

Indicator factsheet

TERM 2003 34 EEA 31 — Proportion of the vehicle fleet meeting certain emission standards (by mode)

Estimates based on the number of cars fitted with a catalytic converter suggest that it takes at least 10 years for a new technology to penetrate the entire car fleet in the EU. Based on the limited data available it seems that this penetration rate is even lower in the acceding and candidate countries. The proportion of trucks and aircraft that comply with the latest and most stringent emission standards is lower than that for cars because of the longer lifetimes of trucks and aircraft.



Figure 2: Estimated share of conventional, open loop, Euro I, Euro II and Euro III passenger cars, trucks, buses and coaches and two-wheelers in the EU in 1990 and 2002



Results and assessment

Policy relevance

With the aim of lowering the environmental and health impact from motorised transport, the EU has developed fuel quality (see TERM 2003 31 EEA - Uptake of cleaner and alternative fuels) and vehicle emission standards. However, no target exists specifying or determining the fraction of the vehicle fleet that should meet these standards.

Policy context

Pollutant emissions

EU legislation on pollutant emissions from new motor vehicles has been in force since 1970 and relates to carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxides (NOx) for petrolfuelled vehicles. Particulate matter (PM) is also included for diesel-fuelled vehicles.

Standards requiring the use of catalytic converters on petrol cars first came into force in 1993 with Euro I (Directive 91/441/EEC (1)) and were replaced by Directive 94/12/EC (2) introducing the Euro II standards in 1997. Emission limits for light commercial vehicles, being subject to less stringent standards than passenger cars, were aligned with these more stringent limit values by Directive 93/59/EEC (3) and Directive 96/69/EC (4). Directive 98/69/EC (5) recently introduced Euro III standards for passenger cars (in 2001) and light commercial vehicles (in 2002). By means of the same directive, future Euro IV standards (which will come into force in 2006 for passenger cars and 2007 for light commercial vehicles) have already been agreed upon.

For heavy duty vehicles, the first standards came into force in 1990 with Euro 0 (Directive 88/77/EEC (6)), which was replaced by Euro I and Euro II in 1993 and 1996, respectively (Directive 91/542/EEC (⁷)). More stringent emission standards, Euro III, IV and V for 2001, 2006 and 2009 have recently been adopted by Directive 1999/96/EC (8). The so-called 'heavy duty directive' envisages the adoption of further measures to take effect from 2005-06 including

OJ L 242, 30.8.1991, pp. 1-106.

OJ L 100, 19.4.1994, pp. 42–52. OJ L 186, 28.7.1993, pp. 21-23.

^{(&}lt;sup>1</sup>) (²) (³) (⁴) (⁵) (⁶) (⁷) (⁸) OJ L 282, 1.11.1996, pp. 64-67.

OJ L 350, 28.12.1998, pp. 1–57.

OJ L 36, 9.2.1988, pp. 33-61.

OJ L 295, 25.10.1991, pp. 1-19.

OJ L 44, 16.2.2000, pp. 1–155.

provisions relating to the development of on-board diagnostic (OBD) and on-board measurement (OBM) systems to monitor in-service exhaust emissions, durability requirements and in-service control, and limits for non-regulated pollutants that may become important as a result of the widespread introduction of new alternative fuels.

Current emission limits for motorcycles and mopeds are defined in Directive 2002/51/EC (°), amending 97/24/EC (1°). The directive and its amendment determine a set of emission limits (both for two-stroke and four-stroke motorcycles) for CO, HC and NO_x to be applied to motorcycles from 2003 onwards. A further tightening of the emission limits is foreseen in the directive for 2006. The introduction of 'in-use' checks to prevent high emissions caused by bikers 'tinkering' with engines is also foreseen.

Emissions from ocean going ships are currently not regulated in the EU. The Commission (European Commission, 2001) has issued a discussion paper titled 'A Community strategy on air pollution from seagoing ships', intended to explain the development of a European strategy on air pollution from seagoing ships. The principal pollutants covered by the strategy will be sulphur oxides (SO_x), nitrogen oxides (NO_x) and volatile organic compounds (VOC). The strategy will also consider particulates and greenhouse gases. Because of the global nature of shipping, the Commission is keen to promote an early ratification of Annex VI on air pollution of the International Maritime Organisation's Marpol Convention. However, the standards set in this annex are not very stringent, and it is not clear when it will enter into force.

Standards limiting the emissions of smoke, HC, CO and NO_x from turbojet and turbofan aircraft engines are contained in Annex 16, Volume II to the Convention on International Civil Aviation. The annex also contains approved test and measurement procedures. With respect to subsonic applications, the provisions of the standards for smoke apply to engines whose date of manufacture is on or after 1 January 1983. For the gaseous emissions, the standards apply only to engines whose rated output is greater than 26.7 kN. For HC and CO, they apply to engines whose date of manufacture is on or after 1 January 1986. For NO_x , the standards have three levels of stringency depending on the date of manufacture of the engine.

The Committee on Aviation Environmental Protection (CAEP) recommended increasing the stringency of the current NO_x standard by 12 %, something which is likely to be endorsed at the 35th International Civil Aviation Organisation (ICAO) assembly later this year.

Noise

Noise emission standards (setting maximum permissible sound levels at the exhaust system of motor vehicles) were first described in Council Directive 70/157/EEC (¹¹) and adapted by more recent directives to technical progress (Directive 92/97/EEC (¹²)).

Aeroplanes are classified according to ICAO noise norms (chapters). Chapter 2 is the standard on noise applicable to jet-powered aircraft designed before October 1997. Chapter 1 aeroplanes have been forbidden in Europe since 1988, Chapter 2 aircraft have been phased out until April 2002 (European Council, 1999). For aircraft designed after 1997, Chapter 3 standards must be followed. In June 2001, the ICAO Council adopted a new Chapter 4 noise certification standard with an increase in stringency of 10 db in comparison with the current Chapter 3 standard. The Chapter 4 standard will be obligatorily applicable to new aeroplane types submitted for certification after 1 January 2006 and voluntarily to aeroplanes originally certificated to the Chapter 3 requirements for which an application for certification is submitted.

Directive 2002/30/EC (¹³) on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports has been recently adopted. The main objective of the directive is to facilitate the introduction of operating restrictions in a consistent manner in order to reduce the number of people affected by the harmful effects of noise. It also aims at promoting the development of airport capacity in harmony with the environment and at facilitating the achievement of specific noise abatement objectives at the level of individual airports.

^{(&}lt;sup>9</sup>) OJ L 252, 20.9.2002, pp. 20–32.

^{(&}lt;sup>10</sup>) OJ L 226, 18.8.1997, pp. 1–454.

^{(&}lt;sup>11</sup>) OJ L 42, 23.2.1970, pp. 16–20.

OJ L 371, 19.12.1992, pp. 1–31.
 OJ L 89, 28.3.2002, pp. 40–46.

Environmental context

Poor air quality affects human health, ecosystems, crops and buildings. Transport contributes significantly to the impairment of air quality through pollutant emissions (see TERM 2003 03 EEA31 — Transport emissions of air pollutants). Setting more stringent emission standards and switching to more environment-friendly fuels (see TERM 2003 31 EEA31 — Uptake of cleaner and alternative fuels) contribute to improving air quality. Due to data limitations, the share of passenger cars fitted with a catalytic converter is used as an indication of the environmental performance of the passenger car fleet (the most important mode of passenger transport).

Noise emissions affect human health as well as ecosystems (see TERM 2002 05 EU — Exposure to and annoyance by traffic noise). Setting more stringent noise emission standards for vehicles and aircraft eventually leads to less noise exposure and annoyance. Due to data limitations, only noise emissions from aircraft are discussed.

Assessment

A factor that has limited the benefits of new technologies is the slow market penetration of these technologies; the average age of passenger cars in the EU has increased (see TERM 2003 33 EEA — Average age of the vehicle fleet). This development can be partly explained by the fact that new cars are bought, but old cars are kept. Indeed, the number of cars per household has increased (see TERM 2003 32 EEA — Size and composition of the vehicle fleet), confirming that new technologies need a long time to penetrate fully. Moreover, new models may be of better quality and therefore have a longer lifetime than less recent vehicles.

One proxy indicator that can be used to show the rate of penetration of new technologies is the share of passenger cars fitted with catalytic converters. For passenger cars, it has taken more than 10 years to reach a 72 % penetration of this new technology.

In 2001, 72 % of petrol-driven cars in the EU had catalytic converters, with wide variations between Member States. The lowest shares were in Portugal (32 %) and Spain (42 %); the highest were in Luxembourg, the Netherlands and Austria (all above 90 %). The penetration of vehicles equipped with a catalytic converter in the acceding and candidate countries was limited compared with the corresponding EU-15 situation in 1996 — the only year for which such data are available. In 1996, the share of passenger cars fitted with a catalytic converter in the acceding countries was between 6.4 and 32.8 %, while in the EU these figures reached 19 to 73 %. The lowest share was observed in Romania (close to 0 %) and the highest in Slovenia (32.8 %). No data were available for Estonia, Latvia, Lithuania and Bulgaria. The average share of vehicles fitted with a catalytic converter in these countries is estimated to be approximately 15.3 % and is found to be significantly lower than the corresponding 1996 EU-15 figure (46 %). However, the lack of time-series hampers a full assessment of the evolution over time of the number of cars fitted with a catalytic converter and thus of the rate of penetration of new technologies.

For heavy-duty and light-duty trucks, the situation is even worse. The average life of a truck is longer than that of a passenger car. It can therefore be expected that the share of trucks complying with the highest emission standards and the corresponding rate of penetration of new technologies is relatively low. In 1995, for example, 70 % of diesel-driven cars, but only 23 % of heavy-duty trucks, complied with Euro I (EEA, 2000).

In view of the stringer emission standards coming into force in 2006, a number of car manufacturers have developed diesel models equipped with diesel particulate filters (DPF). All DPF-equipped car models will meet Euro IV emission standards. However, widespread use of DPF systems in the coming years will require voluntary action by the car makers, as the Euro IV limits can be met (at least in small and medium-sized cars) without the use of filters.

In 1998, Chapter 3 aeroplanes made up over 90 % of the EU fleet, Chapter 2 about 8 %, Chapter 1 only 0.1 % (two aircraft) and supersonic aircraft (Concorde) 0.5 % (see Figure 3). Most of the aeroplane fleet thus complies with the most stringent EU noise standards. The phase out of Chapter 2 aircraft will further improve the average noise performance of the fleet.



NB: Chapter 1 (aircraft types certified before 1970) is not included in the graph as only two aircraft were operating in the EU in 1998. Chapter 2 aircraft refers to types certified between 1970 and 1978. Chapter 3 aircraft refers to types certified after 1978. Supersonic aircraft (Concorde) are not included in the graph since only 13 aircraft were operating in the EU in 1998.

Source: European Commission, 1999.

References

EEA, 2000, Are we moving in the right direction? Indicators on transport and environment integration in the EU — TERM 2000, European Environment Agency, Copenhagen, Denmark, February 2000 (http://reports.eea.eu.int/ENVISSUENo12/en/term2000.pdf).

European Commission, 1999, *Air transport and the environment* — *Towards meeting the challenges of sustainable development*, COM(1999) 640 final, communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions, European Commission, Brussels, Belgium, December 1999 (http://europa.eu.int/eur-lex/en/com/cnc/1999/com1999_0640en01.pdf).

European Commission, 2001, discussion paper, 'A Community strategy on air pollution from seagoing ships', Directorate-General for Environment, European Commission, Brussels, Belgium, January 2001

(http://europa.eu.int/comm/environment/air/pdf/0101discussionpaper.pdf).

European Council, 1999, Council Regulation (EC) No 925/1999 of 29 April 1999 on the registration and operation within the Community of certain types of civil subsonic jet aeroplanes which have been modified and recertificated as meeting the standards of Volume I, Part II, Chapter 3 of Annex 16 to the Convention on International Civil Aviation, third edition (July 1993), OJ L 115, 15 May 1999, pp. 1–4, Office for Official Publications of the European Communities, Luxembourg

(http://europa.eu.int/comm/transport/themes/air/english/library/council-regulation-9251999.pdf).

Eurostat, 2003, Eurostat NewCronos 2003 CD-ROM — Theme 8 (Environment and energy).

REC, 1998, Sofia initiative on local air quality — Phase-out of leaded gasoline — Synthesis report, Regional Environmental Centre for central and eastern Europe (REC), Szentendre, Slovakia, May 1998 (http://www.rec.org/REC/Publications/LeadOut/Lead.pdf).

UNECE, 2001, Annual bulletin of transport statistics for Europe and North America, United Nations Economic Commission for Europe, data received by e-mail, July 2001.

Data

Unit: %												
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	3.3	7.1	11.0	20.2	29.2	37.1	45.3	53.1	61.3	69.4	76.8	83.0
Denmark	2.0	7.0	12.0	17.0	25.0	31.0	38.0	46.0	52.0	58.0	64.0	70.5
Germany	37.6	45.3	51.9	57.3	62.6	67.7	72.4	76.8	81.7	84.9	87.4	89.0
Greece	8.7	18.5	29.2	35.2	38.9	42.7	46.3	49.9	53.5	58.0	62.2	66.2
Spain	4.0	5.4	6.9	10.5	14.8	18.3	22.0	25.9	30.0	34.3	38.5	42.0
France	2.6	5.4	8.3	15.2	22.7	30.1	37.8	43.3	49.1	55.4	61.3	67.1
Ireland	5.1	13.9	20.9	26.9	33.7	40.3	48.0	55.7	63.1	72.4	83.6	88.6
Italy	3.2	5.9	8.7	14.9	20.7	26.9	33.0	41.2	48.2	55.2	61.9	68.2
Luxembourg	5.4	12.2	17.1	29.7	41.0	52.2	61.6	69.9	78.1	85.8	91.9	96.1
Netherlands	31.7	39.7	47.5	55.7	61.7	67.6	72.8	77.7	82.3	86.4	89.8	92.3
Austria	23.8	31.5	39.0	45.2	50.8	56.6	62.3	68.7	75.0	80.9	86.7	90.8
Portugal	1.4	3.0	4.7	9.0	12.7	15.8	19.0	22.0	24.9	27.6	30.0	31.9
Finland	2.1	4.8	7.3	11.8	16.8	22.5	29.1	36.6	44.1	52.1	59.7	66.1
Sweden	26.4	31.1	35.3	39.0	42.7	46.0	51.0	55.9	61.2	66.8	66.8	66.8
United Kingdor	n 2.6	4.7	6.7	13.4	20.1	27.0	33.0	39.3	45.7	51.1	56.8	63.3
EU-15	12.7	17.0	20.9	28.3	34.5	40.4	46.1	51.9	57.5	62.5	67.3	71.6

Table 1: Estimated share of petrol-engined cars fitted with a catalytic converter in the EU

Source: Eurostat, 2003.

Table 2:	Share of	petrol vehicle	s fitted with	a catalytic	converter in	1996, b	y country
----------	----------	----------------	---------------	-------------	--------------	---------	-----------

%		
	Share	
	0.2	
	6.4	
olic	11.5	
	11.6	
	14.4	
	32.8	
	15.3	
	46.1	
	% .lic	% Share 0.2 6.4 dic 11.5 11.6 14.4 32.8 15.3 46.1

Source: REC, 1998; Eurostat, 2003; UNECE, 2001.

Table 3: Number of commercial aircraft by noise certification operated in the EU

Unit:	units Chapter 1 (< 1970)	Chapter 2 (1970–78)	Chapter 3 (> 1978)	Supersonic
1990	1	690	1 093	14
1991		632	1 336	14
1992		551	1 515	14
1993		457	1 613	14
1994		397	1 723	14
1995		358	1 883	13
1996	2	299	2 022	13

1997	2	260	2 195	13
1998	2	224	2 448	13

Source: European Commission, 1999.

	Tier	Year	со	нс	HC+NOx	NOx	PM		
		EU emiss	sion standar	ds for pass	senger cars, g/l	km			
Diesel									
М	Euro 1†	1.1.1993	2.72	-	0.97	-	0.14		
		4 4 4 9 9 7	(3.16)		(1.13)		(0.18)		
	Euro 2, IDI	1.1.1997	1	-	0.7	-	0.08		
	Euro 2, DI a	1.1.1997	1	-	0.9	-	0.1		
	Euro 3	1.1.2001	0.64	-	0.56	0.5	0.05		
	Euro 4	1.1.2006	0.5	-	0.3	0.25	0.025		
Petrol (gasoli	ine)								
М	Euro 1†	1.1.1993	2.72	-	0.97	-	-		
	Euro 2	1 1 1007	(3.10)	_	(1.13)	_	_		
	Euro 3	1.1.1777	2.2	0.2	0.5	0 15	_		
	Euro A	1.1.2001	1	0.2	_	0.15	_		
	Lui 0 4	1.1.2000	1	0.1	-	0.00	-		
Discol	EU emiss	ion standards	s for light co	mmercial	vehicles, g/km				
Diesei	Euro 1	1 1 1002	0.70		0.07		0.14		
NT, Class I	Euro I	1.1.1993	2.72	-	0.97	-	0.14		
< 1 305 kg	Euro 2	1.1.1997	1	-	0.6	-	0.1		
	Euro 3	1.1.2002	0.64	-	0.56	0.5	0.05		
	Euro 4	1.1.2007	0.5	-	0.3	0.25	0.025		
N1, Class II	Euro 1	1.1.1993	5.17	-	1.4	-	0.19		
1 305–1 760 ka	Euro 2	1.1.1997	1.2	-	1.1	-	0.15		
Ng	Euro 3	1.1.2002	0.8	-	0.72	0.65	0.07		
	Euro 4	1.1.2007	0.63	-	0.39	0.33	0.04		
N1, Class III	Euro 1	1.1.1993	6.9	-	1.7	-	0.25		
> 1 760 kg	Euro 2	1.1.1997	1.35	-	1.3	-	0.2		
	Euro 3	1.1.2002	0.95	-	0.86	0.78	0.1		
	Euro 4	1.1.2007	0.74	-	0.46	0.39	0.06		
Petrol (Gasol	ine)								
N1, Class I	Euro 1	1.1.1993	2.72	-	0.97	-	-		
<1305 kg	Euro 2	1.1.1997	2.2	-	0.5	-	-		
	Euro 3	1.1.2002	2.3	0.2	-	0.15	-		
	Euro 4	1.1.2007	1	0.1	-	0.08	-		
N1, Class II	Euro 1	1.1.1993	5.17	-	1.4	-	-		
1 305–1 760	Euro 2	1.1.1997	4	-	0.65	-	-		
kg	F 0	4 4 9 9 9 9	7	0.05		0.40			
	Euro 3	1.1.2002	4.17	0.25	-	0.18	-		
	Euro 4	1.1.2007	1.81	0.13	-	0.1	-		
NT, Class III	Euro 1	1.1.1993	6.9	-	1.7	-	-		
> 1 /60 kg	Euro 2	1.1.1997	5	-	0.8	-	-		
	Euro 3	1.1.2002	5.22	0.29	-	0.21	-		
	Euro 4	1.1.2007	2.27	0.16	-	0.11	-		
† Values in brack	ets are conformit	y of production	(COP) limits						
a - until 30 Sep	tember 1999 (afte	er that date DI	engines must	t meet the II	DI limits).				

Table 4: Summary of vehicle emission standards

Spreadsheet file: TERM 2003 34 EEA - Emission standards.xls

* For Euro 1 and 2 the weight classes were Class I < 1 250 kg, Class II 1 250–1 700 kg, Class III > 1 700 kg.

Metadata

Technical information

- 1. Data source: Eurostat, 2003; Regional Environmental Centre for central and eastern Europe (REC, 1998).
- 2. Description of data: Estimated share of petrol-engined cars fitted with a catalytic converter based on the estimated age distribution of the vehicle fleet.
- Geographical coverage: EEA-20 (Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Austria, Portugal, Finland, Sweden and the United Kingdom, Czech Republic, Hungary, Poland, Slovakia, Romania). No data were available for Iceland, Liechtenstein, Norway, Bulgaria, Estonia, Latvia, Lithuania and Slovenia.
- 4. Temporal coverage: 1990–2001 (for EU-15), 1996 (for Czech Republic, Hungary, Poland, Slovakia, Romania).
- 5. Methodology and frequency of data collection: The estimates of cars fitted with a catalytic converter are based on vehicle stocks at 31 December for all EU-15 countries. For this reason, these estimates may differ slightly from published figures for countries, which use a different reference date. The limited data obtained for the acceding and candidate countries so far (complete lack of time-series) imply that a methodology for data collection does not exist.
- 6. Methodology of data manipulation, including making 'early estimates': None.

Quality information

- 7. Strength and weakness (at data level): The number of cars fitted with a catalytic converter is estimated based on models rather than measured according to registration of cars.
- 8. Reliability, accuracy, robustness, uncertainty (at data level): Data on EU-15 can be considered to be reliable since they are official data reported to and provided by Eurostat. For the acceding and candidate countries it is ambiguous, although data were derived from a reliable data source.
- 9. Overall scoring (give 1 to 3 points: 1 = no major problems, 3 = major reservations): 3

Relevancy: 3 (Catalytic converters are just one aspect of emission standards for vehicles (and cover only petrol-engined cars for road vehicles)).

Accuracy: 3 (Data are estimated rather than based on vehicle registration data. Differences in percentages due to variation in calculation methods are reported (Denmark)).

Comparability over time: 2 (Estimations allow for analysis of trends, but it should be borne in mind that the data are estimated, not based on vehicle registrations).

Comparability over space: 2 (Estimating the share of cars with a catalytic converter instead of calculating it based on registration data also limits comparability over space).

Further work required

Ideally, this indicator contains an overview of the entire vehicle fleet (all modes) and the (noise and pollutant) emission standards they comply with. In particular, the increasing share of diesel in passenger cars requires the monitoring of technology penetration in this type of car as well.

In questionnaires submitted to the EEA, certain acceding countries (the Czech Republic, Latvia, Lithuania, Hungary) indicated that data exist on the share of cars fitted with a catalytic converter. However, these data are not regularly reported to any international organisation (e.g. UNECE, ECMT). Streamlining data exchange seems therefore necessary.

A homogeneously defined deregistration procedure as well as information concerning the registration of in-use vehicles would be needed in order to know more precisely the actual share of the fleet complying with given emission standards in different countries.