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Monitoring CO_2 emissions from passenger cars and vans in 2013

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European Environment Agency

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Executive summary

The European Environment Agency (EEA) supports the European Commission in the monitoring of the CO_2 performance of passenger cars, in accordance with Regulation (EC) 443/2009, and of light commercial vehicles in accordance with Regulation (EC) No 510/2011. The regulation for passenger cars sets a CO_2 'specific emission' ([1]) target of 130 g CO_2/km by 2015 whilst the regulation for light commercial vehicles sets a CO_2 'specific emission' target of 175 g CO_2/km by 2017, defined as the average value for each manufacturer's fleet of newly registered vehicles in the EU that year ([2]). The 2015 (cars) target is being phased in gradually from 2012 while the 2017 (vans) target is being phased in gradually from 2014. Starting from 2013, a specific binding CO_2 target has been calculated for each car manufacturer based on the average mass of its fleet (Annex 1). The specific binding CO_2 target for vans will apply with effect from calendar year 2014.

A long-term target of 95 g CO_2/km to apply to the entire fleet from 2021 and of 147 g CO_2/km applicable from 2020 has been set for passenger cars and for light commercial vehicles respectively. The modalities for compliance with these targets were agreed by the European Parliament and the Council in 2014 with Regulation (EU) No 333/2014 amending Regulation (EC) No 443/2009 and Regulation (EU) 253/2014 amending Regulation (EU) No 510/2011.

Monitoring of vans is more complex than that of passenger cars, due to the relatively high number of multiple stages vehicles ([3]), where different parts are built by different manufacturers. As a consequence some uncertainty remains in the 2013 vans data, in particular as regards the mass in running order. From 2015 a new monitoring scheme will be applicable which is expected to address this issue.

In order to evaluate the progress of manufacturers towards their targets, the EEA has collected and quality-checked data on CO_2 emissions from passenger cars and vans registered in all Member States of the European Union (EU) ([4]) since 2010. Using Member State data, as verified by manufacturers ([5]), this note provides an overview of the performance of car and van manufacturers in meeting their 2013 CO_2 emissions targets.

The main findings are:

- the EU car fleet meets the 130 g CO_2/km target two years ahead of the 2015 deadline 2015. The average specific emissions of the new European car fleet in 2013 was 126.7 g CO_2/km, a reduction of 4.1 % compared to 2012.

- the average specific emissions of the new light commercial vehicles European fleet in 2013 was 173.3 g CO_2/km, a reduction of 3.8 % compared to 2012;

- the difference between preliminary average specific emissions (the emissions data reported by each of the Member States) and final average specific emissions data (the emissions data after any corrections made by the manufacturers) was insignificant (< 0.3 g CO_2/km);

([1]) In this context 'specific emissions' means 'emissions per vehicle kilometre'.
([2]) For the purposes of calculating this average, manufacturers are permitted under the regulation to form pools with other manufacturers. In the event that a pool is formed, the average value is calculated based on all the cars sold in a given year by the manufacturers in that pool.
([3]) Multi-stage vehicles are vehicles built in two or more stages. An incomplete vehicle, such as a chassis-cab or cut-away chassis, built by one manufacturer, is completed by another manufacturer who adds work-performing or cargo-carrying components to the vehicle (e.g. box truck, camper vans, dump truck).
([4]) Data for 2013 were delivered by Croatia, but since the country did not join the EU until July 2013, the Croatian data are not included in this year's report. The Croatian data will only be included as from 2014 (reporting year 2015) — the first full calendar year in which Croatia is a Member State of the EU.
([5]) Data on average specific emissions are provided to the EEA and the Commission by EU Member States. These preliminary data are then submitted to manufacturers, who have three months to notify the Commission if they notice errors with the data. The Commission then considers any notifications from the manufacturer and either confirms or amends the preliminary data. These amended/confirmed data are known as final average specific emissions.

- the average vehicle mass of the passenger car fleet remains at the highest level (1 390 kg) during the last 10 years, although a slight decrease has been observed in the last year (– 11 kg). The average mass of the light commercial vehicle fleet is 1 761 kg;

- data collected reveal that in 2013 the majority of the car and light commercial vehicles manufacturers achieved their CO_2 emission targets set for 2013.

In recent years there has been a growing awareness of the need to ensure that emissions measured in the type approval driving cycle ([6]) better represent 'real-world' driving conditions. In particular, numerous studies have highlighted the often significant divergence between type approval and real-world CO_2 emissions. Reflecting this, a substantial effort has been made in EU in recent years to update the current type-approval procedure by introducing the Worldwide harmonized Light vehicles Test Procedure (WLTP) approach that aims to better represent actual vehicle operations on the road. Despite such differences, it is nevertheless clear that real emission reductions have occurred as a result of the introduction of the EU CO_2 emission performance standards for light duty vehicles.

To illustrate the scope of the potential differences, this report also presents results of an assessment comparing the current reported regulatory 'type-approval' emissions with estimated 'real-world' emissions. Real-world CO_2 emissions were estimated based upon a set of models constructed to determine fuel consumption of passenger cars predicted on the basis of independent variables reported by Member States, including the vehicle mass, engine capacity and type-approval CO_2 emissions.

The main findings of the assessment are:

- EU wide, the real-world to type-approval CO_2 emissions ratio for petrol cars is comparable to the one for diesel cars for all vehicle sizes. Looking at the overall petrol and diesel fleet, the ratio is somewhat higher for diesel cars (21 %) than for petrol ones (19 %) because the relative contribution of large cars (with an engine size above 2.0 litres) is higher for diesel than for petrol.

- The CO_2 emissions ratio for petrol cars varies from 18 % for small cars to 32 % for large cars, whereas for diesel cars it ranges from 22 % for small cars to 27 % for large cars.

([6]) Type-approval is granted to a vehicle that meets a set of regulatory, technical and safety requirements (i.e. emissions standards). It is required before the vehicle is allowed to be sold. The New European Driving Cycle (NEDC) is a testing procedure designed to assess the emission levels and fuel economy of vehicles during the type-approval tests.

1 Introduction

To reduce CO_2 emissions in the road transport sector, the European Parliament and the Council adopted two regulations: Regulation (EC) No 443/2009, which introduced mandatory CO_2 emission performance standards for new passenger cars and Regulation (EU) No 510/2011, which introduced mandatory CO_2 emission performance standards for new vans.

For passenger cars, the regulation sets a CO_2 specific emission target of 130 g CO_2/km by 2015, defined as the average value for the fleet of newly registered passenger cars in the EU. For the period until 2015, the modalities of compliance with the targets have been established and are presented in the following chapter. A long-term target of 95 g CO_2/km has been set for 2021 (phase-in from 2020). The modalities for compliance with that target were agreed in 2014 by the European Parliament and the Council through a new amendment to the regulation (see Box 2.1).

In analogy to passenger cars, Regulation (EU) No 510/2011 sets a CO_2 specific emission target of 175 g CO_2/km by 2017, defined as the average value for the fleet of newly registered vans in the EU. For the period until 2017, the modalities of compliance with the targets have been established and are presented in the following chapter. A long-term target of 147 g CO_2/km has been set for 2020.

The progress of manufacturers in meeting these targets is evaluated on an annual basis by calculating the following three parameters:

1. CO_2 average specific emissions;
2. the specific CO_2 emissions target for that year;
3. the difference between the average specific emissions and the specific emissions target.

2 Methods

Since 2010, the EEA is collecting data from passenger cars registered in all EU Member States ([7]). Since 2013 the EEA has been collecting data from vans as well. The two regulations share the same time scheduling for the monitoring:

1. Member States shall record information for each new passenger car and van registered in its territory and transmit this information to the Commission by 28 February of each year. Data are submitted to the Central Data Repository (CDR) ([8]) managed by the EEA.

2. The EEA performs several quality checks in order to evaluate the accuracy and the quality of the dataset. On the basis of the checks and the feedbacks from Member States the EEA finalises and publishes the preliminary database. At the same time, notification letters are sent to manufacturers informing them of their provisional CO_2 performances.

3. Manufacturers can, within three months of being notified of the provisional calculation, notify the Commission of any errors in the data.

4. The EEA and the European Commission assess the manufacturers' corrections, and, where justified, take them into account for the calculation of the manufacturer final average CO_2 emissions and specific emission targets. The final data and targets are to be published by 31 October each year.

In the following chapter the process is presented in further detail.

2.1 Preliminary data

The EEA performs several quality checks in order to evaluate the accuracy and the quality of the Member States' data. These checks covered various areas, listed in the 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 ([9]).

- 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) ([10]).

After the quality checks, the database is finalised and published as preliminary data.

([7]) Data for 2013 were delivered by Croatia, but since the country did not join the EU until July 2013, the Croatian data are not included in this year's report. The Croatian data will be included starting from 2014 — the first full calendar year in which Croatia is a Member State of the EU.
([8]) CDR — Central Data Repository. The Central Data Repository is like a bookshelf, with data reports on the environment as submitted to international clients (http://cdr.eionet.europa.eu).
([9]) An outlier observation that is well outside of the expected range of values in a study or experiment, and which is often discarded from the data set.
([10]) 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.

2.2 Calculation of manufacturers' performance

Average specific emissions of CO_2 are calculated as a weighted average of the manufacturer's fleet registered in a particular year. The average specific emissions for each manufacturer are subsequently adjusted to take into account the following modalities (Table 2.1):

- phase-in;
- super-credits;
- E85 extra credits;
- eco-innovations.

Phase-in

A phase-in schedule applies for calculating average specific emissions both for cars and for vans:

- For passenger cars during the period 2012–2014, only a certain percentage (65 % in 2012, 75 % in 2013, and 80 % in 2014) of the best-performing registered cars will be taken into account in determining the performance of manufacturers. For the period 2015–2019, 100 % of the new cars of each manufacturer will be taken into account. The 2021 specific emissions are phased-in from 2020 taking into account 95 % of the best-performing cars in that year;

- For vans during the period 2014–2016, only a certain percentage (70 % in 2014, 75 % in 2015, and 80 % in 2016) of the best-performing registered vans will be taken into account in determining the performance of manufacturers. For the period 2017–2020, 100 % of the new cars of each manufacturer will be taken into account.

Super-credits

The regulation foresees the allocation of super-credits for new passenger cars and new vans with CO_2 emissions lower than 50 g CO_2/km. These vehicles are given a greater weight in calculating the average specific emissions as they are considered equivalent to:

- 3.5 cars in 2012 and 2013, 2.5 cars in 2014, 1.5 cars in 2015, and 1 car in 2016.

- 3.5 vans in 2014 and 2015, 2.5 vans in 2016, 1.5 vans in 2017, and 1 van in 2018.

E85 extra credits

Additional reductions of average specific emissions are assigned for vehicles capable of running on a mixture of petrol with 85 % ethanol ('E85'). Until 2015, the emissions of these vehicles will be counted as being 5 % less than their actual emissions in recognition of their ability to reduce emissions when running on biofuels. This reduction can be applied only where at least 30 % of the filling stations in the Member State in which the vehicle is registered provide this type of alternative fuel. In 2013 this applied only in the case of Sweden.

Eco-innovations

Certain innovative technologies cannot demonstrate their CO_2-reducing effects under the current type-approval test procedure. In order to support technical development, a manufacturer or supplier can apply to the Commission for the approval of such innovative technologies. The approval conditions are set out in Commission Regulation (EU) 725/2011. If a manufacturer fits its car fleet with an approved eco-innovation, the average emissions of that vehicle may be counted as being a maximum of 7 g CO_2/km less than it actually is. 2014 was the second year that eco-innovations were submitted to the Commission, and so far, six eco-innovations (i.e. light emitting diodes in certain lighting functions of a vehicle) ([11]) have been approved.

([11]) For more information on eco-innovations: http://ec.europa.eu/clima/policies/transport/vehicles/cars/documentation_en.htm.

Table 2.1 Summary of the parameters applying to the calculation of manufacturer performance from 2013 to 2017

		2013	2014	2015	2016	2017
Phase-in	Passenger cars	75 %	80 %	100 %	100 %	100 %
	Vans	70 %	70 %	75 %	80 %	100 %
Super-credit for vehicle emitting less than 50 g CO_2/km	Passenger cars	3.5	2.5	1.5	1	1
	Vans	3.5	3.5	3.5	2.5	1.5
Emission reduction for E85 vehicles ([a])	Passenger cars/vans	5 %	5 %	5 %	0 %	0 %

Note: ([a]) Applies only where at least 30 % of the filling stations in the Member State in which the vehicle is registered provide this type of alternative fuel.

2.3 Specific emissions targets

Each manufacturer has its individual annual target, calculated on the basis of the 'mass in running order' ([12]) of the registered cars/vans. The following formulas apply for passenger cars (1) and for vans (2):

(1) Passenger cars — Specific emissions of CO_2 = 130 + a × (M – M_0)

Where:

M is the average mass of the manufacturer's fleet in kilograms (kg)

M_0 is the reference mass (1 372.0 kg)

a is 0.0457.

(2) Vans — Specific emissions of CO_2 = 175 + a × (M — M_0)

Where:

M is the average mass of the manufacturer's fleet in kilograms (kg)

M_0 is the reference mass (1 706.0 kg)

a is 0.093.

This means that, for example, if the average mass of a manufacturer's cars in a given year is 1 472 kg, the target for that manufacturer is 134.57 g CO_2/km. If the average mass of the cars is 1 272 kg, the target will be 125.43 g CO_2/km.

The manufacturer complies with its specific emissions target if its average specific emissions (taking into account all the relevant adjustments) are lower than the target.

These formulas aim to guarantee undistorted competition between manufacturers while taking into account their differences.

Pools

Manufacturers may form a pool with other manufacturers in order to have a common target. In this case, the binding target will be the pool target (calculated on the basis of the whole fleet of the pool registered that year). There were 12 pools for cars and 2 pools for vans declared with regard to the 2013 targets (Table 2.2).

Derogations

Manufacturers selling fewer than 10 000 vehicles per year can apply for a derogation. In this case, a specific emissions target consistent with the manufacturer's economic and technological potential to reduce specific CO_2 emissions can be granted. In 2013 the Commission granted 28 derogations for passenger cars (Table 2.3).

Niche derogations

Niche derogations are foreseen for manufacturers responsible for between 10 000 and 300 000 new vehicle registrations. In this case, a special target is established, corresponding to a 25 % reduction compared to the average specific emissions of that manufacturer in 2007. In 2013 four niche derogations were granted for passenger cars (Table 2.4).

([12]) According to Regulation (EC) No 443/2009 mass in running order means the mass of the car with bodywork, coolant, oils, fuel, spare wheel, tools, and driver as stated in the certificate of conformity and defined in Section 2.6 of Annex I to Directive 2007/46/EC.

De minimis exemptions

A manufacturer which, together with all of its connected undertakings, is responsible for less than 1 000 new registered cars may be exempt from meeting a specific emission target pursuant the Regulation (EC) No 443/2009 and the Regulation (EU) No 510/2011, as amended by Regulation (EU) No 333/2014 and Regulation (EU) No 253/2014. In 2013, there were 26 manufacturers responsible for a total of around 4 000 vehicles that benefitted by this exemptions (17 for passenger cars and 9 for vans).

Table 2.2 Manufacturers' pools in 2013

Vehicles	Pool	Manufacturer
Passenger cars	BMW Group	Bayerische Motoren Werke AG
		BMW M GmbH
		Rolls-Royce Motor Cars Ltd
	Daimler AG	Daimler AG
		Mercedes-AMG GmbH
	Fiat Group Automobiles SPA	Chrysler Group LLC
		Fiat Group Automobiles SPA
		Maserati SPA
	Ford-Werke GmbH	Ford Motor Company
		Ford-Werke GmbH
		Ford Motor Australia Limited
		Ford India
		CNG-Technik GmbH
	General Motors	Chevrolet Italia SPA
		General Motors Company
		GMItalia SRL
		GM Korea Company
		Adam Opel AG
	Honda Motor Europe Ltd	Honda Automobile China Co., Ltd
		Honda Motor Co Ltd
		Honda Turkiye AS
		Honda of the UK Manufacturing Ltd
		Honda Automobile Thailand
	Mitsubishi Motors	Mitsubishi Motors Corporation MMC
		Mitsubishi Motors Europe BV MME
		Mitsubishi Motors Thailand Co Ltd MMTH
	Pool Renault	Lada France
		Automobile Dacia SA
		Renault SAS
	Suzuki	Magyar Suzuki Corporation Ltd
		Maruti Suzuki India Ltd
		Suzuki Motor Corporation
	Tata Motors Ltd, Jaguar Land Rover	Jaguar Land Rover
		Land Rover
		Tata Motors Limited
	Toyota-Daihatsu Group	Daihatsu Motor Co Ltd
		Toyota Motor Europe Nv SA
	VW Group PC	Audi AG
		Audi Hungaria Motor KFT
		Bentley Motors Ltd
		Bugatti Automobiles SAS
		Automobili Lamborghini SPA
		Dr Ing HCF Porsche AG
		Quattro GmbH
		Seat SA
		Skoda Auto AS
		Volkswagen AG
Vans	Ford-Werke GmbH	Ford Motor Australia
		Ford Motor Company
		Ford-Werke GmbH
	Mitsubishi Motors	Mitsubishi Motors Corporation
		Mitsubishi Motors Europe
		Mitsubishi Motors Thailand

Table 2.3 Manufacturers with low volume derogations granted for 2013 (passenger cars)

Manufacturer	Specific emissions targets in g CO_2/km
Alpina Burkard Bovensiepen GmbH E Co KG	230
Artega Automobil GmbH E Co KG	223
Aston Martin Lagonda Ltd	318
Avtovaz JSC	201
Caterham Cars Limited	210
Ferrari SPA	303
Zhejiang Geely Automobile Co Ltd	168
Great Wall Motor Company Limited	190
Koenigsegg Automotive AB	275
KTM-Sportmotorcycle AG	195
Litex Motors AD	160
Lotus Cars Limited	280
Mahindra & Mahindra Ltd	183
Marussia Motors LLC	270
Mclaren Automotive Limited	285
MG Motor UK Limited	152
Morgan Motor Co Ltd	168
Noble Automotive Ltd	360
Pagani Automobili SPA	340
PGO Automobiles	175
Potenza Sports Cars	205
Perusahaan Otomobil Nasional SDN BHD	181
Qoros Automotive Co Ltd	152
Radical Motosport Ltd	229
Secma SAS	131
Spyker Automobielen BV	360
Ssangyong Motor Company	180
Wiesmann GmbH	274

Table 2.4 Niche derogations granted for 2013 (passenger cars)

Manufacturer/pool	Specific emissions targets in g CO_2/km
Fuji Heavy Industries Ltd	164.616
Tata Motors Jaguar Cars Land Rover	178.025
Mazda Motor Corporation	129.426
Suzuki Pool	123.114

2.4 Effect of the average fleet mass on the targets

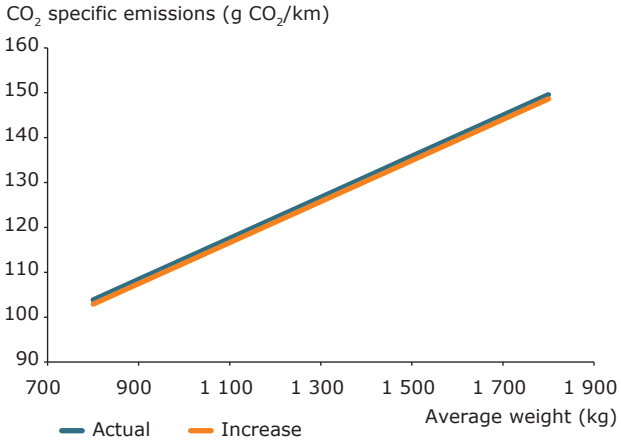
Emission targets are set according to the average mass in running order of the vehicle fleet, using a limit value curve (see formula 1). This curve is set in such a way that if the average mass of a manufacturer fleet is 1 372 kg (equal to M_0 in formula 1), the target for that manufacturer will be 130 g CO_2/km. According to the regulation, the parameter M_0 in the formula should be adjusted in 2014, in order to reflect changes in vehicles' mass over the previous three calendar years. The adjustment shall take effect from 2016.

In order to ensure that the new M_0 used for the target calculation is representative of the evolution seen in the new vehicle fleet over the past three years, it is appropriate to use only those mass values in the monitoring data that have been verified or accepted by manufacturers. This means that the following values identified in the 2011–2013 datasets should be excluded from the calculation:

- mass values that could not be verified by manufacturers due to the lack of necessary identifiers in the monitored records (i.e. missing type-approval number or type, variant or version codes);
- outliers, i.e. extreme mass values that are clearly unrealistic;
- mass values relating to vehicles out of the scope of the regulation; and vehicles the manufacturers cannot recognise.

According to these hypotheses, the new estimated M_0 is 1 392.35 kg. Since the average mass of the new fleet in the period 2011–2013 increased by almost 30 kg compared to the M_0 in formula 1, the limit values curve will shift towards the right part of the graph in (orange line in Figure 2.1). As a consequence, the target of a manufacturer that produces a fleet with average mass of 1 392.35 kg will become 130 g CO_2/km, while the target for that manufacturer was 130.9 g CO_2/km in 2012 (blue line).

Figure 2.1 Effect of fleet weight on the limit value curve



Note: The blue line is the actual limit value curve and the orange line is the limit value curve starting from 2016.

Box 2.1 2020 cars target

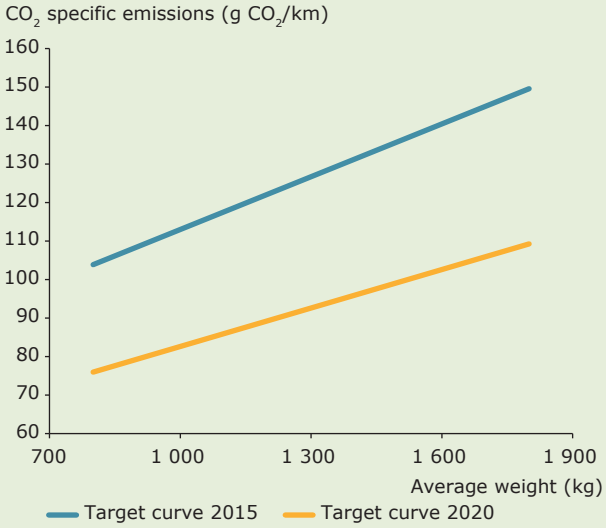
Regulation (EU) No 333/2014 amended Regulation (EC) No 443/2009 with a view to defining the modalities for reaching the 2020 target to reduce CO_2 emissions from new passenger cars. The long-term target of 95 g CO_2/km, proposed in the previous regulation, was confirmed and the following conditions for the calculation of the manufacturers' target will apply:

- A shorter phase-in period will apply to the target of 95 g CO_2/km: **95 %** of each manufacturer's new and best performing cars will have to comply with the target in **2020,** increasing to **100 % in 2021**.
- Super-credits will also apply in the second stage of emission reductions, from 2020 to 2023. Each low-emitting car (less than 50 g CO_2/km) will be counted as **2 vehicles in 2020, 1.67 in 2021, 1.33 in 2022 and 1 from 2023.**
- Manufacturers selling **between 10 000 and 300 000 cars per year** can apply for a fixed target of a **25 % reduction** from their 2007 average emissions for the period 2012–2019, and a **45 % reduction** from the 2007 level as of 2020.
- The new limit values curve will be:

  Specific emissions of CO_2 = 95 + a × (M — M_0)

  Where:
  M is the average mass of the manufacturer's fleet in kilograms (kg)
  M_0 is the reference mass
  a is 0.0333.

Figure 2.2 The two limit value curves for the calculation of the passenger cars target in 2015 and 2020

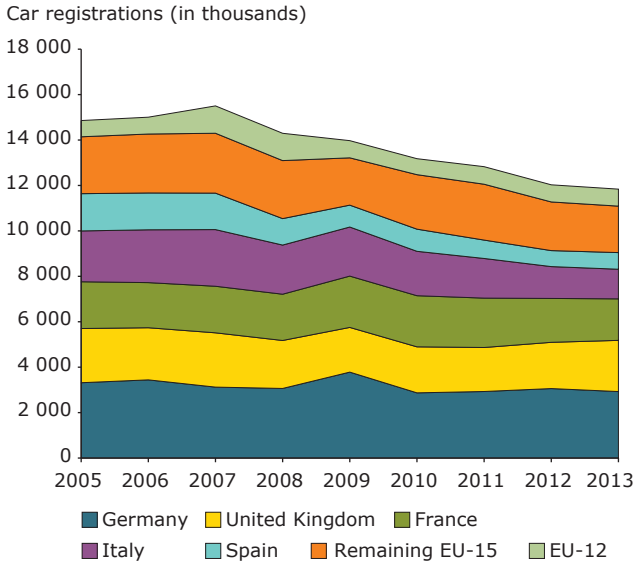


3 Passenger cars

3.1 EU statistics

New passenger cars registrations in the EU-27 have continuously decreased since 2007, when 15.5 million vehicles were registered (see Table A1.1 in Annex 1). In 2013, there were 11.8 million registrations, 200 000 registrations less than in 2012. The number of registrations decreased in 2013 compared to 2012 in about half of the Member States, whereas it increased in the other half. The biggest reductions in new vehicle registrations were observed in Cyprus (– 37 %), the Netherlands (– 17 %) and Romania (– 14 %), whereas the largest increases were seen in the United Kingdom (11 %), Portugal (10 %) and Bulgaria (9.7 %). Compared to 2007 the number of new vehicle registrations dropped by 24 %. This decrease was significant in southern Member States, where car registrations have decreased by 80 % in Greece, 54 % in Spain, 48 % in Portugal and 48 % in Italy compared to 2007.

Figure 3.1 Number of vehicles registered in EU-27 between 2005 and 2013



Germany is the largest vehicle market in Europe, with a 25 % share in 2013, followed by the United Kingdom (19 %) and France (15 %). Together these countries represent almost 60 % of the European fleet. The German market share reached a maximum of 27 % in 2009, due to the adoption of a car scrappage scheme. Over the years the percentage market share of Spain has dropped significantly from 11 % in 2005 to 6.2 % in 2013.

- The final data confirm the preliminary data, i.e. the average CO_2 emissions from the new passenger car fleet in the EU in 2013 were 126.7 g CO_2/km (Table 3.1). The average specific emissions of CO_2 in 2013 have decreased by some 5.5 g CO_2/km, or 4.1 %, compared to the previous year (132.2 g CO_2/km in 2012). This is the biggest decrease since the entry into force of the legislation.

- In 2013, the average new passenger car in the EU-15 emitted 9.7 g CO_2/km less than the average newly registered vehicle in the EU-12 (Table 3.1). 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 over the last four years the average emissions decreased by 18.4 g CO_2/km. For the EU-15, the average reduction of CO_2 emissions over the last five years (27.2 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 average mass of new passenger cars registered in the EU-27 is back to 2011 levels. Compared to 2012 the average mass decreased by 12 kg in 2013 (Table 3.2). 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 (321 kg). While the mass of petrol vehicles has been stable over the last 10 years, the mass of diesel vehicles has increased consistently with a slight decrease in 2013

Table 3.1 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	126.7
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	126.1
EU-12								157.8	156.8	154.2	148.2	144.1	140.9	135.8

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, the 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).

Table 3.2 Average mass (kg) of new passenger cars by fuel

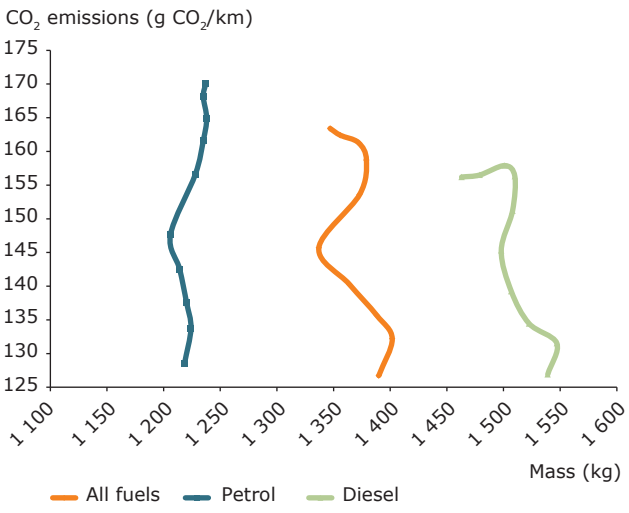
	2004	2005	2006	2007	2008	2009	2010	2011	2012 (a)	2013 (a)
All fuels	1 347	1 356	1 372	1 379	1 373	1 337	1 364	1 388	1 402	1 390
Petrol	1 237	1 235	1 238	1 235	1 228	1 206	1 214	1 220	1 224	1 218
Diesel	1 463	1 479	1 501	1 510	1 508	1 498	1 507	1 523	1 547	1 539
AFV	1 415	1 404	1 392	1 271	1 237	1 169	1 202	1 270	1 247	1 294

Note: Data before 2004 are not shown due to incomplete dataset.
(a) For the calculation of the average mass of AFVs, pure electric, liquefied petroleum gas vehicles (LPGs), natural gas vehicles (NG), ethanol (E85), biodiesel and plug-in hybrid vehicles are all included.

(1 539 kg) compared to 2012 (1 547 kg). The mass of alternative fuel vehicles (AFVs) varies over the years in relation to the composition of the fleet.

During the period 2004–2013 CO_2 emissions have decreased significantly. The relation between average emissions and average mass changes according to fuel type (Figure 3.2): 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 over 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.

Figure 3.2 CO_2 emissions versus vehicles' mass in the EU-27



3.2 Vehicle technologies

Diesel vehicles represented 52.5 % of the newly registered vehicle fleet in 2013 as against 55.2 % in 2011 ([13]) the year in which the percentage of diesel vehicle reached the maximum (Table 3.3). The average CO_2 emissions of diesel and petrol vehicles decreased by 4.6 g CO_2/km and 5.3 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 (Table 3.4 and Figure 3.3). In 2013 an average diesel vehicle emitted 126.9 g CO_2/km, only 1.55 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 registration of AFVs has been increasing substantially in recent years (Figure 3.4). This category was dominated by only a few 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 38 % (56 % if plug-in hybrid vehicles are included in the statistics) between 2011 and 2013, after a significant drop between 2010 and 2011 (when registrations fell by 61 %).

On the basis of the monitoring data, it is possible to report CO_2 emissions for different fuel types used by AFVs (Table 3.5). It is noteworthy that the mix of vehicles considered in the AFV categories has changed over the years (natural gas vehicles (NG vehicles), liquefied petroleum gas vehicles (LPG 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 (Figure 3.3). 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 vehicles and NG vehicles, which have greatly outnumbered the ethanol cars. The significant reduction in CO_2 emissions from AFVs over the past few years is not uniquely 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 contributed to the declining emission levels. Pure electric vehicles are propelled by electric motors, using electrical energy stored in batteries or another energy storage device. The tail-pipe emissions of this kind of vehicle are considered to be 0 g CO_2/km. It is important to mention that only tail-pipe ([14]) 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

Table 3.3 Share of fuel type in new passenger cars (EU-27)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010 ([a])	2011 ([a])	2012 ([a])	2013 ([a])
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	45.1
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	52.5
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: The geographical scope of the data changes over time from EU-15 to EU-25 and EU-27, see Annex 1 for details.
([a]) The calculation for the years 2010, 2011, 2012 and 2013 was done without considering out-of-scope vehicles.

Table 3.4 Average CO_2 emissions (g CO_2/km) from new passenger cars by fuel (EU-27)

g CO_2/km	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010 ([a])	2011 ([a])	2012 ([a])	2013 ([a])
All fuels ([c])	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	126.7
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	128.5
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	126.9
AFV ([b])	208	207.4	179.2	164.7	147.9	149.4	151.1	140	137	125.8	126.0	124.7	118.5	98.3

Note: The geographical scope of the data changes over time from EU-15 to EU-25 and EU-27, see Annex 1 for details.
([a]) The calculation for the years 2010, 2011, 2012 and 2013 was done without considering out-of-scope vehicles.
([b]) For the calculation of the average CO_2 emissions of AFVs, pure electric, liquefied petroleum gas vehicles (LPGs), natural gas vehicles (NG), ethanol (E85), biodiesel and plug-in hybrid vehicles are all included.
([c]) Fuel type is available for 95 % of the vehicle registrations in 2013.

([13]) Fuel type is available for 95 % of the vehicle registrations in 2013.
([14]) Tail-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 **Evolution of CO_2 emissions from new passenger cars by fuel type (EU-27)**

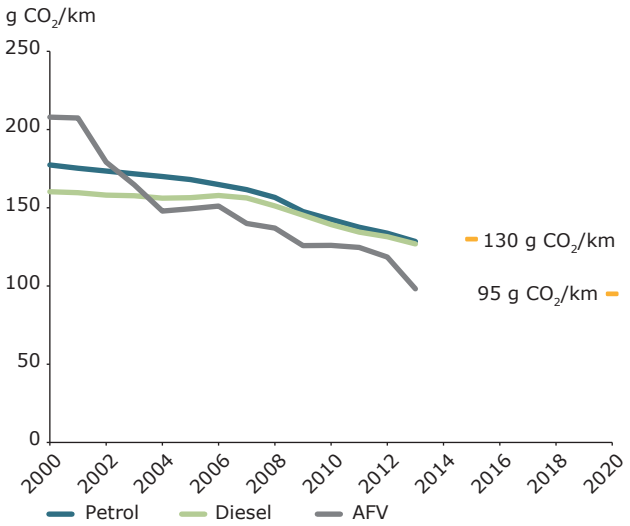
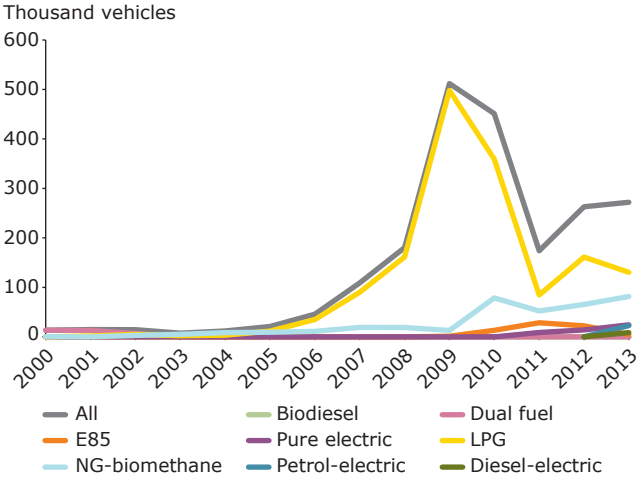


Figure 3.4 **Evolution of total registrations of AFVs over the years**



Note: 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.

also identified in the database. These vehicles have both an internal combustion engine and an electric motor, but the power provided 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 average emissions of plug-in vehicles are in general below 70 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, NG and LPG vehicles have the lowest CO_2 emissions (120.5 g CO_2/km and 101.1 g CO_2/km respectively), whereas ethanol-fuelled vehicles (E85) have the highest specific emissions (154.4 g CO_2/km).

Italy is the country for which the number of AFVs (mainly LPG and NG vehicles) in 2013 has been the highest. The number of pure electric vehicles in the EU-27 has increased in the last four years from around 700 in 2010 to around 25 000 in 2013. France (more than 8 900 vehicles) and Germany (around 6 000 vehicles) are the countries for which the increase has been the highest over the last four years. Around 2 500 electric vehicles were registered in the Netherlands and in the United Kingdom. The number of plug-in hybrid vehicles is comparable to the number of pure electric vehicles: more than 31 000 plug-in hybrid vehicles were registered in the EU-27 in 2013.

Table 3.5 **AFV data: Number of registrations, CO_2 emissions (g CO_2/km), mass (kg) and engine capacity (cm^3)**

	Registration (#)	Average CO_2 emissions (g CO_2/km)	Average mass (kg)	Average engine capacity (cm^3)
E85	4 535	154.4	1 487	113
Electric (a)	24 175	0.0	1 459	–
LPG	130 473	120.5	1 198	65
NG	81 590	101.1	1 274	64
Petrol-electric	22 684	70.0	1 459	73
Diesel-electric	8 483	54.3	1 951	144

Note: Only exhaust emissions are considered. For electric monofuel vehicles the emission is null. For petrol-E85, the petrol CO_2 emissions are reported, for LPG and NG (natural gas) the respective LPG and CNG CO_2 emissions are reported.

(a) Electric vehicles are vehicles for which tail-pipe emissions are 0 g CO_2/km.

3.3 Member States comparison

In all EU Member States the CO_2 emissions from newly registered passenger cars fell in 2013 compared to 2012. The green bars in Figure 3.5 show the absolute reduction by Member State between 2013 and 2012, while the orange 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 3.6). Six of them have emissions values below 120 g CO_2/km.

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 share of diesel vehicles can have an effect in lowering average CO_2 specific emissions in the newly registered vehicle fleet (Figure 3.6). 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.

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.

Figure 3.5 Absolute reduction and relative reduction (%) in specific emissions by Member State between 2012 and 2013

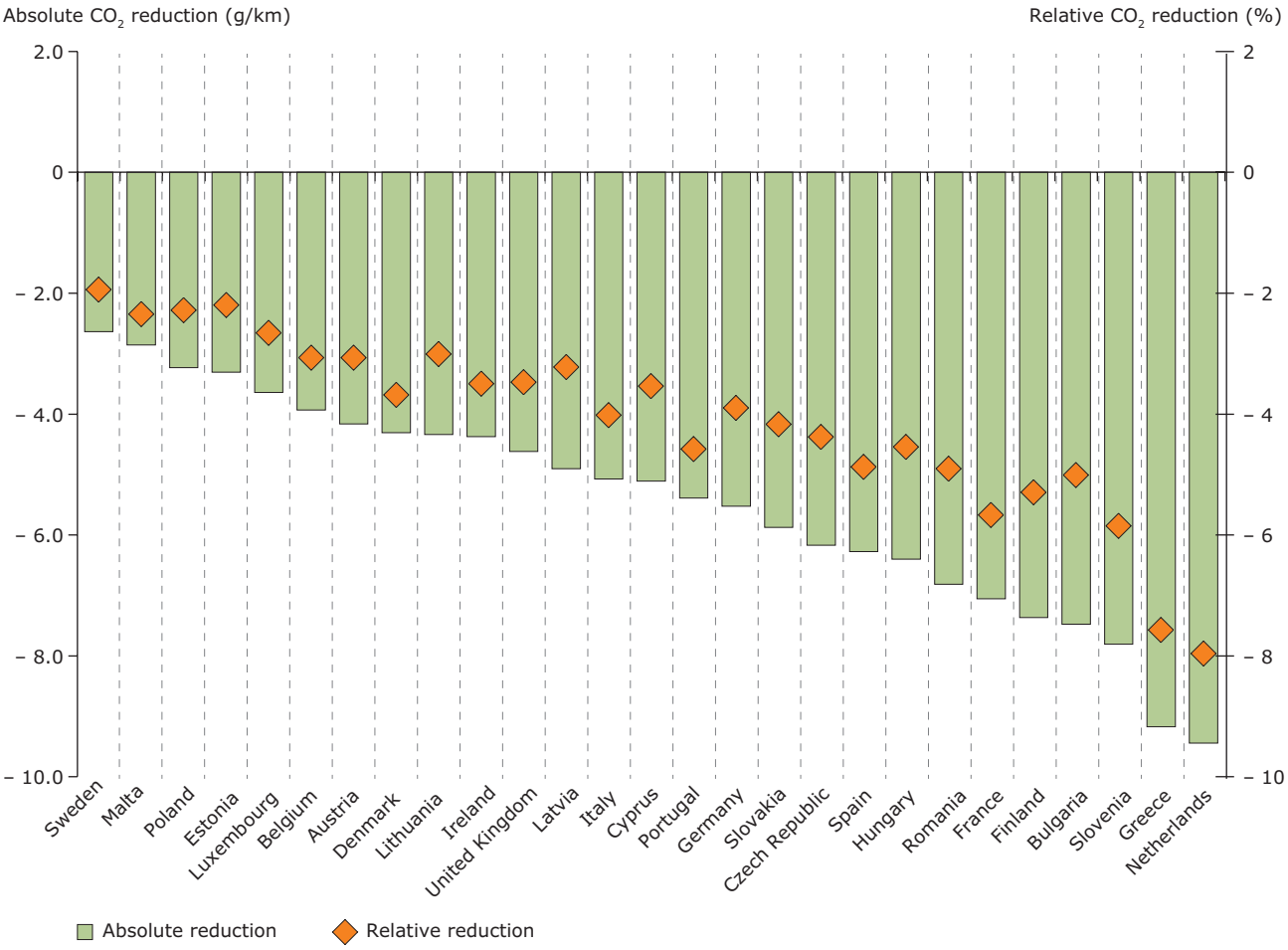
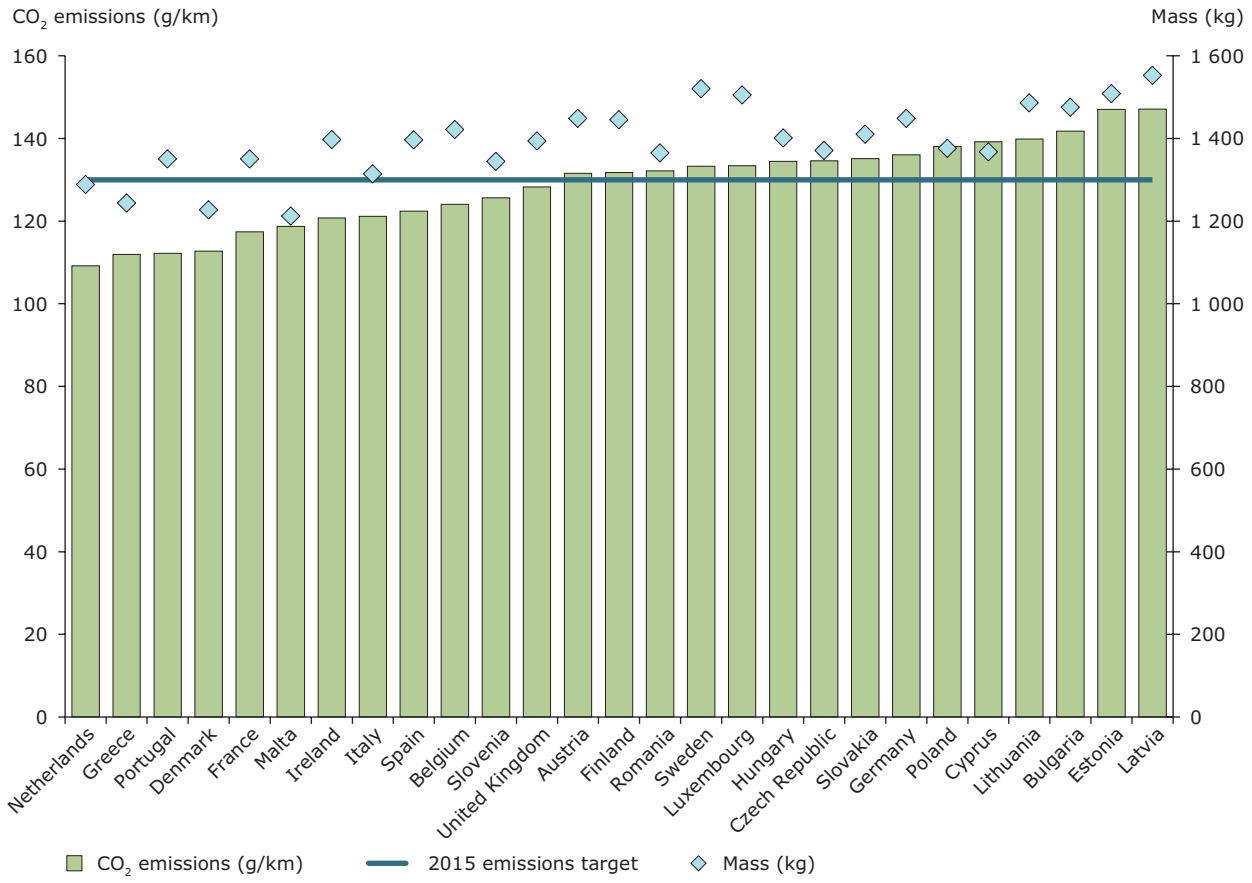


Figure 3.6 Average CO_2 emissions and average mass by EU Member State in 2013



Due to their size, the Member States with higher vehicle registrations — France, Germany, Italy, Spain and the United Kingdom — are the major contributors to the total reductions in EU-27 CO_2 emissions from newly registered passenger 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 119 g CO_2/km and NG cars (5 % of all new registrations) with an average CO_2 value of 99 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.

3.4 CO_2 emissions from car manufacturers in 2013

Table 3.6 presents data (number of registrations, average mass and average emissions) for large manufacturers ([15]), i.e. those that registered more than 100 000 vehicles in 2013. In total, these manufacturers sold around 11.1 million vehicles in the EU-27 in 2013, equivalent to 93.7 % of the total new registrations. Average emissions of those manufacturers in previous years (2009–2012) are also included in the table.

([15]) In this report large manufacturers are the manufacturers that are responsible of more than 100 000 registrations a year, in the Regulation (EC) 443/2009 large manufacturers are the ones responsible of more than 300 000 registrations a year.

The average EU emissions of all manufacturers in 2013 were 126.7 g CO_2/km. The average CO_2 emissions of the large manufacturers were 125.7 g CO_2/km, i.e. 1.0 g CO_2/km lower than the average of the total new registrations.

In 2013, eleven large manufacturers had average emissions below 130 g CO_2/km, whereas in 2012 only eight manufacturers were below this value. The average emissions of those large manufacturers varied from 110.0 g CO_2/km to 181.6 g CO_2/km.

Six manufacturers had average emissions below 120 g CO_2/km: Renault, Automobiles Peugeot, Fiat group, Toyota Motor Europe, Automobiles Citroen and Seat.

Renault had the lowest average CO_2 emissions (110 g CO_2/km) among the large manufacturers. Over the last year, the average emissions decreased by almost 11 g CO_2/km. In 2013, Renault had the highest percentage of vehicles with emissions below 100 g CO_2/km (34 %). 3.3 % of those are electric vehicles, with zero emissions. Renault, Toyota, Automobiles Peugeot and Automobiles Citroen continue to produce some of the lowest-emitting cars; one third of their fleet had emissions below 100 g CO_2/km (33 %, 28 % and 27 % respectively).

During the period 2000-2013, Fiat showed a 26 % reduction in the specific CO_2 emissions of new cars registered in the EU. Downsizing, i.e. a shift to smaller and lighter vehicles, has been one of the drivers for this reduction. As in previous years, in 2013 Fiat had the lowest average car mass among the large manufacturers (1 145 kg). The increasing share of diesel and AFVs in Fiat's fleet, notably those that run on LPG and NG, has also contributed to the observed emissions reduction. The newly registered LPG and NG passenger cars in 2009 exceeded 19 % of the total Fiat new registrations. This share decreased to 15 % in 2012 and 2013. In the last four years, Fiat reduced emissions by 8.7 g CO_2/km. This is the third smallest reduction after Opel and GM Korea.

Table 3.6 Main specific emission statistics for the largest car manufacturers (> 100 000 vehicle registrations per year)

Manufacturer	Registrations 2013 ([a])	Average mass (kg) 2013	Average CO_2 (g CO_2/km)				
			2013	2012	2011	2010	2009
Renault SAS	793 063	1 262	110	121	129	134	138
Automobiles Peugeot	723 688	1 349	115	121	128	131	134
Fiat Group Automobiles SPA	646 554	1 145	116	117	118	125	130
Toyota Motor Europe Nv SA	513 116	1 315	116	122	126	129	132
Automobiles Citroen	587 544	1 356	116	123	126	131	138
Seat SA	280 310	1 231	119	127	125	131	140
Ford-Werke GmbH	891 562	1 342	122	129	132	137	140
Skoda Auto AS	480 748	1 268	125	132	135	139	148
Automobile Dacia SA	289 150	1 200	127	137	143	145	152
Volkswagen AG	1 486 282	1 382	127	133	135	140	151
Kia Motors Corporation	285 340	1 320	128	129	137	143	146
Volvo Car Corporation	203 165	1 700	131	142	151	157	173
Nissan International SA	411 702	1 399	131	137	142	147	154
Adam Opel AG	804 117	1 443	132	133	134	140	148
Audi AG	650 995	1 554	133	138	145	152	160
Bayerische Motoren Werke AG ([b])	758 186	1 560	134	138	144	146	151
Mazda Motor Corporation	133 183	1 422	134	142	147	149	149
GM Korea Company	135 379	1 405	136	141	142	144	146
Daimler AG	661 356	1 577	137	143	153	160	167
Hyundai Motor Manufacturing Czech SRO ([c])	220 348	1 426	138				
Jaguar Land Rover Limited ([d])	131 530	2 049	182				

Note: ([a]) These are total number of registrations in the EU-27, not the registrations used for the calculation of the target and of the average emissions (see Annex 1).

([b]) In 2009 BMW AG included both BMW AG and BMW GMBH.

([c]) In previous years, Hyundai appeared as a unique manufacturers.

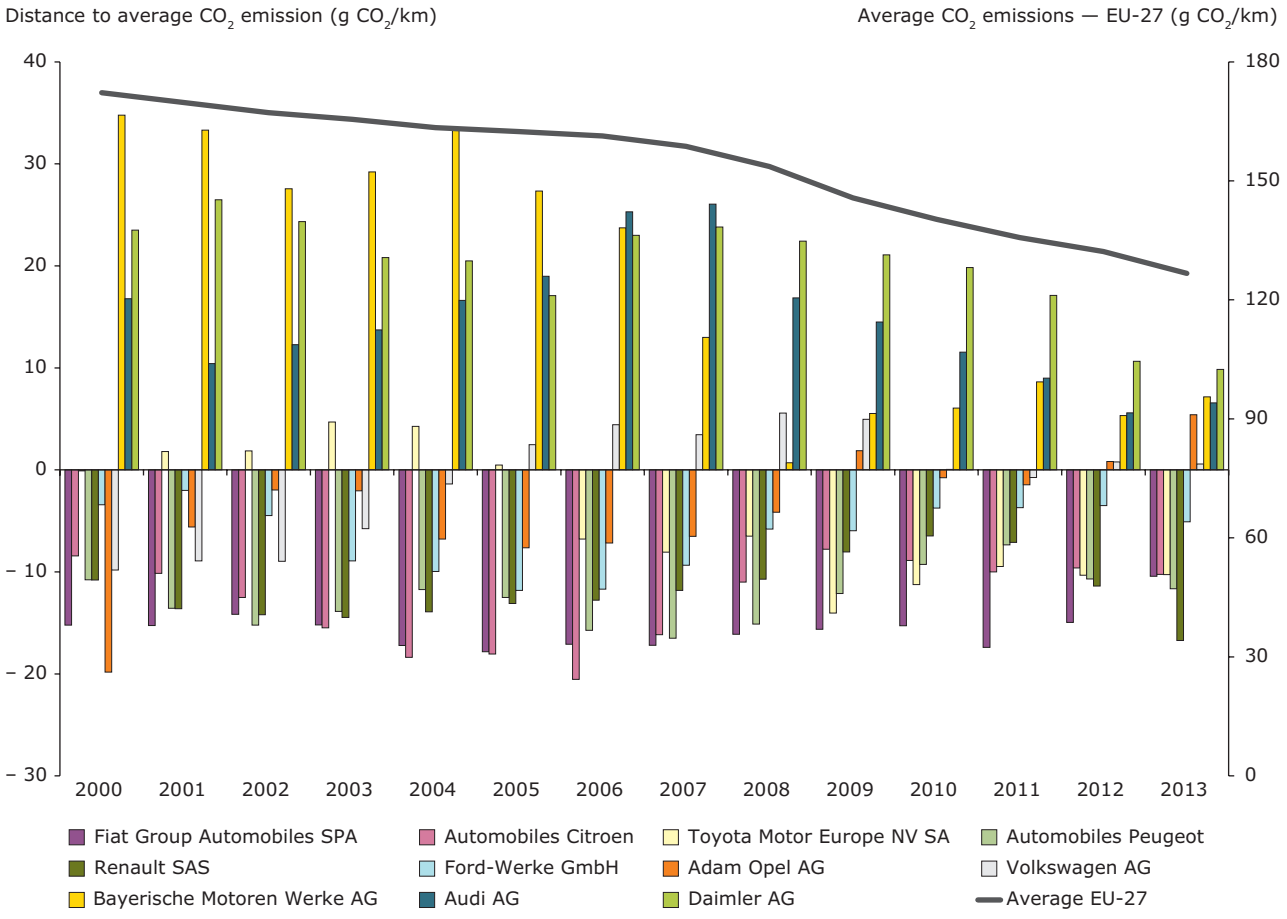
([d]) In previous years, Jaguar and Land Rover appeared as two independent manufacturers.

Seat has achieved a significant reduction (8.4 g CO_2/km) in its average emissions between the years 2012 and 2013, reaching 119 g CO_2/km. As for Fiat, Seat has one of the lowest average car mass among the large manufacturers (1 231 kg) and high share of AFVs (11 %), mainly LPG and NG vehicles.

All manufacturers in this group decreased their average emissions levels in 2013 compared to 2012. The largest reductions in average emissions were achieved by Volvo (11.4 g CO_2/km), Renault (10.8 g CO_2/km) and Dacia (10.3 g CO_2/km). These decreases permitted Dacia to get below the 130 g CO_2/km threshold (127 g CO_2/km) and Volvo to get closer to the same threshold (131 g CO_2/km). Since 2009 when the car emissions legislation came into force, Volvo, Daimler AG, Renault and Audi AG recorded an average emission decrease (over the following four years) of 42 g CO_2/km, 30 g CO_2/km, 28 g CO_2/km and 27 g CO_2/km respectively. These are the greatest decreases among the largest manufacturers.

In Figure 3.7 the average CO_2 specific emissions in the EU-27 over the period 2000 to 2013 is compared with the performances of manufacturers responsible for more than 500 000 registrations a year. Positive bar values mean that the manufacturers' average emissions are higher than the EU average emissions; negative bar values mean that the manufacturers' average emissions are lower than the EU average emissions. Over the years, some manufacturers more or less followed the trend of the average performance of the European fleet, notably the FIAT group and FORD WERKE. However, some manufacturers showed a better emission reduction trend compared to the average reduction of total EU new registrations. For example, the average CO_2 emissions of BMW, Renault and Toyota have decreased by 35 % and 32 % respectively since 2000 (compared to an average decrease in emissions of 26 % across the European fleet as a whole). The opposite situation is observed for Adam Opel and Volkswagen: for these manufacturers the emissions

Figure 3.7 Emissions trends: average CO_2 specific emissions and manufacturers' distance to average European CO_2 specific emissions



Note: Data for the time series 2000–2009 were gathered via the monitoring regulated by Decision 1753/2000/EC, which was repealed by Regulation (EC) No 443/2009. These data do not include all Member States in all years. Manufacturers' names and groups may have changed. Moreover, due to changes in methodology and monitoring improvements, breaks in trends may occur.

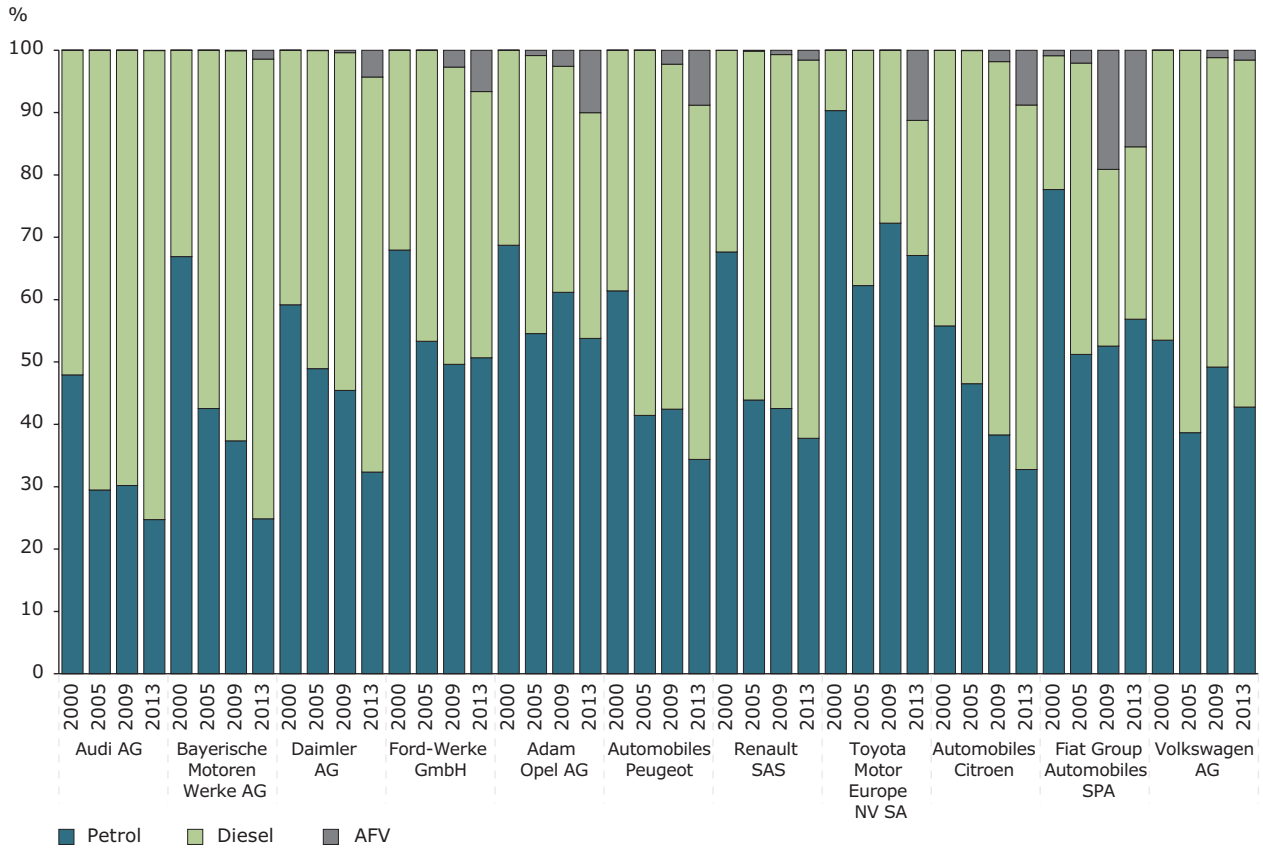
reduction is lower than the reduction made in the average fleet (13 % and 22 % respectively). For some manufacturers, the average emissions did not follow a uniform path. For example, Toyota's emissions performance improved at a slower pace compared to the European average in the period 2000–2005, but it surpassed the European average during the last seven years. The opposite was observed for Volkswagen, who achieved greater improvements than the European average in the period 2000–2004, but smaller improvements in the past eight years.

As a general observation, dieselisation ([16]) (the introduction of more diesel vehicles) is one of the main drivers for the emissions reductions of the large manufacturers since 2000 (Figure 3.8).

In EU-27 registrations of diesel vehicles have increased consistently over the years, but for some manufacturers their share of diesel cars has stabilised over the last couple of years. Despite the increasing trend, the share of alternative-fuelled vehicles remains low in absolute terms, and hence has not contributed significantly to the observed emissions reductions. However in 2013, the contribution of AFVs is becoming important for some manufacturers, accounting for more than 10 % of registrations for Adam Opel, Toyota and Fiat.

The distribution of registrations over different emissions classes (Figure 3.9) shows that for some manufacturers (Volvo, Nissan, Toyota Motor Europe, and Renault) the market for

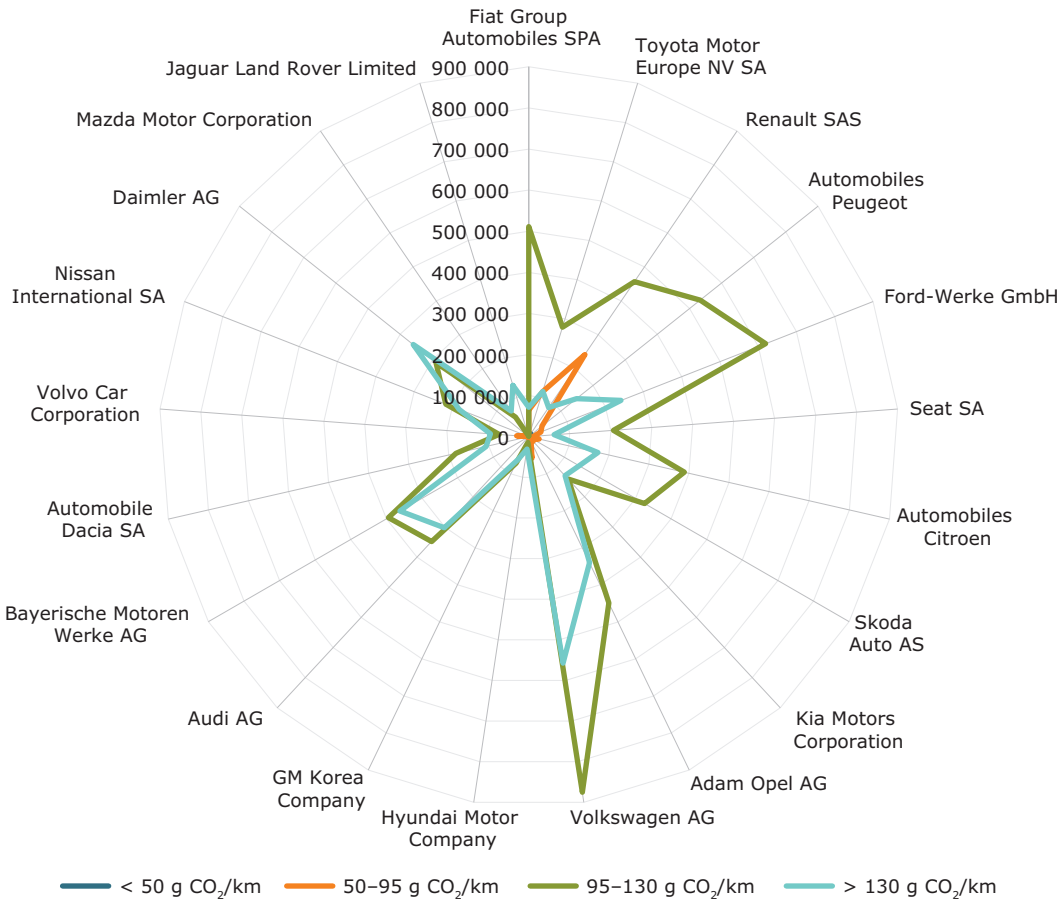
Figure 3.8 Emissions trends: fuel type for the largest manufacturers (> 500 000 vehicle registrations per year)



Note: Data for the time series 2000–2009 were gathered via the monitoring regulated by Decision 1753/2000/EC, which was repealed by Regulation (EC) No 443/2009. These data do not include all Member States in all years. Manufacturers' names and groups may have changed. Moreover, due to changes in methodology and monitoring improvements, breaks in trends may occur.

([16]) Diesel vehicles generally emit more air pollutants per kilometre than their conventional petrol equivalents. This is particularly true for diesel vehicle emissions of black carbon, which has impacts on health and the climate, but diesel vehicles also emit more particulate matter (PM) and more nitrogen oxide (NO_x) per kilometre than conventional-petrol-powered cars. Please see *EMEP/EEA air pollutant emission inventory guidebook 2013* (http://www.eea.europa.eu/publications/emep-eea-guidebook-2013).

Figure 3.9 Emissions trends: number of registrations over different specific emissions classes



very low-emitting vehicles (below 50 g CO_2/km) is increasing. However, for each of those manufacturers the percentage of electric vehicles is lower than 4 %. For Toyota and Renault the percentage of vehicles emitting less than 95 g/km is relatively high, being 23 % and 32 % respectively. Vehicles with emissions below 130 g CO_2/km account for the largest share of registrations for the majority of the large manufacturers (17 out of 21).

3.5 Distance to the 2013 target

The distance of manufacturers to their specific emissions targets is calculated by taking into account the adjustments listed in Chapter 2 (phase-in, super-credits, E85 extra credits and eco-innovations).

Based on their average CO_2 emissions in 2013, 55 manufacturers out of 84, representing 99 % of the total registrations in the EU, achieved their specific emissions targets for the year 2013 (including derogations). Taking into account the pools, 72 manufacturers out of 84 achieved their respective target.

Only a small number of manufacturers did not meet their specific emission targets in 2013. These are all small-volume manufacturers with less than 10 000 registrations. Some of the companies concerned have either ceased production since 2013, or would fall within the scope of the proposed *de minimis* threshold, according to which manufacturers with less than 1 000 registrations will be exempt from achieving a specific emissions target. In total, there were 17 manufacturers with less than 3 000 vehicles registered in 2013 that benefitted from the *de minimis* derogation. In 2013 two manufacturers responsible for more than 1 000 vehicles did not meet their respective target. The data are available in Annex 2.

Over the last years, all manufacturers were able to improve their performance, and have decreased their emissions levels below their respective targets. The distance to the target varies between

1.94 g CO_2/km below its target for Hyundai Czech and 38.0 g CO_2/km below its target for Volvo. All relevant data are included in Annex 1.

For 2013, the pool for Tata, Jaguar Land Rover and Mazda were granted niche derogations.

Figure 3.10 shows the distance to target for the the manufacturers that registered more than 100 000 vehicles in 2013. In 2010, 14 larger manufacturers achieved the 2012 target set by the regulation. In 2011, this number increased to 18, whereas all the largest manufacturers achieved their targets in 2012 and in 2013.

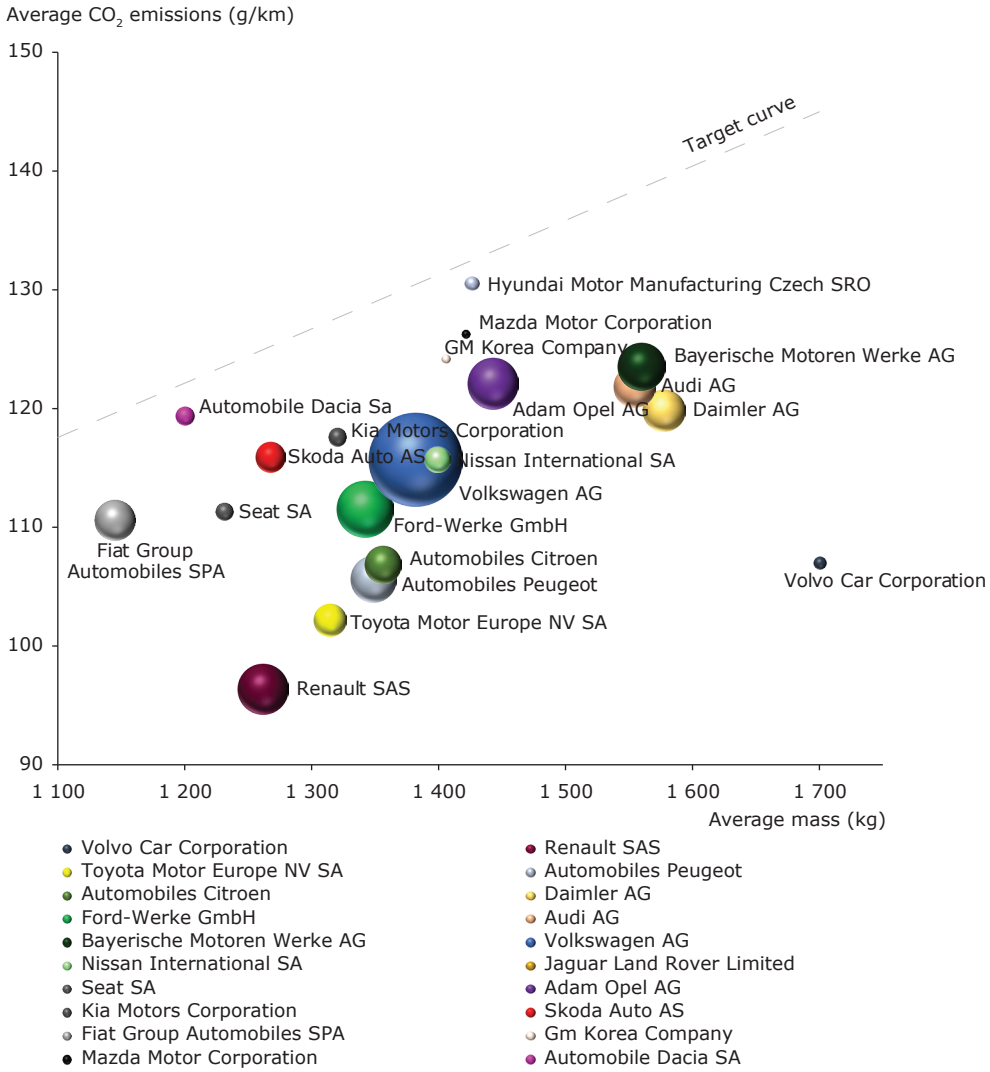
As explained in Chapter 2, the limit value curve implies that heavier cars are allowed higher emissions than lighter cars. As a result, the specific CO_2 emission targets of this group range from 120 to 178 g CO_2/km.

Over the last years, all manufacturers were able to improve their performance, and have decreased their emissions levels below their respective targets. The distance to the target varies between 1.94 g CO_2/km below its target for Hyundai Czech and 38.0 g CO_2/km below its target for Volvo. All relevant data are included in Annex 1.

For 2013 the pool for Tata, Jaguar Land Rover and Mazda were granted niche derogations.

The distance to target for pools of manufacturers is presented in Table 3.7. In 2013, all the pools respected their specific emissions' targets.

Figure 3.10 Distance to 2013 target by individual manufacturers (only manufacturers registering > 100 000 vehicles)



Note: The size of the bubble is proportional to the number of vehicles registered in Europe.

Table 3.7 Distance to target for the pools in 2013

Pool	Manufacturer	Average emissions (g CO_2/km)	Target (g CO_2/km)	Distance to target (g CO_2/km)
	Bayerische Motoren Werke AG	124	139	– 15
	BMW M GmbH	240	154	86
	Rolls-Royce Motor Cars Ltd	324	182	142
BMW Group		124	139	– 15
	Daimler AG	120	139	– 20
	Mercedes-AMG GmbH	177	147	30
Daimler AG		120	139	– 20
	Chrysler Group LLC	184	161	22
	Fiat Group Automobiles SPA	111	120	– 9.0
	Maserati SPA	266	158	108
Fiat Group Automobiles SPA		111	122	– 11
	Ford-Werke GmbH	112	129	– 17
	Ford Motor Company	194	165	29
	CNG-Technik GmbH	19	138	– 118.6
Ford-Werke GmbH		111	129	– 17
	Mitsubishi Motors Corporation MMC	89	141	– 52
	Mitsubishi Motors Europe BV MME	118	121	– 2.9
	Mitsubishi Motors Thailand Co Ltd MMTH	94	110	– 16.5
Mitsubishi Motors		90	135	– 45
	Chevrolet Italia SPA	112	119	– 7.4
	General Motors Company	82	150	– 67
	GM Korea Company	124	132	– 7.3
	Adam Opel AG	122	133	– 11
General Motors		122	133	– 11
	Honda Automobile China Co Ltd	124	120	4.5
	Honda Motor Co Ltd	122	131	– 8.3
	Honda of the UK Manufacturing Ltd	134	138	– 3.8
	Honda Turkiye As	154	127	27
Honda Motor Europe Ltd		126	132	– 6.2
	Lada France	179	129	50
	Automobile Dacia Sa	119	122	– 2.8
	Renault Sas	96	125	– 29
Pool Renault		102	124	– 22
	Suzuki Motor Corporation	159	123	35.6
	Maruti Suzuki India Ltd	98	123	– 24.9
	Magyar Suzuki Corporation Ltd	119	123	– 4.3
Suzuki Pool		116	123	– 7.4
	Daihatsu Motor Co Ltd	149	124	25
	Toyota Motor Europe Nv Sa	102	127	– 25
Toyota-Daihatsu Group		102	127	– 25
	Jaguar Land Rover Limited	165	178	– 13
	Tata Motors Limited	130	178	– 48
Tata Motors Ltd, Jaguar Cars, Land Rover		164	178	– 14
	Audi AG	122	138	– 16
	Audi Hungaria Motor KFT	142	133	8.5
	Bentley Motors Ltd	289	181	107
	Bugatti Automobiles SAS	539	162	377
	Automobili Lamborghini SPA	341	145	196
	Dr Ing HCF Porsche AG	190	151	39
	Quattro GmbH	235	153	82
	Seat SA	111	124	– 12
	Skoda Auto AS	116	125	– 9.3
	Volkswagen AG	116	130	– 15
VW Group PC		117	131	– 14

3.6 Effect of super credits on manufacturers

Regulation (EC) No 443/2009 gives incentives to the car manufacturers to produce vehicles with very low emissions (below 50 g CO_2/km). As explained in Chapter 2 each low-emitting car is counted as 3.5 vehicles in 2013 for the calculation of the fleet average.

Table 3.8 summarises the average emissions calculated including and excluding the super credits for the 21 largest manufacturers. It is noted that even when excluding the super credits from the calculation of the CO_2 average emissions, all the largest manufacturers are achieving their 2013 target. The effect of the super credits on the average fleet emissions is below 7.5 g CO_2/km.

Even if the number of low-emitting vehicles will increase in the future, the effect of super credit on CO_2 specific emissions will decrease because the credits decrease annually, i.e. low-emitting cars will be counted as 1.5 vehicles in 2015 and as 1 car from 2016 till 2019.

Table 3.8 Performance of the manufacturers that registered > 100 000 vehicles in 2013 including and excluding super-credits adjustments

Manufacturer	CO_2 specific emissions	Target	Distance to target	CO_2 specific emissions — no super credit	Distance to target — no super credit	Difference with or without super credit
Renault SAS	96.384	125	– 28.581	99.975	– 24.990	3.591
Automobiles Peugeot	105.652	129	– 23.282	105.823	– 23.111	0.171
Fiat Group Automobiles SPA	110.620	120	– 9.013	110.62	– 9.013	0.000
Toyota Motor Europe NV SA	102.194	127	– 25.192	103.797	– 23.589	1.603
Automobiles Citroen	106.856	129	– 22.419	107.177	– 22.098	0.321
Seat SA	111.316	124	– 12.258	111.317	– 12.257	0.001
Ford-Werke GmbH	111.513	129	– 17.107	111.541	– 17.079	0.028
Skoda Auto AS	115.924	125	– 9.302	115.924	– 9.302	0.000
Automobile Dacia SA	119.365	122	– 2.778	119.365	– 2.778	0.000
Volkswagen AG	115.735	130	– 14.707	115.987	– 14.455	0.252
Kia Motors Corporation	117.620	128	– 10.013	117.62	– 10.013	0.000
Volvo Car Corporation	107.012	145	– 38.000	114.428	– 30.584	7.416
Nissan International SA	115.711	131	– 15.529	121.48	– 9.760	5.769
Adam Opel AG	122.121	133	– 11.128	123.291	– 9.958	1.170
Audi AG	121.881	138	– 16.438	121.881	– 16.438	0.000
Bayerische Motoren Werke AG	123.541	139	– 15.051	124.255	– 14.337	0.714
Mazda Motor Corporation	126.281	129	– 3.145	126.281	– 3.145	0.000
GM Korea Company	124.192	132	– 7.338	124.347	– 7.183	0.155
Daimler AG	119.834	139	– 19.552	121.664	– 17.722	1.830
Hyundai Motor Manufacturing Czech SRO	130.549	132	– 1.940	130.594	– 1.895	0.045
Jaguar Land Rover Limited	164.623	178	– 13.402	164.623	– 13.402	0.000

Note: If the difference is 0.000, the manufacturer does not produce low emitting vehicles (< 50 g CO_2/km).

3.7 Distance to the 2015 and 2021 targets

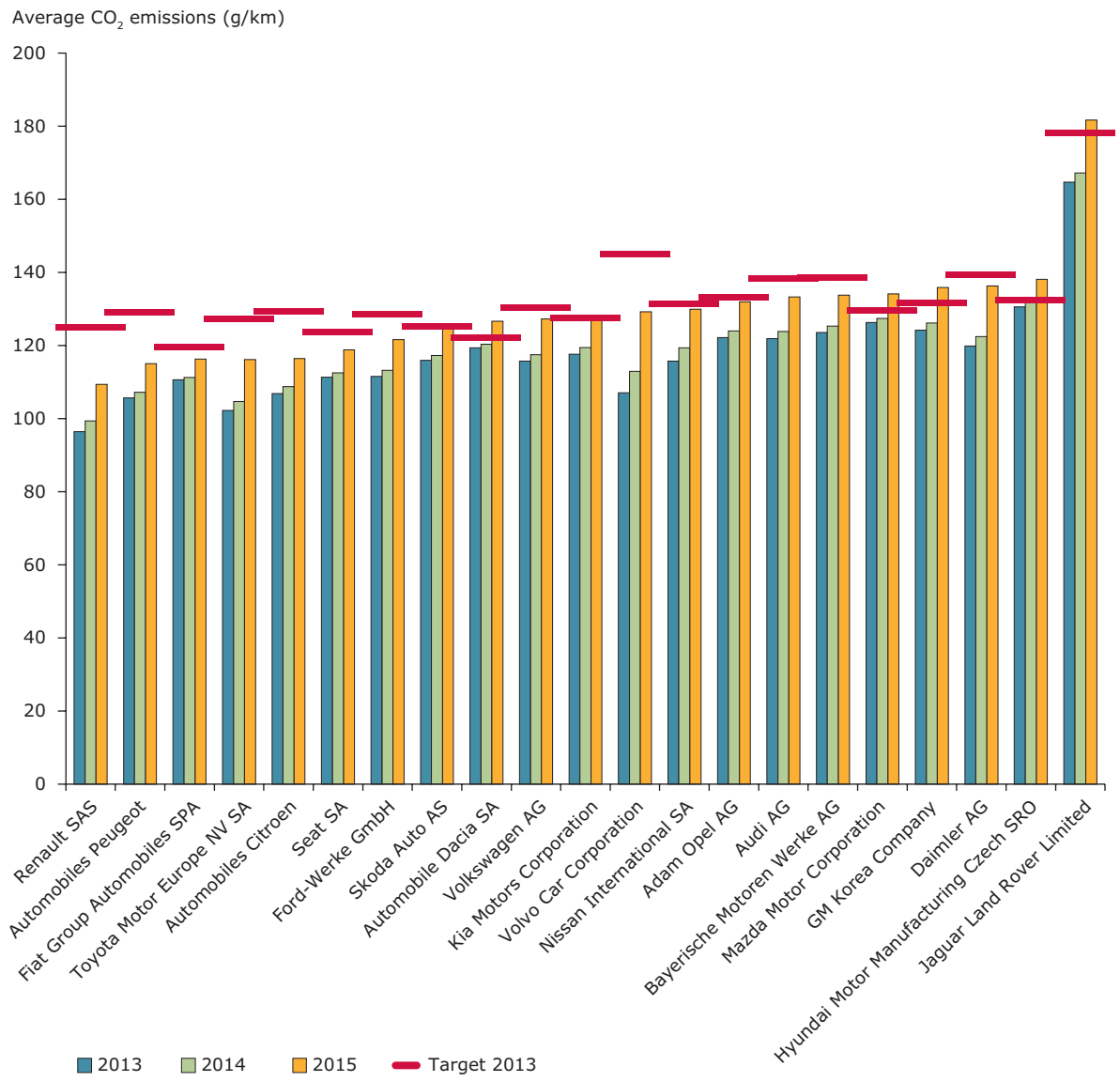
The distance of the largest manufacturers (i.e manufacturers registering more than 100 000 vehicles per year) to their targets is calculated based on the 2013 CO_2 emission data.

Progress towards the target for the period 2014–2015 is calculated on the basis of the adjustments summarised in Chapter 2. A different set of adjustments is applied in every year of this period. For example, for the year 2015, the calculation includes 100 % of the vehicle fleet, and manufacturers receive super-credits of 1.5 cars for vehicles emitting less than 50 g CO_2/km. Manufacturers have two more years to further reduce CO_2 emissions and ensure compliance with their targets in 2015. In general, if car manufacturers continue to reduce emissions as in past years they will meet the 2015 targets.

Already in 2013, among the 21 large manufacturers:

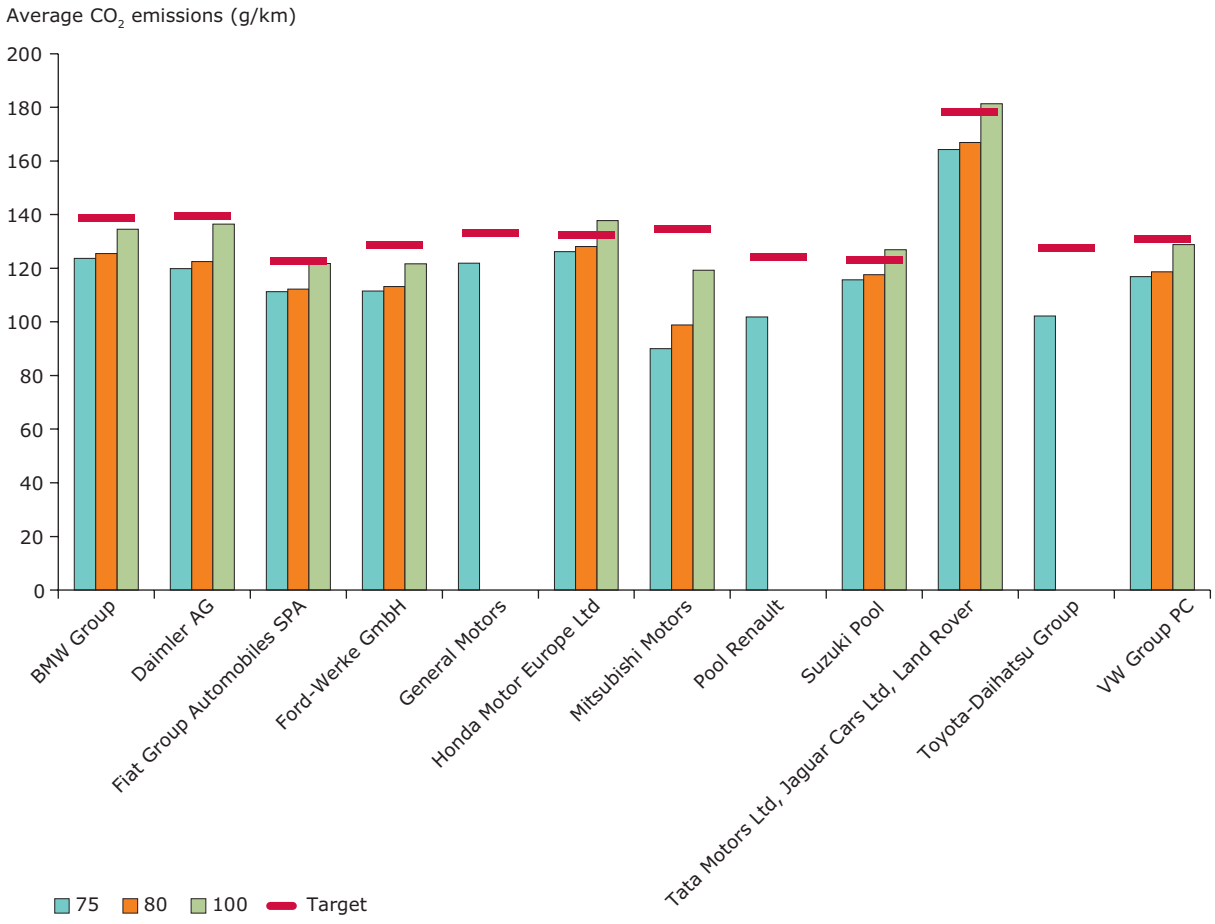
- fifteen manufacturers already comply with their 2015 targets;
- all manufacturers have achieved their 2013 and 2014 targets.

Figure 3.11 Distance to the 2013–2015 targets by manufacturer



Note: Targets are calculated on the basis of 2013 data. Renault pool Toyota pool and General Motors are valid for 2013 only.

Figure 3.12 Distance to the 2013–2015 targets by pools



Note: Targets are calculated on the basis of 2013 data. Renault pool Toyota pool and General Motors are valid for 2013 only.

All the manufacturers seem to be on track to reach their 2015 target. In order to fully comply with the 2015 targets, one manufacturer has to reduce emissions by less than < 1 g CO_2/km and five manufacturers have to reduce the average emissions of their fleets by less than 6 g CO_2/km respectively over the next two years.

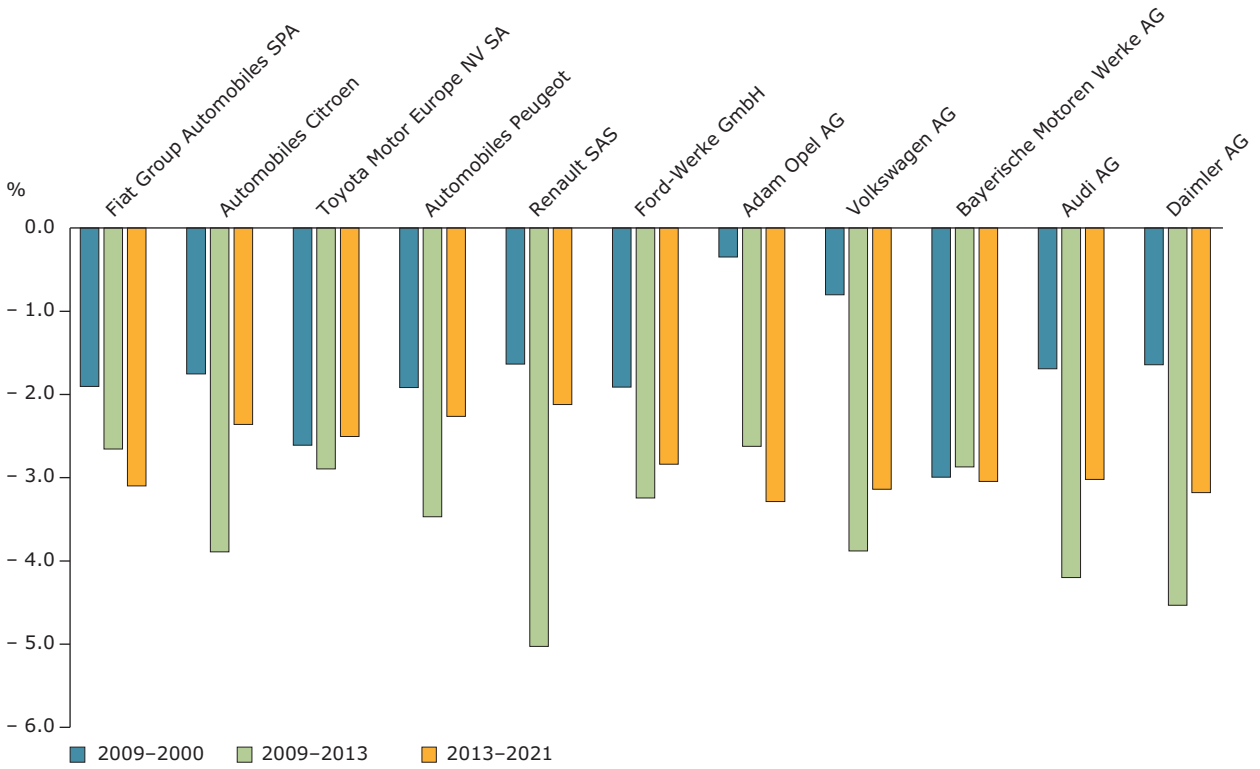
It should be noted that further pooling agreements between manufacturers can also be expected, which may change these estimates further.

Regulation No 333/2014 defines the modalities for reaching the 2020 target. Taking into account those modalities, it is possible to make an estimate of the emission reduction that manufacturers would have to achieve in order to reach their respective targets in 2020.

Figure 3.13 presents the progress of the manufacturers responsible for more than 500 000 vehicles a year in terms of annual percentage changes for two periods: 2000–2009, 2009–2013. These rates are compared with the expected reductions for respecting the 2021 target set by the regulation.

For these manufacturers the rate of progress required from now till 2021 is in general lower than the rate that has been achieved in the last four years, since the Regulation (EU) No 443/2009 came into force. There are only three manufacturers for which the progress rates in the period 2013–2021 are slightly greater than in the previous years. The figure shows that the highest improvements were achieved over the period 2009–2013.

Figure 3.13 **Comparison of past and future progress for meeting the 2021 target (only manufacturers registering > 500 000 vehicles in Europe)**



3.8 Excess emission premiums

If a manufacturer's or a pool's average specific CO_2 emissions exceed the specific average target, Regulation (EC) No 443/2009 requires the payment of an excess emissions premium. The excess emissions premium for failing to meet the specific CO_2 emissions target is calculated by multiplying the following three elements:

- the distance to the emissions target in a given year (in g CO_2/km), i.e. the excess emissions;
- the number of vehicles registered by the manufacturer during that year;
- the premium level included in Table 3.9.

The premium amounts to EUR 5 for the first g CO_2/km of exceedance, EUR 15 for the second g CO_2/km, EUR 25 for the third g CO_2/km, and EUR 95 for each subsequent g CO_2/km. A higher distance to the target therefore implies a higher excess premium per g CO_2/km emitted.

Table 3.9 **Coefficients to be used in the formula for calculating excess emissions premium**

Excess emissions (g CO_2/km)	Fine (EUR)				Number of vehicles	Formula for calculating excess emission premium (EUR)
	5	15	25	95		
0–1	(EE)	-	-	-	NV	((EE) * 5)*NV
1–2	1	(EE — 1)	-	-	NV	(1*5 + (EE-1)*15)*NV
2–3	1	1	(EE — 2)	-	NV	(1*5 + 1*15 + (EE-2)*25)*NV
> 3	1	1	1	(EE — 3)	NV	(1*5 + 1*15 + 1*25 + (EE-3)*95)*NV

Note: 'EE' is the distance to target or excess emission; 'NV' is the number of vehicles registered.

For example, if a manufacturer registers 100 000 vehicles in the EU, the formula to be used for calculating the excess emissions premium varies depending on the distance to the target as follows:

- if the distance to the target is 0.5 g CO_2/km, the first formula in Table 3.9 applies and the excess emission premium = 0.5*5*100 000 = EUR 250 000;
- if the distance to the target is 1.5 g CO_2/km, the second formula in Table 3.9 applies and the excess emission premium = (1*5 + (1.5–1)*15)*100 000 = EUR 1 250 000;
- if the distance to the target is 2.5 g CO_2/km, the third formula in Table 3.9 applies and the excess emission premium = (1*5 + 1*15 + (2.5–2)*25)*100 000 = EUR 3 250 000;
- if the distance to the target is 3.5 g CO_2/km, the fourth formula in Table 3.9 applies and the excess emission premium = (1*5 + 1*15 + 1*25 + (3.5–3)*95)*100 000 = EUR 9 250 000.

In 2013 two manufacturers will be required to pay the excess emissions premium (see Annex 2).

4 Light commercial vehicles

4.1 EU statistics

In 2013, there were 1.24 million new light commercial vehicle registrations in the EU-27. This includes 9 395 IVAs, 12 389 vehicles approved under NSS rules, around 4 300 unknown vehicles and 106 unidentified vehicles. Unknown vehicles are vehicles where the entries for the manufacturer's 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. 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 were not considered for the calculation of the average specific emissions or the specific emissions targets for manufacturers.

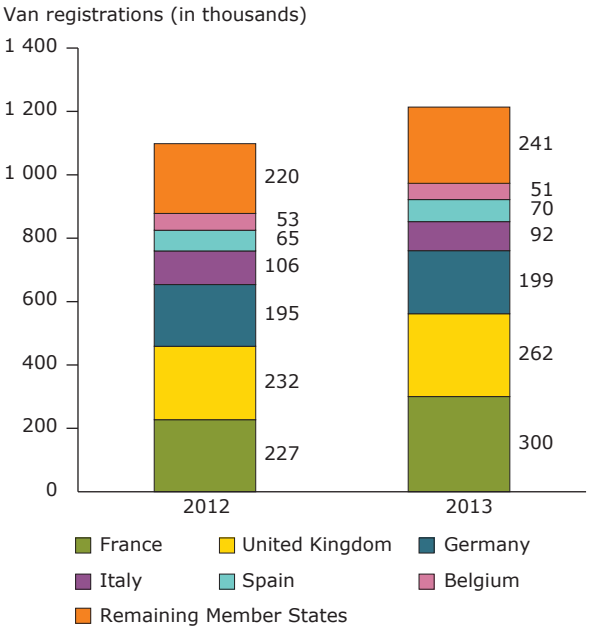
It should be noted that there are uncertainties in both the 2012 and 2013 datasets mainly due to the difficulty experienced by Member States in the monitoring of multi-stage vans. A new monitoring system will apply from 2015 with effect for the 2014 data collection exercise that is intended to address this issue.

For almost half of the Member States, the number of registrations decreased in 2013 compared to 2012, while for the other half of the Member States registrations increased for the same period. The biggest declines in new vehicle registrations were observed in Cyprus (23 %), Romania (15 %), Italy (14 %), whereas the biggest increases were seen in Ireland (82 %), Denmark (52 %), Portugal and Greece (32 %).

The largest markets in Europe with regard to the new registrations of vans are France with a share of 25 %, the United Kingdom (22 %) and Germany (16 %) (Figure 4.1). The EU-15 still accounts for the vast majority of registrations of new light commercial vehicles in the European Union, with a share of 93 % of the total registrations. Compared to 2012, the number of vehicles registered in the EU-12 has increased by 6 %, while the number of newly registered vehicles in the EU-15 has increased by 11 %.

The average CO_2 emissions from the new light commercial vehicle fleet in the EU-27 in 2013 were 173.3 g CO_2/km. The average specific emissions of CO_2 in 2013 have decreased by 6.9 g CO_2/km compared to the previous year (180.2 g CO_2/km in 2012).

Figure 4.1 Number of light commercial vehicles registered in the EU-27 in 2012 and 2013



Note: Remaining Member States: EU-12, Austria, Denmark, Finland, Greece, Ireland, Luxembourg, the Netherlands, Portugal, Sweden.

Last year, France did not provide information on their entire fleet of vans due to an update of the registrations system.

Table 4.1 **Average CO_2 emissions (g CO_2/km) from light commercial vehicles by region**

	2012	2013
EU-27	180.2	173.3
EU-15	180.0	172.9
EU-12	182.5	178.5

Table 4.2 **Average CO_2 emissions (g CO_2/km) from light commercial vehicles by fuel (EU-27)**

	2012	2013
All fuels	180.2	173.3
Petrol	161.3	153.0
Diesel	182.7	175.2
AFV (a)	109.4	101.8

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

(a) For the calculation of the average CO_2 emissions of AFVs, pure electric, LPG, NG, E85, biodiesel and plug-in vehicles are included.

In 2013, the average new light commercial vehicle in the EU-15 emitted 7.1 g CO_2/km less than the average newly registered vehicle in 2012 (Table 4.1), whereas in the EU-12 it emitted 4.0 g CO_2/km less.

The percentage of newly registered vehicles with emissions lower than 140 g CO_2/km has increased in 2013 compared to 2012 and almost 32 % of newly registered vehicles emit less than 140 g CO_2/km, compared to 27 % of last year. The number of vehicles emitting less than 180 g CO_2/km represents 48 % of the registrations in 2013 (44 % in 2012).

Table 4.3 **Share (%) of fuel type in light commercial vehicles (EU-27)**

	2012	2013
Diesel	96.5	96.5
Petrol	1.8	2.0
AFV	1.7	1.5

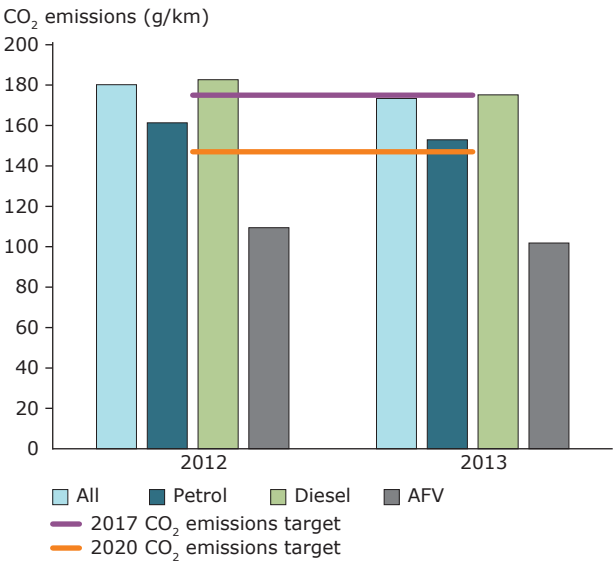
Note: The geographical scope of the data changes over time from EU-15 to EU-25 and EU-27, see Annex 1 for details.

4.2 Vehicles technologies

Diesel vehicles account for more than 96 % of the total new registrations as in 2012. The average CO_2 emissions of diesel and petrol vehicles decreased by 7.5 g CO_2/km and 8.4 g CO_2/km respectively, compared to 2012 (Table 4.3). In 2013 the average diesel vehicle emitted 175.2 g CO_2/km, about 22.2 g CO_2/km more than the average petrol vehicle (in 2012 the difference diesel — petrol vehicles was 21.4 g CO_2/km). It should be noted that this difference in the average CO_2 emissions between diesel and petrol vehicles is due to the difference in their average mass. Diesel vehicles are generally bigger, and hence heavier (1 777 kg on average), than petrol vehicles (1 222 kg on average).

There are about 6 000 newly registered electric vehicles compared to 5 600 registered in 2012. Of the other types of AFVs, LPG have the lowest CO_2 emissions (below 150 g CO_2/km), whereas ethanol-fuelled vehicles (E85) have the highest specific emissions (169 g CO_2/km).

Figure 4.2 **Evolution of CO_2 emissions from light commercial vehicles by fuel type in the EU-27**



4.3 Member States comparison

With the exception of Cyprus, Malta, Ireland and Sweden, for which the average CO_2 emissions in 2013 increased compared to 2012, in all other countries CO_2 emissions from light commercial vehicles fell in 2013 (Figure 4.3). The green bars in the figure show the absolute reduction by Member State between 2013 and 2012, while the orange diamonds represent the percentage variation between the same two years.

Thirteen Member States have average CO_2 specific emissions from newly registered vehicles already below the 175 g CO_2/km EU target set for 2015 (Figure 4.4). Four of them have emissions values below 160 g CO_2/km. For some of these Member States (Bulgaria, Malta and Portugal), the low average emissions are mainly related to the registration of relatively small vehicles: the average mass of the new fleet of these countries is below 1 600 kg. Malta, Portugal and France have the lowest average engine capacity in Europe. Portugal also has the lowest average engine power value, followed by France, the Netherlands, Romania and Italy (only 19 EU Member States reported engine power).

For light commercial vehicles the share of diesel vehicles is very high. For the majority of Member States (exceptions are Bulgaria, Spain, Italy, Poland and Estonia), the share of diesel vehicles is above 90 %.

Due to their market size, the Member States with higher vehicle registrations — France, Germany, Italy, Spain and the United Kingdom — are the major contributors to the total reductions in EU-27 CO_2 emissions from light commercial vehicles. 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 Malta and Portugal, has one of the lowest average engine capacity (1 792 cm^3 — the fourth lowest among the EU Member States) and engine power

Figure 4.3 Absolute reduction and relative reduction by Member State between 2012 and 2013

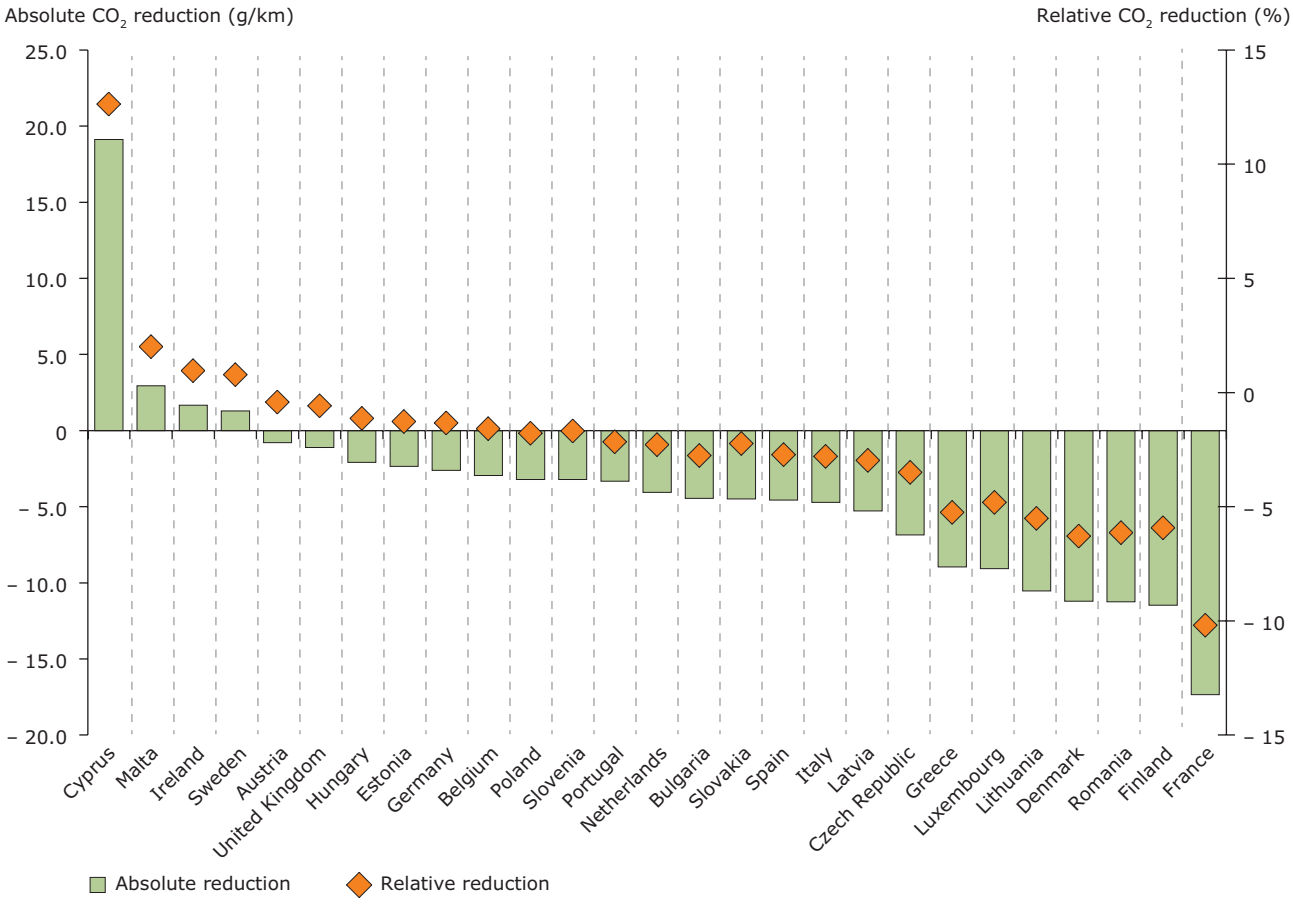
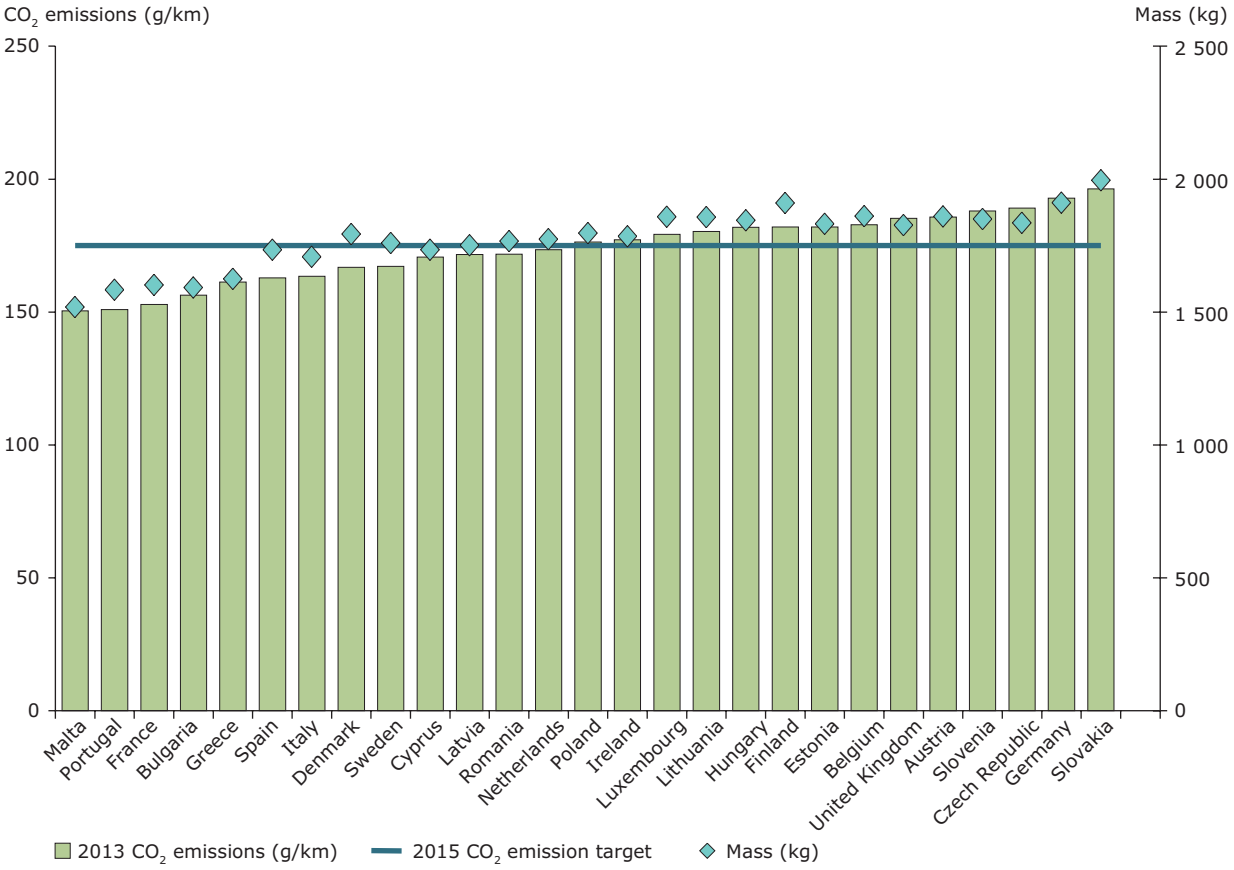


Figure 4.4 Average CO_2 emissions and average mass by EU Member State in 2013



(third lowest value among those Member States reporting engine power) values. In addition to this, Italy has registered the most AFVs among EU-27 (9 % in total new registrations of Italy). The latter are mainly NG vehicles (80 % of all AFVs registrations) with an average CO_2 value of 159 g CO_2/km and LPG vehicles (17 % of all AFVs registrations) with an average CO_2 value of 139 g CO_2/km. France has a relatively high share of pure electric vans (1.5 % of all vehicles registered in France) with zero emissions.

4.4 CO_2 emissions from van manufacturers in 2013

Table 4.4 presents data (number of registrations, average mass and average emissions) for van manufacturers that registered more than 10 000 vehicles in 2013 ([17]). In total they account for 95.6 % of the vans fleet. 2012 average emissions of those manufacturers are also presented in the same table.

Five manufacturers, representing almost 48 % of the European new vans fleet, had average emissions lower than 175 g CO_2/km: Dacia, Renault, Automobiles Citroen, Automobiles Peugeot and Fiat group. These are the manufacturers with the lower average mass in the group. The average emissions for the larger manufacturers are in the range of 132 — 276 g CO_2/km. Average mass values are in the range of 1 273 — 2 026 kg.

Dacia achieved the lowest average CO_2 emissions, as well as the lowest average mass as last year. Last year, Dacia lowered its average emissions by approximately 9 % (from 145 g CO_2/km in 2012 to 132 g CO_2/km in 2013). Downsizing, i.e. the shift to smaller and lighter vehicles, has been one of the

([17]) It should be noted that Regulation (EU) No 510/2011 provides manufacturers responsible for less than 22 000 registrations of new vehicles in a calendar year with the possibility of applying for a derogation target.

Table 4.4 Main specific emission statistics for the vans manufacturers registering > 10 000 vehicles a year

Manufacturer	Registrations 2013	Average mass (kg) 2013	Average CO_2 (g CO_2/km)	
			2013	2012
Automobile Dacia SA	17 056	1 273	132	145
Renault SAS	184 708	1 608	152	171
Automobiles Citroen	130 301	1 607	153	158
Automobiles Peugeot	129 341	1 615	154	159
Fiat Group Automobiles SPA	113 793	1 659	157	157
Adam Opel AG	67 383	1 724	178	178
Volkswagen AG	163 416	1 828	180	185
Ford-Werke GmbH	139 486	1 858	189	188
Toyota Motor Europe NV SA	24 372	1 913	191	202
Nissan International SA	37 546	1 869	192	199
Daimler AG	114 305	2 077	205	219
Iveco SPA	23 491	2 360	224	230
Jaguar Land Rover Limited (a)	11 351	2 026	276	

Note: (a) In previous years, Jaguar and Land Rover appeared as two independent manufacturers.

drivers for this reduction. The increasing share of diesel vehicles in Dacia's fleet (from 70 % in 2012 to 76 % in 2013), has also contributed to the observed emission reductions.

Renault is another large manufacturer that lowered its emissions considerably compared to last year by 11.2 %. The same applies to their average mass.

All manufacturers in this group, with the exception of Fiat and Ford, decreased their average emissions level in 2013 compared to 2012.

4.5 Distance to the 2013 target

The distance of the manufacturers to their specific emission targets is calculated by taking into account the adjustments listed in Chapter 2 (phase-in, super-credits, E85 extra credits and eco-innovations).

Based on their average CO_2 emissions in 2013, 12 manufacturers out of 13 larger manufacturers, representing 95 % of the total registrations in the EU, achieved their specific emissions targets for the year 2013. The average emission of Jaguar Land Rover exceeded its indicative target. However, as from 2014 this manufacturer was granted a derogation that will allow the manufacturer to respect its individual binding target from that year. .

Figure 4.5 graphically illustrates the distance to target for the fourteen manufacturers registering more than 10 000 vehicles a year.

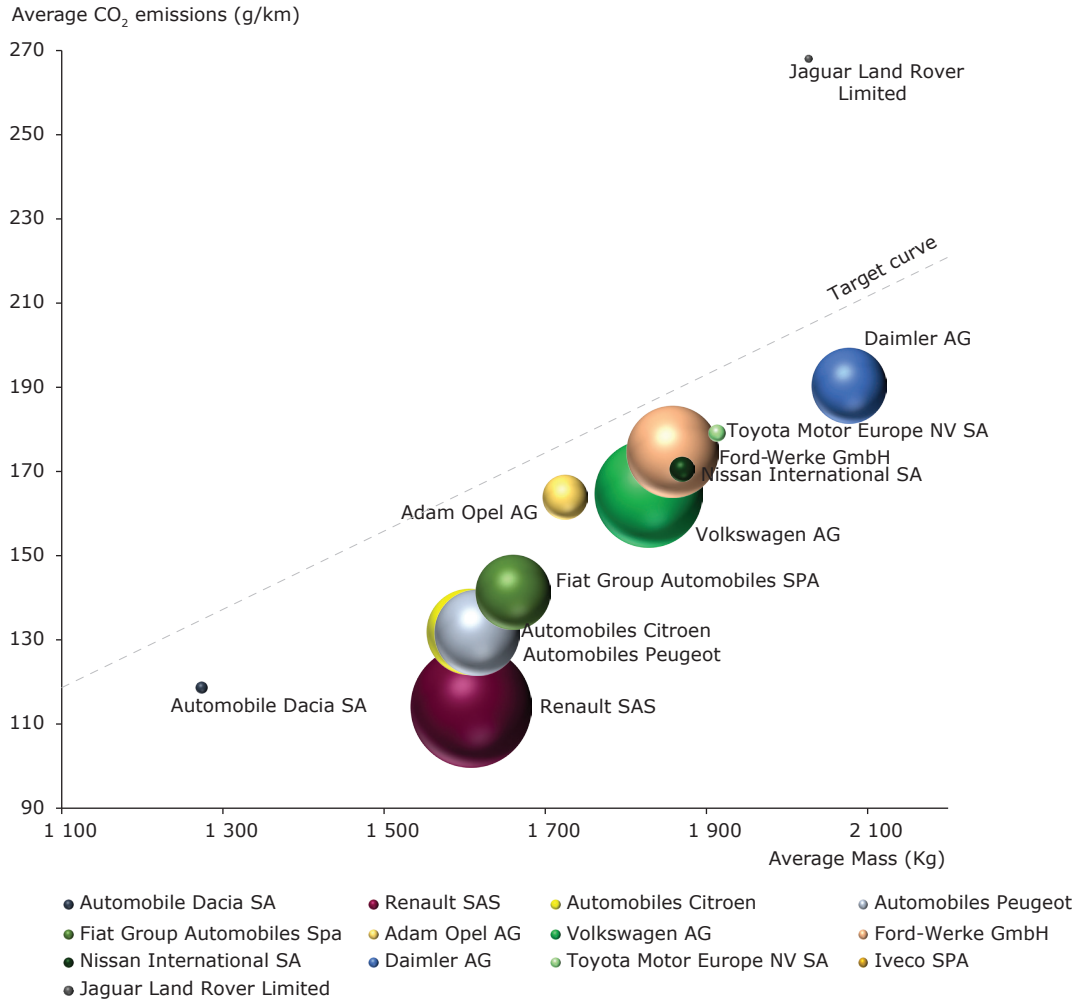
The distance to target for the two pools of manufacturers is presented in Table 4.5. In 2013, the pool Ford-Werke GmbH achieved the specific emissions target, whereas the distance to the specific emissions target for the Mitsubishi Motors pool is about 6 g CO_2/km. The latter has however been granted a derogation with effect from 2014 and is expected to meet its target in that year.

4.6 Excess emission premiums

In analogy to the Regulation (EC) 433/2009, if a manufacturer's or a pool's average specific CO_2 emissions exceed the specific average target, Regulation (EU) No 510/2011 requires the payment of an excess emissions premium. The formulas for calculating excess emissions premium for failing to meet the specific CO_2 emissions target is equivalent to the ones used for passenger cars (see Section 3.8).

As there are no binding target for vans in 2013 no premium will be imposed this year. The excess emissions premium will, if necessary be imposed from 2015 (based on data for new registrations in 2014).

Figure 4.5 Distance to 2013 target by individual manufacturers (only manufacturers registering > 10 000 vehicles in Europe)



Note: The size of the bubble is proportional to the number of vehicles registered in Europe.

Table 4.5 Distance to target for the pools in 2013

Pool	Manufacturer	Average emissions (g CO_2/km)	Target (g CO_2/km)	Distance to target (g CO_2/km)
	Ford Motor Company of Australia Limited	213	218	– 5
	Ford Motor Company	210	217	– 7
	Ford-Werke GmbH	175	189	– 14
Ford-Werke GmbH		177	191	– 14
	Mitsubishi Motors Corporation MMC	202	193	9
	Mitsubishi Motors Europe BV MME	228	209	19.3
	Mitsubishi Motors Thailand Co Ltd MMTH	203	201	1.4
Mitsubishi Motors		202	196	6

5 Real world vs legislative emissions

A feature of present EU regulations on CO_2 emissions from passenger cars and light commercial vehicles is that the CO_2 emission targets and vehicle monitoring are based upon the CO_2 emissions determined by the New European Driving Cycle (NEDC) ([18]) as part of the type-approval process. In recent years there has been a growing awareness that the NEDC type-approval driving cycle does not well represent 'real world' driving conditions, as it covers only a small portion of the vehicle engine operation in both load and speed (i.e. the driving cycle has an artificial driving speed pattern with low accelerations, constant speed cruises, and many idling events).

Numerous studies have documented the often significant divergence between type-approval and real-world CO_2 emissions. Evidence is also apparent that there may indeed be an increasing divergence between type-approval and real world fuel consumption and hence CO_2 emissions. A recent study (Ntziachristos et al., 2014) suggests that the difference is 11 % for petrol cars and 16 % for diesel cars. The study also stated that the difference can reach up to 60 % for newer vehicle models registered in the low 90–100 g CO_2/km category. Another recent report (ICCT, 2014) suggests that the divergence has increased from 10 % on average in 2001 to 23 % by 2011 and to more than 30 % in 2013.

Reflecting this, substantial efforts have been made in Europe over the recent years to update the current type-approval procedure by introducing the WLTP approach that aims to better represent actual vehicle operations on the road. WLTP has been in development since 2007 within the activities of the United Nations Economic Commission for Europe (UNECE) Working Party on Pollution and Energy (GRPE), and 'aims at providing a worldwide harmonised method to determine the levels of gaseous and particulate emissions, CO_2 emissions, fuel consumption, electric energy consumption and electric range from light-duty vehicles in a repeatable and reproducible manner designed to be representative of real world vehicle operation' (UNECE, 2013).

Despite the difference in CO_2 emissions when measured using real-world and type-approval approaches, real emission reductions have occurred as a result of regulation based upon the current type-approval monitoring regime. Using implied emission factors based on total consumption and activity, studies (Papadimitriou et al., 2014) have, for example, calculated a 2 % fleet-wide fuel consumption reduction for both diesel and gasoline passenger cars in 2010 compared to 2005. The improved testing method and the increased focus on real world emissions are expected to bring additional reductions in the future.

5.1 Methodology

In order to estimate the real-world CO_2 emissions of the passenger vehicle fleet, a modelling exercise was performed based upon information reported by Member States and using results from a study conducted by the Joint Research Centre (JRC, 2011).

In the JRC study, simple empirical models were constructed to predict in-use fuel consumption of passenger cars based upon linear combinations of key variables including the vehicle mass, engine capacity, rated power, and power to mass ratio. In addition, type-approval fuel consumption was used as an independent variable and, in some cases, the manual and automatic transmission and the Euro technology ([19]) were used as independent variables in addition.

The set of models used were based on vehicle mass, engine capacity and type-approval fuel consumption (which can be easily deducted from the reported

([18]) NEDC: The New European Driving Cycle (NEDC) is a driving cycle designed to assess the emission levels and fuel economy in passenger cars. More information at http://www.dieselnet.com/standards/cycles/ece_eudc.php.

([19]) European emission standards define the acceptable limits for exhaust emissions of new vehicles sold in EU member states. The emission standards are defined in a series of EU directives staging the progressive introduction of increasingly stringent standards. The stages are typically referred to as Euro 1, Euro 2, Euro 3, Euro 4, Euro 5 and Euro 6 for light duty vehicle standards.

CO_2 emissions). They are considered ideal to predict the real world CO_2 emissions of new car registrations as all data are readily available from the CO_2 monitoring database.

The model equations are:

Petrol Euro 5 passenger cars

(3) $FC_{InUse,Petrol}$ (l/100 km) = 1.15 + 0.000392 × CC + 0.00119 × m + 0.643 × FC_{TA}

Diesel Euro 5 passenger cars

(4) $FC_{InUse,Diesel}$ (l/100 km) = 0.133 + 0.000253 × CC + 0.00145 × m + 0.654 × FC_{TA}

Where FC_{TA} is the type-approval fuel consumption, m is the vehicle reference mass (empty weight + 75 kg for driver and 20 kg for fuel), and CC is the engine capacity (in cm^3).

The COPERT road transport emissions software ([20]) is a recognised and widely used tool for calculating road transport emission inventories based on real world emissions. It is supported by the EEA and the JRC, while it has been developed, maintained and constantly updated through the activities of EEA's European Topic Centre on Air and Climate Change Mitigation. The methodology described above has been implemented in the latest versions of the COPERT model.

COPERT applies the Eurostat classification to define vehicle fleets, in which cars are distinguished into capacity classes (< 0.8 l, 0.8 – 1.4, 1.4 – 2.0 l, and > 2.0 l for petrol and < 1.4, 1.4 – 2.0 l, and > 2.0 l for diesel cars) as a method to group together vehicles with similar characteristics.

In order to apply formulas 3 and 4, the number of vehicle registrations, engine capacity, vehicle mass and type-approval CO_2 per fuel type and engine size class were extracted from the CO_2 monitoring database (as described in Chapter 2) for passenger cars registered between 2010 and 2013, hence complying with the Euro 5 emission standards. Table 5.1 shows an example of the standard data format used for importing the relevant information in COPERT.

Table 5.1 Data requirements for the CO_2 correction option in COPERT (example of Austria)

Sector	Size class and technology	Year	% share of registrations	Average capacity	Average mass	Average TA emissions
Passenger cars	Euro 5 Petrol 0.8–1.4 l	2010	25.5	1 262	1 157	134
Passenger cars	Euro 5 Petrol 0.8–1.4 l	2011	26.7	1 255	1 179	130
Passenger cars	Euro 5 Petrol 0.8–1.4 l	2012	24.5	1 237	1 181	127
Passenger cars	Euro 5 Petrol 0.8–1.4 l	2013	23.4	1 214	1 182	123
Passenger cars	Euro 5 Petrol 1.4–2.0 l	2010	30.1	1 690	1 396	161
Passenger cars	Euro 5 Petrol 1.4–2.0 l	2011	26.1	1 683	1 413	156
Passenger cars	Euro 5 Petrol 1.4–2.0 l	2012	22.7	1 699	1 420	151
Passenger cars	Euro 5 Petrol 1.4–2.0 l	2013	21.1	1 698	1 416	144
Passenger cars	Euro 5 Petrol > 2.0 l	2010	32.0	3 466	1 805	237
Passenger cars	Euro 5 Petrol > 2.0 l	2011	26.1	3 542	1 836	228
Passenger cars	Euro 5 Petrol > 2.0 l	2012	21.7	3 622	1 830	220
Passenger cars	Euro 5 Petrol > 2.0 l	2013	20.3	3 706	1 832	218
Passenger cars	Euro 5 Diesel < 1.4 l	2010	24.0	1 276	1 243	114
Passenger cars	Euro 5 Diesel < 1.4 l	2011	26.2	1 284	1 286	110
Passenger cars	Euro 5 Diesel < 1.4 l	2012	25.9	1 311	1 293	107
Passenger cars	Euro 5 Diesel < 1.4 l	2013	23.9	1 319	1 332	109
Passenger cars	Euro 5 Diesel 1.4–2.0 l	2010	22.7	1 785	1 550	141
Passenger cars	Euro 5 Diesel 1.4–2.0 l	2011	26.7	1 772	1 579	137
Passenger cars	Euro 5 Diesel 1.4–2.0 l	2012	26.1	1 780	1 584	134
Passenger cars	Euro 5 Diesel 1.4–2.0 l	2013	24.6	1 778	1 573	131
Passenger cars	Euro 5 Diesel > 2.0 l	2010	23.3	2 505	1 899	184
Passenger cars	Euro 5 Diesel > 2.0 l	2011	25.9	2 536	1 908	175
Passenger cars	Euro 5 Diesel > 2.0 l	2012	24.8	2 522	1 929	170
Passenger cars	Euro 5 Diesel > 2.0 l	2013	26.0	2 475	1 896	162

([20]) http://www.emisia.com/copert/General.html.

In addition to the data requirements described above, the implementation in COPERT took into account the national vehicle stock configuration. A correction factor was applied to adjust the in-use fuel consumption predicted by COPERT to the national stock characteristics. Average real-world CO_2 emission factors (in g CO_2/km) are computed by dividing the total CO_2 emissions calculated with COPERT, by the total vehicle-kilometres for each fuel/size class.

A complete and detailed dataset of road vehicle type, technology, activity and fuel use for each EU Member State has been compiled through the completion of the DG Climate Action TRACCS project ([21]) and used as input in COPERT. This dataset contains number of vehicles per type, age group, fuel use, and technology level for each individual country. Detailed model runs with COPERT 4 were performed for the EU-27 Member States.

5.2 Results and discussion

Calculated real-world CO_2 emissions by fuel type and vehicle size class are presented in Table 5.2. The average engine capacity, vehicle mass, and type-approval CO_2 emissions are also included, as well as the percentage difference between real world compared to type-approval CO_2 emissions. The data in the table refer to all vehicles registered during the 2010–2013 period.

The data clearly illustrate the effect of vehicle and engine size on the real-world over type-approval CO_2 emissions ratio. At the EU level, this ratio is comparable for petrol and diesel cars and increases with engine size. The excess fuel consumption — and hence CO_2 emissions — for petrol cars varies from 17 % for small cars to 31 % for large cars, whereas for diesel cars it ranges between 17 % for small cars to 28 % for large cars.

Smaller or larger deviations can be observed at the individual Member State level depending on the respective specific vehicle fleet configurations. The type-approval and the excess real-world over type-approval CO_2 emissions for petrol and diesel cars by EU Member State are shown in Figure 5.1 and Figure 5.2 respectively.

For petrol cars, the lowest differences between real-world and type approval CO_2 emissions in absolute terms are observed in Denmark and the United Kingdom (below 20 g CO_2) and highest in Cyprus and Bulgaria (45 and 54 g CO_2 respectively). For diesel cars, the differences are lowest in Sweden and Estonia (48 and 54 g CO_2 respectively) and highest in Romania and Bulgaria (50 and 53 g CO_2 respectively).

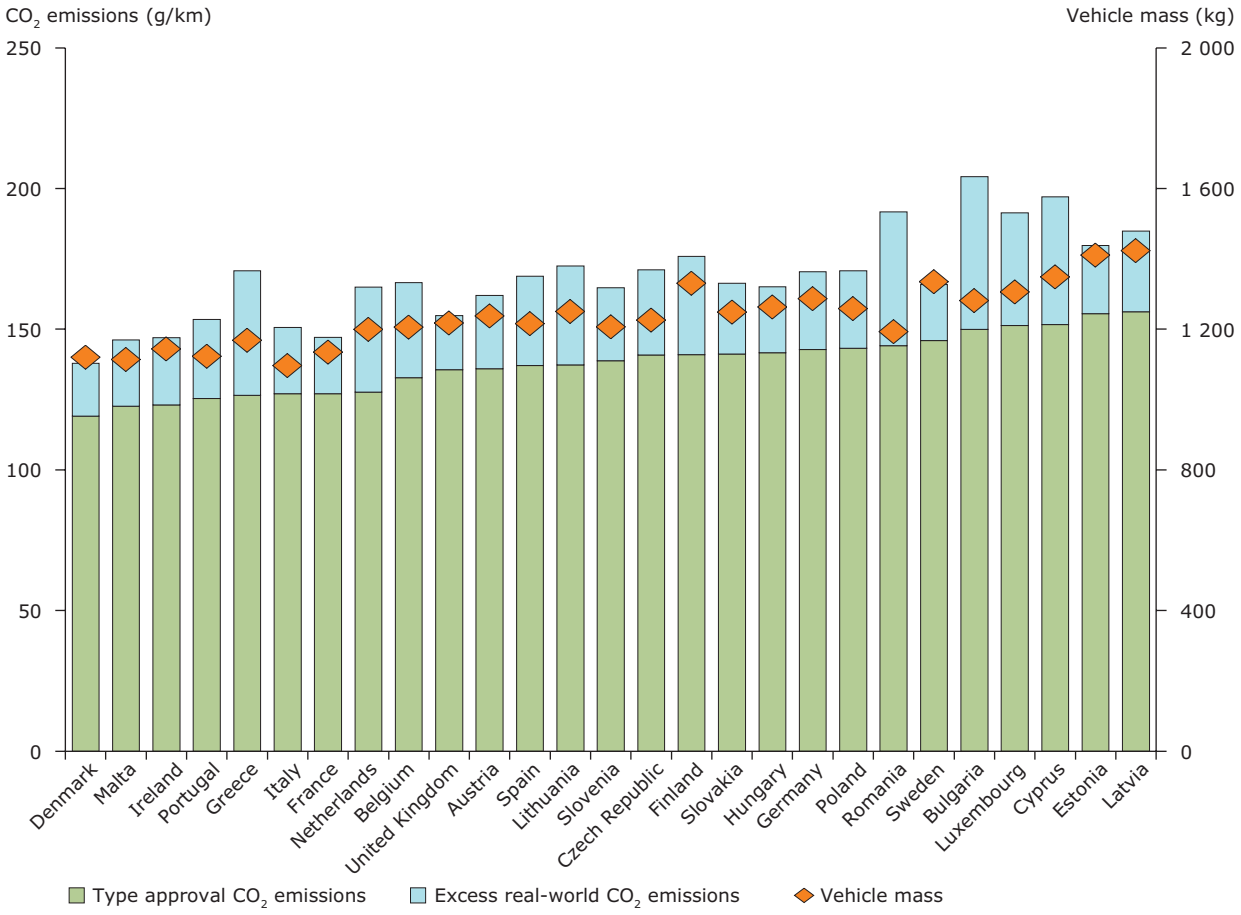
As mentioned previously, the basic formulas to calculate real-world CO_2 emissions are linear functions of engine capacity, vehicle mass and type approval fuel consumption. Hence, the differences observed among different Member States are

Table 5.2 Real-world vs legislative CO_2 emissions for the EU-27, 2010–2013

	Average capacity	Average mass	Average TA emissions	Real-world emissions	% difference over TA
Euro 5 Petrol < 0.8 l	791	912	120.3	-	-
Euro 5 Petrol 0.8–1.4 l	1 220	1 122	125.1	146.2	17 %
Euro 5 Petrol 1.4–2.0 l	1 703	1 399	153.0	183.4	20 %
Euro 5 Petrol > 2.0 l	3 546	1 788	224.5	294.2	31 %
Petrol — all capacities	1 423	1 218	135.8	161.0	19 %
Euro 5 Diesel < 1.4 l	1 300	1 199	107.3	106.9	17 %
Euro 5 Diesel 1.4–2.0 l	1 741	1 499	129.1	155.2	20 %
Euro 5 Diesel > 2.0 l	2 545	1 914	173.4	222.2	28 %
Diesel — all capacities	1 813	1 528	133.3	161.8	21 %

([21]) http://traccs.emisia.com.

Figure 5.1 **Type-approval and excess real-world over type approval CO_2 emissions (g/km) — petrol vehicles**

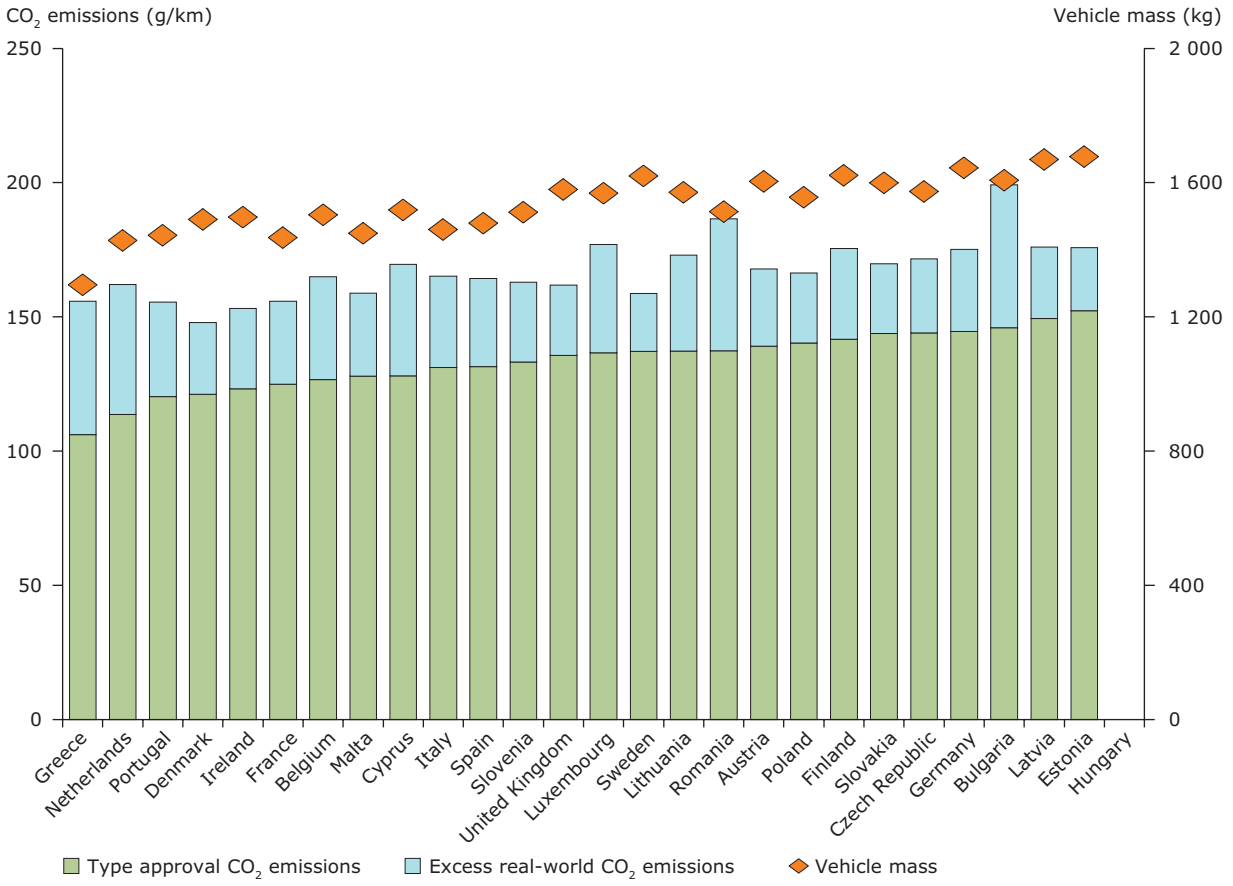


attributed to the respective differences in the above parameters. This is easily understood with the help of Table 5.3, in which the basic variables for petrol vehicles are summarised for the two Member States (Denmark and the United Kingdom) having the lowest real-world over type approval difference in CO_2 emissions and the two Member States (Cyprus and Bulgaria) with the highest difference.

For petrol vehicles, all three key variables (i.e. the engine capacity, vehicle mass and type approval CO_2 emissions) for Denmark and the United Kingdom are significantly lower compared to Cyprus and Bulgaria. The difference in the variables explains the much lower deviations of real-world from the legislative CO_2 emissions.

With the application of new type-approval procedures in the future, such as those based upon the new WLTP approach, it is expected that type approval measurements will better represent real world driving conditions, and thus differences between on-road and laboratory measurement of CO_2 emissions will decrease.

Figure 5.2 **Type-approval and excess real-world over type approval CO_2 emissions (g/km) — diesel vehicles**



Note: In the TRACCS dataset, data on Euro 5 diesel cars are not available for Hungary.

Table 5.3 **Real-world vs legislative CO_2 emissions for the Member States with the lowest and highest absolute differences**

	Average capacity	Average mass	Average TA emissions	Real-world emissions	Difference over TA
Denmark	1 243	1 120	119	138	19
United Kingdom	1 457	1 217	136	155	19
Cyprus	1 555	1 349	152	197	45
Bulgaria	1 517	1 281	150	204	54

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Annex 1

Table A1.1 Registration of new passenger cars by Member State (in thousands)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
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	2 930
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	74
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	732
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

Table A1.2 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
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	1 448
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	1 421
Bulgaria										1 454	1 462	1 485	1 475
Cyprus				1 205	1 277	1 316	1 354	1 372	1 367	1 388	1 377	1 370	1 367
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	1 227
Estonia				1 349	1 408	1 433	1 465	1 456	1 471	1 473	1 502	1 514	1 508
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	1 445
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	1 350
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	1 243
Hungary				1 182	1 203	1 237	1 264	1 288	1 330	1 370	1 396	1 390	1 401
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	1 397
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	1 314
Latvia				1 452	1 445	1 468	1 502	1 498	1 535	1 522	1 543	1 563	1 552
Lithuania				1 433	1 448	1 483	1 481	1 467	1 486	1 481	1 498	1 497	1 486
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	1 505
Malta								1 317	1 182	1 200	1 216	1 465	1 212
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	1 376
Portugal		1 229	1 254	1 295	1 329	1 352	1 365	1 352	1 344	1 333	1 354	1 361	1 350
Romania							1 268	1 286	1 291	1 281	1 325	1 381	1 365
Slovakia					1 174					1 386	1 418	1 421	1 410
Slovenia				1 246	1 305	1 316	1 340	1 350	1 346	1 332	1 355	1 358	1 344
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	1 396
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	1 520
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

Table A1.3 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
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 Republic				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	147.0
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	120.7
Italy	158.3	156.6	152.9	150	149.5	149.2	146.5	144.7	136.3	132.7	129.6	126.2	121.1
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	139.8
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	118.7
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	138.1
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	132.1
Slovakia					157.4	152	152.7	150.4	146.6	149.0	144.9	141.0	135.1
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	133.2
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

Table A1.4 New vans by Member State: registrations (in thousands), mass (kg) and average emissions (g CO_2/km)

	Registrations		Mass		Emissions	
	2012	2013	2012	2013	2012	2013
Austria	26	27	1 856	1 860	186.6	185.8
Belgium	53	51	1 842	1 861	185.8	182.8
Bulgaria	8	7	1 578	1 592	160.8	156.3
Cyprus	1	1	1 605	1 734	151.5	170.6
Czech Republic	10	10	1 827	1 835	196.0	189.1
Denmark	11	17	1 854	1 793	178.1	166.8
Estonia	2	3	1 821	1 831	184.4	182.0
Finland	10	10	1 922	1 910	193.5	182.0
France	227	300	1 804	1 601	170.2	152.8
Germany	195	199	2 034	1 911	195.5	192.9
Greece	2	3	1 634	1 624	170.3	161.3
Hungary	8	10	1 828	1 845	184.0	181.9
Ireland	6	10	1 762	1 785	175.6	177.2
Italy	106	92	1 713	1 707	168.2	163.5
Latvia	2	2	1 770	1 750	176.9	171.6
Lithuania	1	2	1 891	1 856	190.8	180.3
Luxembourg	3	3	1 902	1 857	188.3	179.2
Malta	0	0	1 507	1 518	147.5	150.5
Netherlands	47	49	1 777	1 774	177.5	173.4
Poland	30	34	1 778	1 796	179.6	176.4
Portugal	13	17	1 579	1 583	154.2	150.9
Romania	8	6	1 806	1 766	183.1	171.8
Slovakia	5	5	1 986	1 995	200.8	196.3
Slovenia	5	6	1 860	1 849	191.2	188.0
Spain	65	70	1 764	1 734	167.4	162.9
Sweden	21	20	1 724	1 760	165.8	167.1
United Kingdom	232	262	1 815	1 827	186.3	185.2

Annex 2

Table A2.1 Data used in calculating the CO_2 emission performance of car manufacturers in 2013

Manufacturer	Pools and derogations	Number of registrations	Average CO_2 (75 %) corrected	Specific emission target	Distance to target
Alpina Burkard Bovensiepen GmbH E Co KG	DMD	444	169.820		
Aston Martin Lagonda Ltd	D	1 579	313.688	318.000	– 4.312
Audi AG	P12	650 919	121.881	138.319	– 16.438
Audi Hungaria Motor KFT	P12	7 132	141.911	133.391	8.520
Automobiles Citroen		587 504	106.856	129.275	– 22.419
Automobiles Peugeot		723 633	105.652	128.934	– 23.282
Avtovaz JSC	D	1 295	215.429	201.000	14.429
Bentley Motors Ltd	P12	1 952	288.711	181.440	107.271
Bayerische Motoren Werke AG	P1	758 080	123.541	138.592	– 15.051
BMW M GmbH	P1	4 307	239.855	153.566	86.289
Bugatti Automobiles SAS	P12	11	539.000	161.670	377.330
Caterham Cars Limited	DMD	85	162.714		
Cecomp SPA		566	0.000	123.282	– 123.282
Chevrolet Italia SPA	P5	746	112.021	119.423	– 7.402
Chrysler Group LLC	P3	46 131	183.732	161.282	22.450
CNG-Technik GmbH	P4	85	19.235	137.855	– 118.620
Automobile Dacia SA	P8	289 149	119.365	122.143	– 2.778
Daihatsu Motor Co Ltd	P11	487	148.923	124.189	24.734
Daimler AG	P2	661 318	119.834	139.386	– 19.552
Donkevoort Automobielen BV	DMD	8	178.000		
Dr Motor Company SRL	DMD	424	125.075		
Ferrari SPA	D	2 049	304.561	303.000	1.561
Fiat Group Automobiles SPA	P3	646 554	110.620	119.633	– 9.013
Fisker Automotive Inc		90	47.650	181.778	– 134.128
Ford Motor Company	P4	2	194.000	164.526	29.474
Ford-Werke GmbH	P4	891 562	111.513	128.620	– 17.107
Fuji Heavy Industries Ltd	ND	26 962	151.086	164.616	– 13.530
General Motors Company	P5	2 301	82.392	149.866	– 67.474
GM Korea Company	P5	135 377	124.192	131.530	– 7.338
Great Wall Motor Company Limited	DMD	448	164.583		
Honda Automobile China Co Ltd	P6	14 183	124.104	119.617	4.487
Honda Motor Co Ltd	P6	61 983	122.335	130.626	– 8.291
Honda Turkiye AS	P6	1 743	154.271	126.797	27.474
Honda of the UK Manufacturing Ltd	P6	53 052	134.040	137.886	– 3.846

Table A2.1 Data used in calculating the CO_2 emission performance of car manufacturers in 2013 (cont.)

Manufacturer	Pools and derogations	Number of registrations	Average CO_2 (75 %) corrected	Specific emission target	Distance to target
Hyundai Motor Company		44 551	134.693	143.242	– 8.549
Hyundai Motor Manufacturing Czech SRO		220 348	130.549	132.489	– 1.940
Hyundai Motor India Ltd		72 184	108.201	114.154	– 5.953
Hyundai Assan Otomotiv Sanayi VE		62 241	110.201	117.953	– 7.752
Jaguar Land Rover Limited	P10/ND	131 530	164.623	178.025	– 13.402
Jiangling Motor Holding Co Ltd	DMD	23	140.000		
Kia Motors Corporation		285 334	117.620	127.633	– 10.013
Kia Motors Slovakia SRO		53 230	131.814	132.382	– 0.568
KTM-Sportmotorcycle AG	DMD	31	187.652		
Lada Automobile GmbH	DMD	386	225.000		
Lada France	P8	13	179.000	129.452	49.548
Automobili Lamborghini SPA	P12	404	340.558	144.718	195.840
Lotus Cars Limited	D	491	197.899	280.000	– 82.101
Magyar Suzuki Corporation Ltd	P9/ND	98 295	118.793	123.114	– 4.321
Mahindra & Mahindra Ltd	DMD	231	181.017		
Maruti Suzuki India Ltd	P9/ND	26 564	98.182	123.114	– 24.932
Maserati SPA	P3	1 356	266.367	158.264	108.103
Mazda Motor Corporation	ND	133 180	126.281	129.426	– 3.145
McLaren Automotive Limited	D	185	275.920	285.000	– 9.080
Mercedes-AMG GmbH	P2	1 930	177.115	147.147	29.968
MG Motor UK Limited	D	488	147.645	151.600	– 3.955
Mia Electric SAS		257	0.000	108.278	– 108.278
Mitsubishi Motors Corporation MMC	P7	54 367	89.125	140.783	– 51.658
Mitsubishi Motors Europe BV MME	P7	6 648	118.295	121.228	– 2.933
Mitsubishi Motors Thailand Co Ltd MMTH	P7	9 816	93.898	110.407	– 16.509
Morgan Motor Co Ltd	DMD	426	168.746		
Nissan International SA		411 671	115.711	131.240	– 15.529
Adam Opel AG	P5	804 072	122.121	133.249	– 11.128
Perodua Manufacturing SDN BHD	DMD	200	137.000		
Dr Ing HCF Porsche AG	P12	41 854	190.087	150.634	39.453
Perusahaan Otomobil Nasional SDN BHD	D	3	157.000	181.000	– 24.000
Qoros Automotive Co Ltd	DMD	12	146.000		
Quattro GmbH	P12	4 282	234.695	153.137	81.558
Radical Motosport Ltd	DMD	4	229.000		
Renault SAS	P8	793 038	96.384	124.965	– 28.581
Renault Trucks	DMD	18	193.000		
Rolls-Royce Motor Cars Ltd	P1	420	324.203	181.767	142.436
Seat SA	P12	280 310	111.316	123.574	– 12.258
Secma SAS	DMD	39	131.000		
Skoda Auto AS	P12	480 729	115.924	125.226	– 9.302
Ssangyong Motor Company	D	4 937	171.485	180.000	– 8.515
Suzuki Motor Corporation	P9/ND	21 742	158.668	123.114	35.554
Tata Motors Limited	P10/ND	883	130.428	178.025	– 47.597

Table A2.1 Data used in calculating the CO_2 emission performance of car manufacturers in 2013 (cont.)

Manufacturer	Pools and derogations	Number of registrations	Average CO_2 (75 %) corrected	Specific emission target	Distance to target
Tazzari GL SPA	DMD	2	0.000		
Tesla Motors Ltd		1 671	0.000	166.426	– 166.426
Toyota Motor Europe NV SA	P11	512 761	102.194	127.386	– 25.192
Vehicules Electriques Pininfarina-Bollore SAS		72	0.000	123.282	– 123.282
Volkswagen AG	P12	1 486 188	115.735	130.442	– 14.707
Volvo Car Corporation		203 065	107.012	145.012	– 38.000
Wiesmann GmbH	DMD	37	281.815		

Note: The number of registrations represents the number of vehicles having both a mass and an emission value. The parameters used in calculating manufacturer performance for 2013 are set out in Table 1.1.

The Commission's Implementing Decision confirming the 2013 CO_2 emissions assigns some manufacturers an uncertainty adjustment for 2013 data, which modifies the distance to their targets. Here the uncertainty is not reported. A detailed description of the uncertainty calculation is presented with the Commission Implementing Decision.

'D' indicates that a derogation for small-volume manufacturers has been granted in accordance with the Commission Implementing Decision.

'DMD' means that a de minimis derogation applies, i.e. a manufacturer which together with all its connected undertakings was responsible for fewer than 1 000 new registered vehicles in 2013 does not have to meet a specific emissions target.

'ND' indicates that a derogation for niche manufacturers has been granted in accordance with Commission Implementing Decision.

'P' indicates that the manufacturer is member of a pool in accordance with Article 7 of Regulation (EC) No 443/2009.

Table A2.2 Data used in calculating the CO_2 emission performance of light commercial vehicle manufacturers in 2013

Manufacturer	Pools and Derogations	Number of registrations	Average CO_2 (70 %) corrected	Specific emission target	Distance to target
Alke SRL		3	0	176.767	– 176.767
Audi AG		956	126.447	167.776	– 41.329
Automobiles Citroen		130 216	132.088	165.747	– 33.659
Automobiles Peugeot		129 301	131.8	166.577	– 34.777
Avtovaz JSC		188	213.061	137.118	75.943
Bayerische Motoren Werke AG		1 400	107.298	142.422	– 35.124
BMW M GmbH		250	133.771	179.006	– 45.235
Chrysler Group LLC		975	203.633	210.29	– 6.657
Automobile Dacia SA		17 056	118.698	134.724	– 16.026
Daimler AG		113 930	190.454	209.487	– 19.033
Dongfeng Motor Corporation		660	157.693	123.311	34.382
Dr Motor Company SRL	DMD	2	163		
Fiat Group Automobiles SPA		113 326	141.438	170.671	– 29.233
Ford Motor Company of Australia Limited	P1	8 306	213.047	218.129	– 5.082
Ford Motor Company	P1	231	209.82	216.776	– 6.956
Ford-Werke GmbH	P1	139 486	174.866	189.16	– 14.294
Fuji Heavy Industries Ltd	DMD	12	151.25		
Mitsubishi Fuso Truck & Bus Corporation		509	243.728	218.545	25.183
GM Korea Company		190	132.797	167.21	– 34.413
GONOW Auto Co Ltd	D	81	201.536	156.933	44.603
Great Wall Motor Company Limited	D	377	253.163	190.421	62.742
Hebei Zhongxing Automobile Co Ltd	DMD	37	228.88		
Honda of the UK Manufacturing Ltd		148	150.981	173.488	– 22.507
Hyundai Motor Company		1 116	194.493	209.191	– 14.698
Hyundai Assan Otomotiv Sanayi VE		56	99	126.944	– 27.944
Hyundai Motor Manufacturing Czech SRO		438	119.085	144.904	– 25.819
Hyundai Motor India Ltd		13	106.222	120.695	– 14.473
Isuzu Motors Limited		9 591	194.209	208.343	– 14.134
Iveco SPA		22 853	215.23	235.846	– 20.616
Jaguar Land Rover Limited	D	11 351	268.105	204.771	63.334
Kia Motors Corporation		618	105.928	133.172	– 27.244
Kia Motors Slovakia SRO		195	120.11	149.191	– 29.081
Lada Automobile GmbH		24	225	134.817	90.183
Lada France		17	179	140.634	38.366
Magyar Suzuki Corporation Ltd	DMD	48	117.485		
Mahindra & Mahindra Ltd	DMD	137	214.484		
Maruti Suzuki India Ltd	DMD	4	99		
Mazda Motor Corporation	DMD	393	156.295		
Mia Electric SAS		67	0	99.972	– 99.972
Mitsubishi Motors Corporation MMC	P2/D	7 682	201.514	192.934	8.58
Mitsubishi Motors Europe BV MME	P2/D	329	228.039	208.761	19.278
Mitsubishi Motors Thailand Co Ltd MMTH	P2/D	3 332	202.931	201.498	1.433
Nissan International SA		37 487	170.623	190.191	– 19.568

Table A2.2 Data used in calculating the CO_2 emission performance of light commercial vehicle manufacturers in 2013 (cont.)

Manufacturer	Pools and Derogations	Number of registrations	Average CO_2 (70 %) corrected	Specific emission target	Distance to target
Adam Opel AG		67 369	164.033	176.676	– 12.643
Piaggio & C SPA	D	2 304	110.431	116.932	– 6.501
Dr Ing HCF Porsche AG		69	202.625	220.133	– 17.508
Quattro GmbH		5	236.667	186.16	50.507
Renault SAS		184 708	114.165	165.846	– 51.681
Renault Trucks		3 845	211.847	220.438	– 8.591
Seat SA		1 132	99.999	128.148	– 28.149
Skoda Auto AS		4 591	122.491	133.043	– 10.552
Ssangyong Motor Company	D	753	199.178	209.424	– 10.246
Suzuki Motor Corporation	DMD	250	161.137		
Tata Motors Limited		260	192.176	202.295	– 10.119
Toyota Motor Europe NV SA		24 281	179.208	194.259	– 15.051
Toyota Caetano Portugal SA	DMD	455	256.849		
Volkswagen AG		163 306	164.829	186.358	– 21.529
Volvo Car Corporation		848	161.089	204.01	– 42.921

Note: The number of registrations represents the number of vehicles having both a mass and an emission value. The parameters used in calculating manufacturer performance for 2013 are set out in Table 1.1.

The Commission's Implementing Decision confirming the 2013 CO_2 emissions assigns some manufacturers an uncertainty adjustment for 2013 data, which modifies the distance to their targets. Here the uncertainty is not reported. A detailed description of the uncertainty calculation is presented with the Commission Implementing Decision.

'D' indicates that a derogation for small-volume manufacturers has been granted in accordance with the Commission Implementing Decision.

'DMD' means that a de minimis derogation applies, i.e. a manufacturer which together with all its connected undertakings was responsible for fewer than 1000 new registered vehicles in 2013 does not have to meet a specific emissions target.

'ND' indicates that a derogation for niche manufacturers has been granted in accordance with Commission Implementing Decision.

'P' indicates that the manufacturer is member of a pool in accordance with Article 7 of Regulation (EC) No 510/2011.

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