447	1 426	1 452	1 455	1 446
France	1 254	1 280	1 305	1 327	1 341	1 349	1 375	1 387	1 326	1 326	1 343	1 385	1 352
Germany	1 332	1 352	1 381	1 408	1 412	1 424	1 433	1 425	1 347	1 433	1 460	1 466	1 448
Greece	1 172	1 223	1 262	1 277	1 287	1 304	1 314	1 311	1 423	1 252	1 231	1 242	1 249
Hungary				1 182	1 203	1 237	1 264	1 288	1 330	1 370	1 396	1 390	1 405
Ireland	1 248	1 276	1 265	1 314	1 341	1 372	1 441	1 440	1 440	1 380	1 378	1 420	1 403
Italy	1 604	1 632	1 649	1 259	1 277	1 294	1 287	1 285	1 255	1 269	1 306	1 311	1 322
Latvia				1 452	1 445	1 468	1 502	1 498	1 535	1 522	1 543	1 563	1 559
Lithuania				1 433	1 448	1 483	1 481	1 467	1 486	1 481	1 498	1 497	1 495
Luxembourg	1 834	1 851	1 442	1 471	1 487	1 504	1 498	1 490	1 462	1 473	1 519	1 528	1 517
Malta								1 317	1 182	1 200	1 216	1 465	1 223
Netherlands	1 260	1 264	1 301	1 314	1 337	1 332	1 350	1 324	1 295	1 254	1 249	1 266	1 288
Poland				1 181	1 242	1 271	1 304	1 260	1 261	1 317	1 378	1 383	1 384
Portugal		1 229	1 254	1 295	1 329	1 352	1 365	1 352	1 344	1 333	1 354	1 361	1 353
Romania							1 268	1 286	1 291	1 281	1 325	1 381	1 370
Slovakia					1 174					1 386	1 418	1 421	1 415
Slovenia				1 246	1 305	1 316	1 340	1 350	1 346	1 332	1 355	1 358	1 345
Spain	1 266	1 725	1 317	1 335	1 374	1 395	1 416	1 400	1 394	1 399	1 413	1 410	1 400
Sweden	1 448	1 454	1 472	1 467	1 470	1 488	1 503	1 488	1 490	1 497	1 510	1 522	1 526
United Kingdom	1 347	1 356	1 392	1 387	1 374	1 390	1 394	1 380	1 358	1 384	1 410	1 398	1 394
Croatia [b]													1 309
Norway [b]													1 468

Note: [a] Data for 2013 are provisional.

[b] Croatia and Norway are not used for the calculation of 2013 target.

Table A.3 Average CO_2 emissions (g CO_2/km) from new passenger cars by Member State

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013 [a]
Austria	165.6	164.4	163.8	161.9	162.1	163.7	162.9	158.1	150.2	144.0	138.7	135.7	131.6
Belgium	163.7	161.1	158.1	156.5	155.2	153.9	152.8	147.8	142.1	133.4	127.2	128.0	124.0
Bulgaria							171.6	171.5	172.1	158.9	151.4	149.2	141.7
Cyprus				173.4	173	170.1	170.3	165.6	160.7	155.8	149.9	144.3	139.2
Czech Rep.				154	155.3	154.2	154.2	154.4	155.5	148.9	144.5	140.8	134.6
Denmark	172.9	170.0	169.0	165.9	163.7	162.5	159.8	146.4	139.1	126.6	125.0	117.0	112.7
Estonia				179	183.7	182.7	181.6	177.4	170.3	162.0	156.9	150.3	146.9
Finland	178.1	177.2	178.3	179.8	179.5	179.2	177.3	162.9	157.0	149.0	144.0	139.1	131.8
France	159.8	156.8	155	153.1	152.3	149.9	149.4	140.1	133.5	130.5	127.7	124.4	117.4
Germany	179.5	177.4	175.9	174.9	173.4	172.5	169.5	164.8	154.0	151.1	145.6	141.6	136.1
Greece	166.5	167.8	168.9	168.8	167.4	166.5	165.3	160.8	157.4	143.7	132.7	121.1	111.9
Hungary				158.5	156.3	154.6	155	153.4	153.4	147.4	141.6	140.8	134.4
Ireland	166.6	164.3	166.7	167.6	166.8	166.3	161.6	156.8	144.4	133.2	128.3	125.1	120.6
Italy	158.3	156.6	152.9	150	149.5	149.2	146.5	144.7	136.3	132.7	129.6	126.2	122.4
Latvia				192.4	187.2	183.1	183.5	180.6	176.9	162.0	154.4	152.0	147.1
Lithuania				187.5	186.3	163.4	176.5	170.1	166.0	150.9	144.4	144.2	139.9
Luxembourg	177	173.8	173.5	169.7	168.6	168.2	165.8	159.5	152.5	146.0	142.2	137.0	133.4
Malta				148.8	150.5	145.9	147.8	146.9	135.7	131.2	124.7	121.5	118.4
Netherlands	174	172.4	173.5	171	169.9	166.7	164.8	156.7	146.9	135.8	126.1	118.6	109.1
Poland				154.1	155.2	155.9	153.7	153.1	151.6	146.2	144.5	141.3	141.4
Portugal		154.0	149.9	147.1	144.9	145	144.2	138.2	133.8	127.2	122.8	117.6	112.2
Romania							154.8	156	157.0	148.5	140.7	139.0	132.2
Slovakia					157.4	152	152.7	150.4	146.6	149.0	144.9	141.0	135.2
Slovenia				152.7	157.2	155.3	156.3	155.9	152.0	144.4	139.7	133.4	125.6
Spain	156.8	156.4	157	155.3	155.3	155.6	153.2	148.2	142.2	137.9	133.8	128.7	122.4
Sweden	200.2	198.2	198.5	197.2	193.8	188.6	181.4	173.9	164.5	151.3	141.8	135.9	133.3
United Kingdom	177.9	174.8	172.7	171.4	169.7	167.7	164.7	158.2	149.7	144.2	138.0	132.9	128.3
Croatia [b]													127.1
Norway [b]													123.2

Note: [a] Data for 2013 are provisional.

[b] Croatia and Norway are not used for the calculation of 2013 target.

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