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**COMMISSION STAFF WORKING PAPER**

**Monitoring of ACEA's Commitment on CO<sub>2</sub> Emission  
Reductions from Passenger Cars  
(2003)**

**Monitoring of JAMA's Commitment on CO<sub>2</sub> Emission  
Reductions from Passenger Cars  
(2003)**

**Monitoring of KAMA's Commitment on CO<sub>2</sub> Emission  
Reductions from Passenger Cars  
(2003)**

**Final reports  
5 October 2004**

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**Monitoring of ACEA's Commitment on CO<sub>2</sub> Emission  
Reductions from Passenger Cars  
(2003)**

*Final Report*  
*05.10.2004*

**Joint Report  
of the  
European Automobile Manufacturers Association  
and  
the Commission Services**

**Monitoring of ACEA Commitment<sup>1</sup> on CO<sub>2</sub> Emission Reductions from Passenger Cars**  
**JOINT REPORT OF ACEA AND THE COMMISSION SERVICES<sup>2</sup>: YEAR 2003 REPORT**  
**ES SUMMARY OF PROGRESS IN DELIVERING THE COMMITMENT**

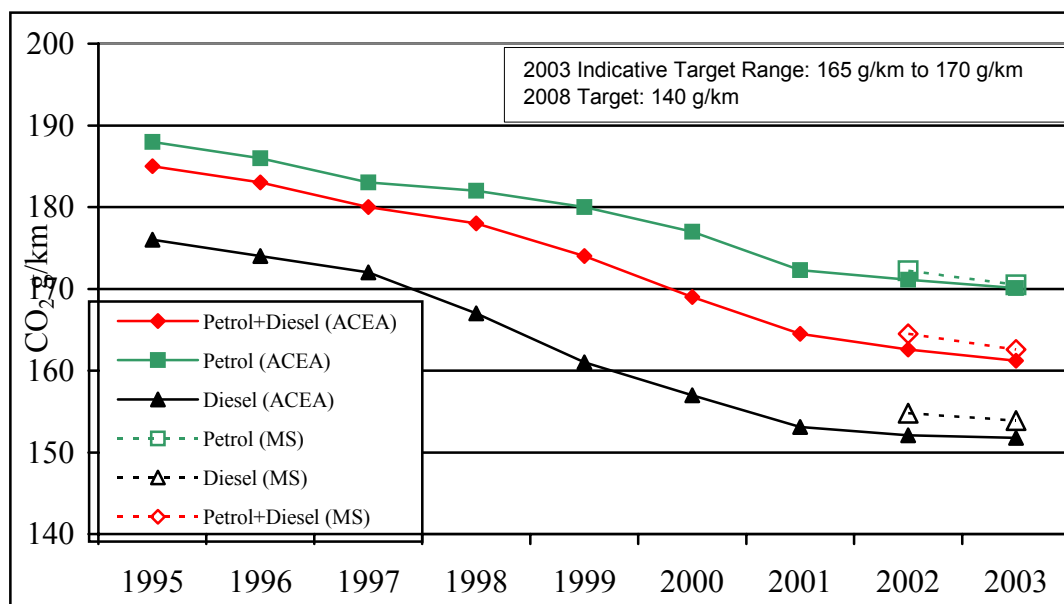
**E1 Trends in specific emissions of CO<sub>2</sub> (g/km)**

In 2003 - using official EU data<sup>3</sup> - the average specific emissions of ACEA's new car fleet registered in the EU was 163 g CO<sub>2</sub>/km. For petrol-fuelled cars, specific emissions were 171 g CO<sub>2</sub>/km; for diesel-fuelled cars, the corresponding value was 154 g/km and for alternative fuelled<sup>4</sup> passenger cars the value was 162 g CO<sub>2</sub>/km.

Compared to official EU 2002 data, ACEA reduced the average specific CO<sub>2</sub> emissions of its new car fleet (petrol + diesel) registered within the EU by 2 g/km; a reduction of 1.2%<sup>5</sup>. According to ACEA's data, its average new car CO<sub>2</sub> emissions in 2003 were 161g CO<sub>2</sub>/km (petrol + diesel); there was therefore less than a 0.9% deviation between overall official & ACEA (petrol + diesel) figures in 2003.

Official EU data only became available in 2002. There are underlying differences between this new data source, and the prior source, supplied by ACEA (see Section 2.10). It is therefore not correct to simply adjoin official data for the most recent years, onto ACEA's historical data (from 1995). For this and other reasons, ACEA data is still also used for monitoring purposes, particularly where longer-term trends (say between 1995 and 2003) are needed.

Since 1995, ACEA has maintained an unbroken trend of CO<sub>2</sub> emission reduction (see Figure 1).



**Figure 1: EU Trends of ACEA members' fleet in average specific emissions of CO<sub>2</sub>.**

Using ACEA's time-series between 1995 and 2003, ACEA achieved an overall reduction in new car CO<sub>2</sub> emissions of 12.9 %; petrol cars were down by 9.5 %, and diesel cars were down by 13.8 %. The

<sup>1</sup> As recognized by the European Commission in the Recommendation of 5 February 1999 on the reduction of CO<sub>2</sub> emissions from passenger cars (1999/125/EC). Hereafter referred to as "The Commitment".

<sup>2</sup> Hereafter often referred to as "The Commission".

<sup>3</sup> According to the Joint Monitoring System prior 1995-2001 monitoring was based on data provided by ACEA which are broadly similar to those specified in Annex I of Decision 1753/2000/EC. In 2002, for the first time, official EU data was used in the joint monitoring report -- based on data delivered by Member States under Decision 1753/2000/EC. In the 2003 report ACEA data continues to be used in certain places, where official EU data is not available/inappropriate (such as where consistent longer-term trends are needed to contribute to a better understanding of CO<sub>2</sub> reduction developments).

<sup>4</sup> These are all vehicles not using diesel or petrol, e.g. LPG, CNG or electric power.

<sup>5</sup> All percentage figures are based on unrounded numbers.

two data points for 2002 and 2003 based on Member States data (MS) are coherent with ACEA's trend data but differ somewhat in the absolute values.

## E2 Trends in specific fuel consumption by fuel type (litres/100km)

Fuel consumption in terms of litres per 100 km (l/100km) has followed a similar downward profile to that of CO<sub>2</sub> emissions. Over the 1995 to 2003 period, using ACEA's time-series data, average fuel consumption fell for new petrol and diesel cars combined from 7.6 l/100km to 6.5 l/100km<sup>6</sup> (EU official 2003 data: 6.5l/100km). The corresponding consumption reductions for new petrol cars and new diesel cars were decreases from 7.9 l/100km to 7.2 l/100km (EU official 2003 data: 7.2l/100km) and from 6.6 l/100km to 5.7 l/100km (EU official 2003 data: 5.8l/100km), respectively (see Figure 2).

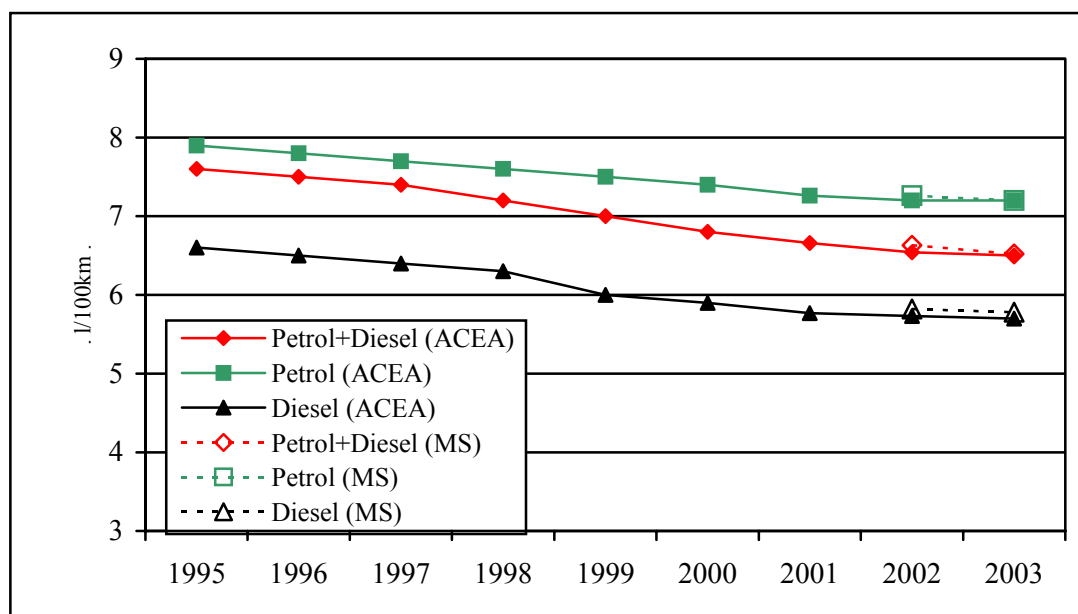


Figure 2: Trends of ACEA members' fleet in average specific fuel consumption (l/100km) by fuel

## E3 Trends in physical fleet characteristics

Since 1995, ACEA has achieved these sizeable improvements in new car CO<sub>2</sub> performance whilst overall increases in physical fleet characteristics have occurred. However, although EU official figures for average engine capacity and power increased in 2003, compared to 2002 – disaggregating the capacity figures shows that both petrol & diesel engine capacities decreased in 2003. Further, based on ACEA's time-series data, some car characteristics were also down in 2003 on much earlier periods; for example, petrol car mass (down on 1999) and diesel engine capacity (down on 1996).

## E4 Technical developments introduced to reduce CO<sub>2</sub> emissions

New technological developments introduced by ACEA manufacturers in 2003 included: dual clutch transmission; 7-speed fuel-economy optimised automatic transmissions; common-rail injection system with 1600 bar; unit injector of 2050 bar; new electro-hydraulic power assisted steering system; and new energy control management systems. In addition to these new developments, 2003 saw the increased application or continued improvement of vehicle technologies introduced in prior years.

ACEA's technological developments, along with the launch of new product ranges, models and variants, have brought to market cars with attractive product attributes that have shifted the EU new car market towards enhanced fuel efficiency and reduced CO<sub>2</sub> emissions. In total CO<sub>2</sub> reductions in the ACEA new car fleet of some 13% were achieved over the 1995-2003 period.

## E5 Brief overall assessment on progress in relation to the target

In 2003, ACEA again reduced the average CO<sub>2</sub> emissions of its new car fleet. Taking the official EU data, the average specific emissions of ACEA's new car fleet registered in the EU was 163 g CO<sub>2</sub>/km.

<sup>6</sup> The following conversion factors were used for the calculation of specific fuel consumption (l/100km) from specific CO<sub>2</sub> emissions (g/km): petrol 23.7, diesel 26.6.

This means that ACEA achieved the 2003 estimated intermediate target range of 165 -170 g/km specified in its Commitment. ACEA had already met the first of its CO<sub>2</sub> commitments ("some members of ACEA will introduce in the EU market, not later than 2000, models emitting 120 g CO<sub>2</sub>/km or less"). In fact, 2003 saw new registrations of cars emitting 120 g CO<sub>2</sub>/km or less once again rise sharply (even though car registrations in total fell by over 3 %<sup>7</sup>). The volume and share of cars emitting 140 g CO<sub>2</sub>/km or less also rose in 2003.

Using ACEA's 1995-2003 data set, CO<sub>2</sub> emissions have been cut from 185 g CO<sub>2</sub>/km in 1995 to 161 g CO<sub>2</sub>/km in 2003; therefore last year ACEA moved well past the half-way point to attaining the 140g/km-level. To reach 140g CO<sub>2</sub>/km in 2008, ACEA must achieve an annual average reduction rate of between 2.6% and 2.8% a year during the remaining period of the Commitment. In compliance with the provision of the Commitment to carry out a "Major Review" based on 2003 data and Article 10 of Decision 1753/2000/EC, issues related to the means actually used to achieve the identified reductions are discussed in Annex II. The results of these investigations should be taken into account when interpreting the data and statements of this report.

The 2003 monitoring report shows that ACEA is fully in line with its 2008 commitment. However, ACEA stresses that the 2008 target remains extremely ambitious, both technically and economically.

The Commission Services acknowledge that ACEA has met, or is even ahead of, all its targets set out in its Commitment on CO<sub>2</sub> emissions from passenger cars. They also acknowledge that ACEA has reconfirmed their firm determination to make the best possible efforts to live up to their CO<sub>2</sub> commitment, but take note of the fact that ACEA no longer wishes to confirm the concluding statement made in earlier reports.

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<sup>7</sup> Based on ACEA data.

# 1 MONITORING OF TECHNOLOGICAL DEVELOPMENTS AFFECTING THE COMMITMENT

<b>1.1 Commitment initiatives</b>
1.1.1 Brief description of current R&D programmes
1.1.2 Other

The ACEA Commitment continues to ensure that right across the European automotive industry, CO<sub>2</sub> reduction remains a high priority in R&D expenditures, as well as in product and process planning and development. The vast majority of this R&D effort is being undertaken independently, by each of the ACEA manufacturers freely pursuing their own policies and initiatives in this highly competitive area. It is not possible, for competitive reasons, to review individual manufacturer R&D programmes as part of the monitoring report.

In addition, however, ACEA and its sister body EUCAR are undertaking a collaborative, pre-competitive automotive R&D programme on medium and long-term technologies for CO<sub>2</sub> reduction (as detailed in previous Joint Monitoring Reports). The programme reflects the research interests of the participating companies, and serves to illustrate key areas of R&D activity. It seeks to use "Framework Programme" (FP) funding to launch collaborative projects between manufacturers, suppliers, research institutes and universities.

Section 4.5 provides a summary of EUCAR's research activities in 2003.

<b>1.2 Technological developments</b>
1.2.1. Description of fuel efficiency characteristics of new technologies, alternative concepts
1.2.2. Availability of new technologies in the EU
1.2.3. Availability of alternative concepts passenger cars in the EU
1.2.4. Availability of low emission passenger cars (e.g. emitting 120 g CO <sub>2</sub> /km or less) in the EU

New technological developments introduced by one or more ACEA manufacturers in 2003 included:

- Dual clutch transmission;
- 7-speed fuel-economy optimised automatic transmissions;
- Common-rail injection system with 1600 bar;
- Unit injector of 2050 bar;
- New energy control management systems, including load levelling to reduce idle speed.
- New electro-hydraulic power assisted steering system.

New technologies tend to be implemented progressively, reflecting factors such as the need to link-into new model launches, and the need to phase-in range deployment. Also through R&D efforts, improvements to certain existing technologies are made. Therefore in addition to the above-mentioned new developments, 2003 saw the increased application or continued improvement of vehicle technologies introduced in prior years. In this regard, ACEA would draw specific attention to:

- Further improvement/application of gasoline & diesel engine technologies (e.g. increased offering of turbocharged and GDI engines);
- Further reduction of driving resistances (e.g. lower rolling resistance tyres) & friction losses (e.g. low viscosity oil, plasma-coating of cylinder walls);
- Greater utilisation of lightweight materials (e.g. aluminium front structure assembly, door panels & hoods; new low-weight/alloy engines);
- Further evolution of intelligent engine management systems;
- Expansion in usage of: fully variable valvetrain, 6-speed automatic & manual transmissions, auto shift manuals, & electric power steering;
- Continued technical development of alternative-fuelled vehicle (AFV) technologies (CNG/LPG/bioethanol/biogas/biodiesel/electric); 2003 saw ACEA sales of AFVs more than double.

ACEA's technological developments, along with the launch of new product ranges, models & variants, have brought to market cars with attractive product attributes that have shifted the EU new car market towards enhanced fuel efficiency and reduced CO<sub>2</sub> emissions.

In 2003, based on ACEA data, ACEA first registrations of (petrol + diesel) cars with CO<sub>2</sub> levels of 140 g/km or less, rose to 25.9% of total registrations -- up from a 23.7 % share in 2002 and a 2.6 % share in 1995. Further, ACEA continued to build on its Year 2000 achievement of the first of its CO<sub>2</sub> commitments: "some members of ACEA will introduce in the EU market models emitting 120 g CO<sub>2</sub>/km or less". 2003 saw first registrations of cars emitting 120 g CO<sub>2</sub>/km or less rise by 43.8% on the prior year; first registrations of such cars totalled almost 840,000 units, and they achieved an impressive 7.4 % share of new registrations, compared to only 0.7 % as recently as 1999.

In total, CO<sub>2</sub> reductions in the ACEA new car fleet of some 13% were achieved over the 1995-2003 period.

**1.3 Description of market trends in physical fleet characteristics**

See Sections E3 and 2.4

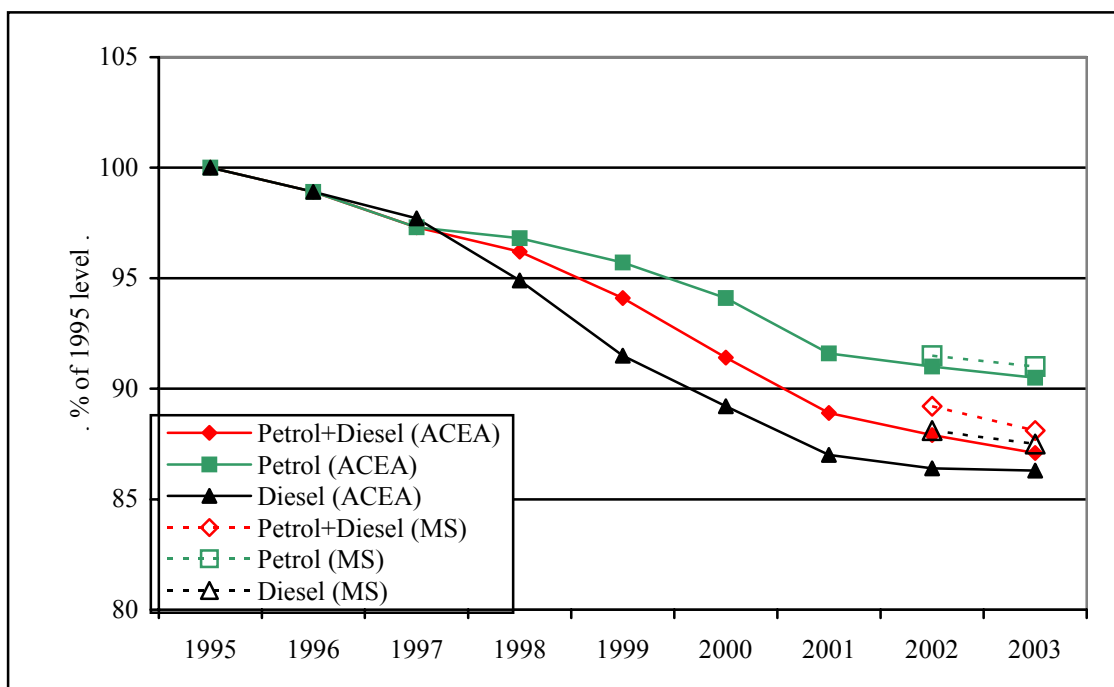
**2. STATISTICAL MONITORING (1995-2002)**

**2.1 Trends in specific emissions of CO<sub>2</sub> (g/km)**

In 2003, taking the official EU data, the average specific emissions of ACEA's new car fleet registered in the EU was 163 g CO<sub>2</sub>/km.

Compared to official EU 2002 data, ACEA reduced the average specific CO<sub>2</sub> emissions of its new car fleet (petrol + diesel) registered within the EU by 2 g CO<sub>2</sub>/km; a reduction of 1.2 %. According to ACEA's data, its average new car CO<sub>2</sub> emissions in 2003 were 161g CO<sub>2</sub>/km (petrol + diesel); there was therefore less than a 0.9 % deviation between overall official & ACEA petrol + diesel figures in 2003.

Since 1995, ACEA has maintained an unbroken trend of CO<sub>2</sub> emission reduction. Using ACEA's historical time-series, between 1995 and 2003, ACEA achieved an overall reduction in new car CO<sub>2</sub> emissions of 12.9 %; petrol cars were down by 9.5 %, and diesel cars were down by 13.8 % (see Figure 3).



**Figure 3: ACEA's CO<sub>2</sub> Reduction Index (1995=100)**

**2.2 Number of newly registered passenger cars**

Based on ACEA data, in 2003, ACEA new car registrations in the EU amounted to 11,664,587 units, down over 3% on the previous year and since 2001 there has been a fall of more than 7%<sup>8</sup> (see Figure 4). ACEA's market share of total EU passenger cars was cut to 84% (including Rover) in 2003. Over the period 1995-2003 new registrations increased by 13.9%.

<sup>8</sup> All figures given in this chapter are based on ACEA data.

Petrol car registrations totalled 5,887,342 units in 2003, a 9.2% decrease on the previous year. The number of diesel cars registered totalled 5,512,880 in 2003, a 5% increase on 2002. The number of cars equipped with other fuel types (AFVs) more than doubled in 2003 (see Section 2.5).

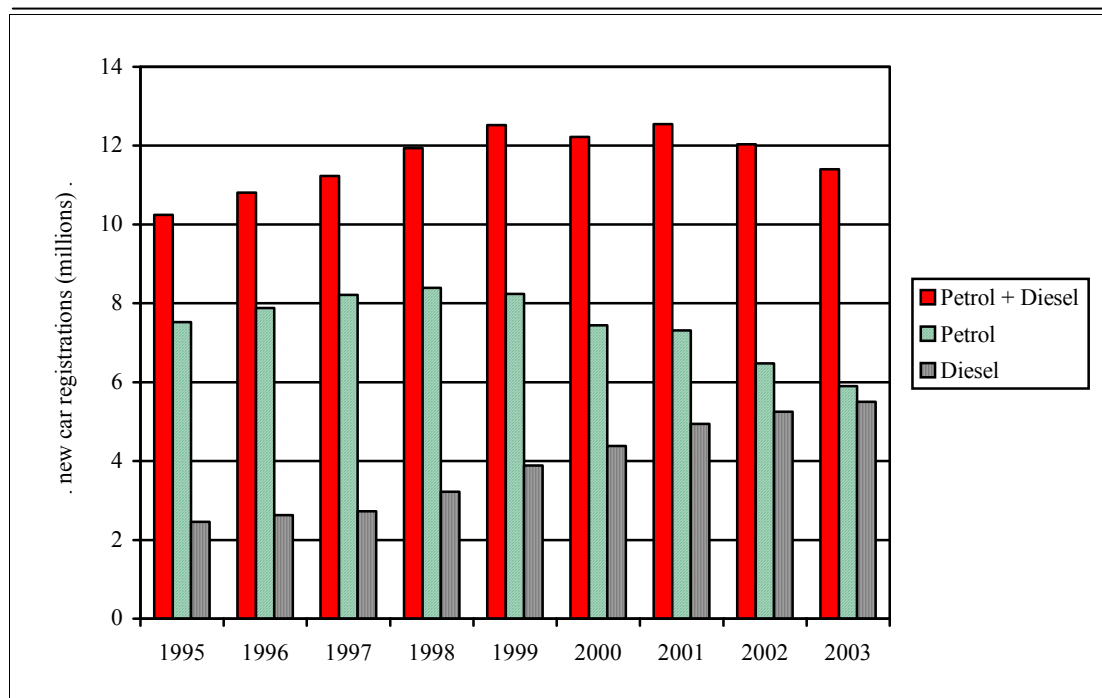


Figure 4: New Car Registrations by ACEA (million units)

### 2.3 Fleet composition

Figure 5 shows ACEA's fleet composition by CO<sub>2</sub> categories for the year 2003, and the reference year 1995 (using ACEA data).

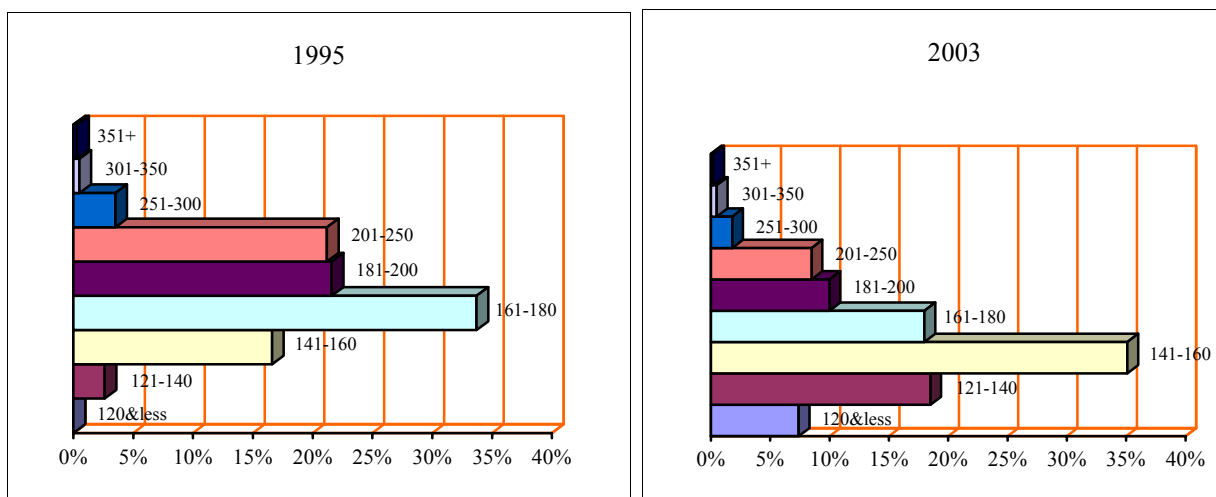
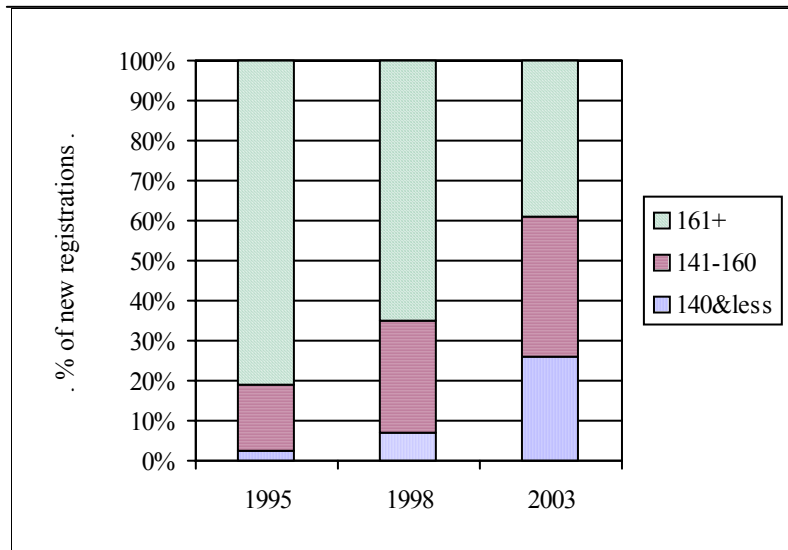


Figure 5: ACEA's Fleet Composition by CO<sub>2</sub> Categories (% share of total registrations) in 1995 and 2003

In 2003, ACEA's CO<sub>2</sub>-related fleet composition continued to show a strong move towards more fuel-efficient cars, with 140 g CO<sub>2</sub>/km or below cars achieving a 25.9 % share of total (petrol + diesel) registrations in 2003 -- up from 6.8 % in 1998, and only 2.6 % in 1995 (see Figure 6). Over the 1995 to 2003 period new registrations of such cars has been multiplied more than 10-fold. By contrast, in 2003, there were continuing,

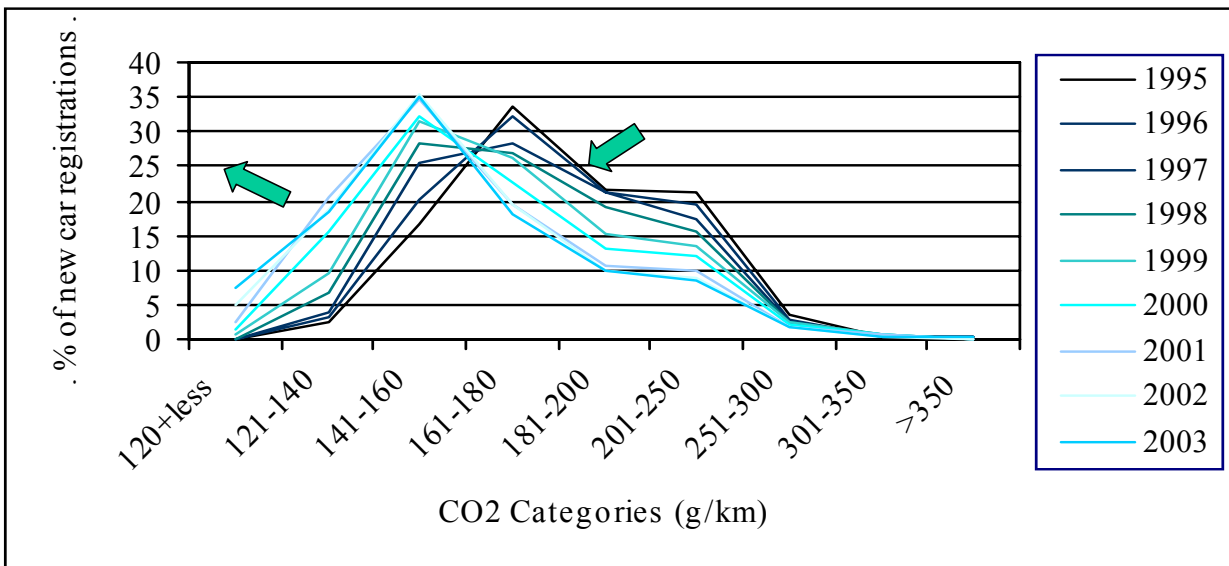


sizeable falls in both the registrations and market share of cars with CO<sub>2</sub> emissions of more than 160 g CO<sub>2</sub>/km. Registrations of these cars fell by over 7 % in 2003 on the prior year, and by almost 45 % compared to 1995; as a proportion of total ACEA registrations, such cars decreased from 80.8 % in 1995, to 64.9 % in 1998 to reach 39 % in 2003.



**Figure 6: Change in ACEA's Fleet Composition by "aggregated CO<sub>2</sub> Categories"**

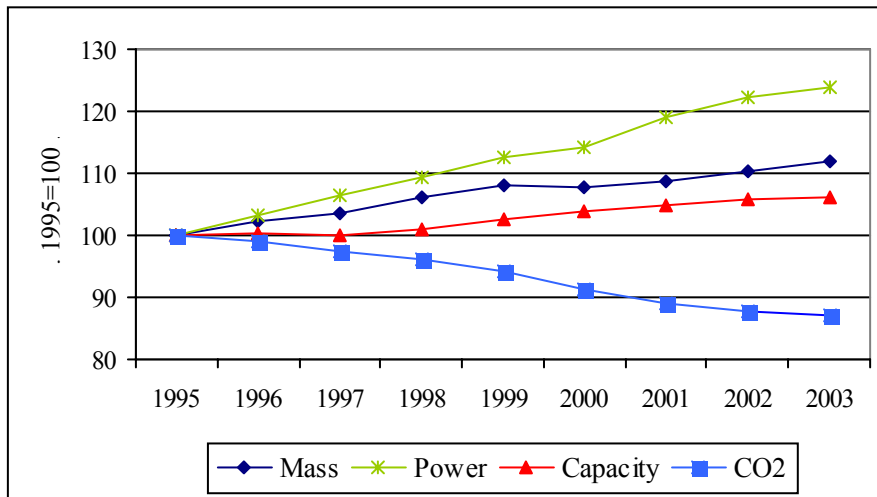
Figure 7 shows how ACEA shares of registrations have developed by CO<sub>2</sub> category over the 1995-2003 period. As can be seen, ACEA achieved a clearly identifiable "wave-effect" towards enhanced new car fuel efficiency.



**Figure 7: ACEA's "wave-effect" of CO<sub>2</sub> categories towards enhanced fuel efficiency (g/km)**

**2.4 EU trends in physical fleet characteristics**

Trends in physical characteristics of ACEA's new car fleet are shown in Figure 8 below (see also E3).



**Figures 8: Physical ACEA Fleet Characteristics (1995=100)**

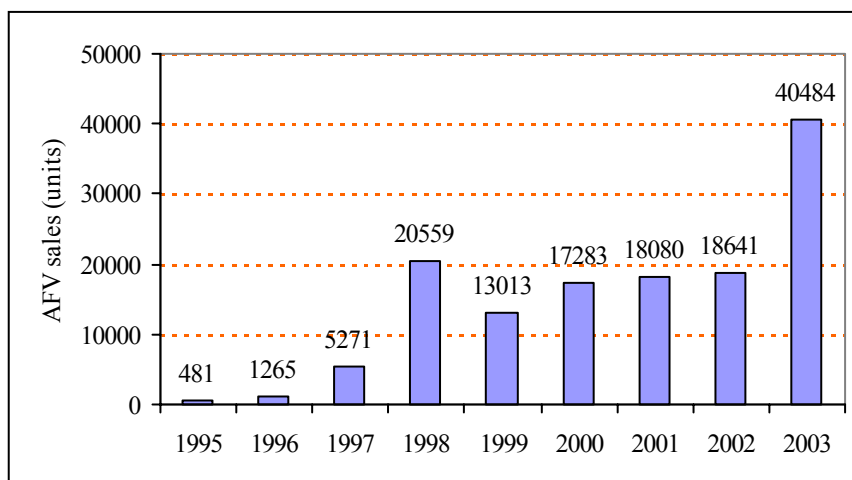
Using ACEA time-series data, average car mass (petrol + diesel) rose in 2003, and since 1995 a 12.2 % increase in mass has occurred. For petrol cars, mass in 2003 was below the 1999 level. In 2003, diesel car mass maintained its recent upward trend.

In 2003, both petrol & diesel engine capacities were down on the prior year, however the combined figure showed a small rise. Petrol capacity in 2003 was only 1.6 % up on 1995, and the diesel figure in 2003 was virtually the same as in 1995. Over the 1995 to 2003 period the combined figure has only shown a growth of 6 %. Engine power (petrol + diesel) rose in 2003, and since 1995, quite a strong increase has occurred, driven particularly by increased diesel power.

Through its technical developments (such as those set-out in Section 1.2), ACEA has achieved sizeable improvements in new car CO<sub>2</sub> performance whilst increases in other physical fleet characteristics have occurred.

## 2.5 Trends in new technologies in the EU

As noted in Sections 1.2, in 2003 ACEA manufacturers introduced, improved or increased the application of a wide range of technical developments to reduce CO<sub>2</sub> emissions. Within these reduction efforts, ACEA manufacturers continued their on-going technical development of alternative-fuelled vehicle (AFV) technologies (CNG/LPG/bioethanol/biogas/electric); and 2003 saw ACEA sales of AFVs more than double. See Figure 9 for AFV sales developments since 1995, based on ACEA data. It should be mentioned that the official registrations of AFV are lower than the sales reported by ACEA. ACEA manufacturers offer a wide range of AFV products, and consider a much higher volume could have been sold if the fuels infrastructure had existed.



**Figure 9: ACEA sales of Alternative-Fuelled Vehicles (units)**

## 2.6 Trends in low emission passenger cars in the EU

In 2003 ACEA built further on its Year 2000 achievement of the first of its CO<sub>2</sub> commitments ("some members of ACEA will introduce in the EU market models emitting 120 g CO<sub>2</sub>/km or less"). Using ACEA data, in 2003 ACEA first registrations of 120 g CO<sub>2</sub>/km or less cars rose by over 43 % on the prior year (even though car registrations in total dropped by over 3 %). Back in 2000, ACEA manufacturers achieved this commitment, by bringing to market more than 20 models that achieved 120 g CO<sub>2</sub>/km or less - with registrations of almost 160 000 units. In 2003, first registrations of cars emitting 120 g CO<sub>2</sub>/km or less reach almost 840000 units (see Figure 10 for longer-term profile), and achieved a 7.4 % share of total new registrations.

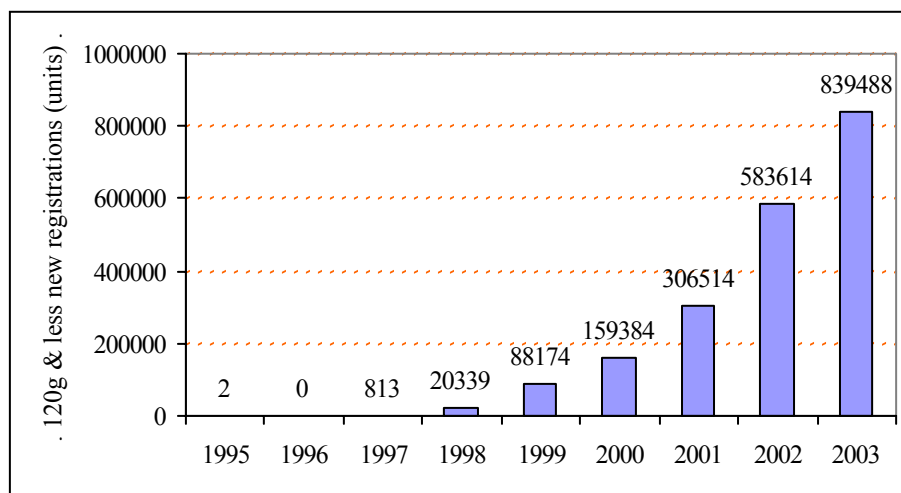


Figure 10: ACEA Registrations of Cars with CO<sub>2</sub> emissions of 120 g CO<sub>2</sub>/km or less

## 2.7 Trends in alternative concepts passenger cars in the EU

Nothing new to report.

## 2.8 Trends in innovative concepts passenger cars in the EU

Nothing new to report.

## 2.9 Brief description of the degree of occurrence of grey areas between M1 and N1 vehicles

Nothing to report (see Section 2.10).

## 2.10 Data sources, data methods and data confidence levels

The 2003 Joint CO<sub>2</sub> Monitoring Report utilises data from the official EU scheme (1753/2000/EC), that is based on Member State submissions (see Annexes). This is the second year that data, submitted by Member States (slightly processed by the Commission<sup>9</sup>), has been the official basis for the monitoring process. Prior to 2002, ACEA purchased data from the French-based association AAA (Association Auxiliaire de l'Automobile), so as to enable the annual monitoring exercises to be undertaken.

ACEA is closely monitoring data quality of this newly available EU data source. In 2003, the variance between EU & ACEA data in terms of the overall average CO<sub>2</sub> figure (petrol + diesel) was less than 0.9 %; although differences in some details exist, over the long-term data differences should narrow further. With official EU data becoming available (for 2002 & 2003), a discontinuity from the past data series (for 1995 to 2001) exists. Actual and underlying methodological differences exist between EU data and ACEA's data (see Section 2.10 in the 2002 Monitoring Report). As a result, it is not correct to simply adjoin official data for the most recent year, onto ACEA's historical CO<sub>2</sub> time-series built-up from 1995. The EU data does not provide a means to undertake longer-term "trend" evaluations of key CO<sub>2</sub> developments that can contribute

<sup>9</sup> The cycle change correction of 0.7 % has been applied, and potentially erroneous allocations of vehicles to CO<sub>2</sub> classes, involving a few hundred vehicles, have been suppressed.

to a better understanding of CO<sub>2</sub> reduction developments, and consequently this Joint Report uses ACEA's consistent historical time-series data from 1995 through to 2003 for such evaluations. ACEA data is also used where EU official data either is not available in the format required or is not appropriate to use.

The differences in ACEA's and Member States' data sets identified in 2002 were subject to in-depth investigations carried out in the beginning of 2004. The results are as follows:

**Total registrations:** The official EU data comprise 0.9 % less identified registrations than the ACEA data (last year 3 %). The biggest differences in the number of identified vehicles occur for Belgium (6.4 % more identified registrations in AAA database) and Denmark (8.2 % less identified registrations in AAA database).

AAA states that the rate of unidentified vehicles in the ACEA database is 2.5 % as average for EU15. Without Greece, ACEA's average 2003 EU14 rate of unidentified vehicles (all manufacturers) is 0.67 %. Similar data are not available for EU15 from Member States because some Member States did not deliver the number of total new registrations (identified + unidentified)<sup>10</sup>. Because of the relatively small difference in the total number of identified registrations (0.9 %) it can be expected that the identification rate in the Member States data is not much lower.

**Methodology Differences:** In a detailed analysis of the data from those Member States, where significant differences in the CO<sub>2</sub> values were observed systematic sources for those differences were investigated. As a result it can be stated that ACEA data are based partly (proven for 27 % of the total number of identified registrations in EU15) on more aggregated data than the Member States data. If there are different CO<sub>2</sub> values for the vehicles in one aggregated cluster the lower values are used in ACEA's data for the calculation of the average CO<sub>2</sub> value (see exemplary table below).

	Cylinder capacity (ccm)	Engine power (kWh)	Weight (kg)	No of identified reg.	CO <sub>2</sub> emissions (g/km)
<b>Data Provider</b>	1910	81	1310	47	157
		85	1310	61	157
	2387	99	1410	2	179
		103	1370	23	179
		110	1370	24	176
<b>Total/ Average</b>				<b>157</b>	<b>163</b>
<b>Competent Authority</b>	1910	81	1310	3	157
			1350	44	162
		85	1310	12	157
			1350	49	162
	2387	98	1370	1	179
			1410	1	182
		103	1370	4	179
			1410	19	182
		110	1370	3	176
			1410	19	179
1596	110	1410	1	194	
<b>Total/ Average</b>				<b>157</b>	<b>167</b>

**Table 1: Comparison of data providers' and competent authorities' data sets (example of one vehicle model in one Member State; [Data source: AAA, Austrian Lebensministerium])**

<sup>10</sup> Further explanation and training might be necessary for some Member States in order to change this situation.

More detailed data would enable a more differentiated calculation for AAA. However, beside potentially higher costs availability of those data might be restricted.

Some improvement with regard to the identification rate and the combination of registration data and corresponding CO<sub>2</sub> values will be achieved when the CO<sub>2</sub> values become part of the registration document.

<b>2.11 Description of measurement issues for CO<sub>2</sub> emission factors</b>
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Nothing new to report.

<b>2.12 Other issues</b>
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Nothing new to report.

### **3 KEY ASSUMPTIONS TO THE COMMITMENT**

<b>3.1 Availability of enabling fuels</b>
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Statement on implication for the Commitment and justification
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Nothing new to report.

<b>3.2 Distortion of competition</b>
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Statement on implication for the Commitment and justification
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Nothing new to report.

<b>3.3 Promotion of CO<sub>2</sub> efficient technologies</b>
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Statement on implication for the Commitment and justification
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Nothing new to report.

<b>3.4 Acceptance of innovation</b>
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Statement on implication for the Commitment and justification
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Nothing new to report.

### **4 OTHER ISSUES**

<b>4.1 New measures affecting CO<sub>2</sub></b>
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Comment on impact of the issue and on implication for the Commitment
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Nothing new to report.

<b>4.2 New regulatory measures</b>
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Comment on impact of the issue and on implication for the Commitment
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Nothing new to report.

<b>4.3 Fiscal measures</b>
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Comment on impact of the issue and on implication for the Commitment
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Nothing new to report.

<b>4.4 Breakthrough technologies</b>
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Comment on impact of the issue and on implication for the Commitment
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Nothing further to report (see Sections 1.1, 1.2 & 4.5).

#### 4.5 Research Programmes: Description and future potential

Comment on impact of the issue and implications for the Commitment

During 2003 the EU's FP6 research programme opened up for its first call for proposals. As reported earlier, EUCAR had stressed the importance of having within FP6 research for the reduction of car CO<sub>2</sub> emissions. In the work programmes of FP6 this type of research has been acknowledged through the inclusion of topics on renewable fuels, more efficient combustion engines, hybrid – electric vehicles, fuel cell technologies and powertrains, designs and materials for low weight vehicles, etc.

The EUCAR members and their partners have invested a great deal of effort in order to develop project proposals suitable for the various calls of FP6. During 2003 about 15 proposals on Integrated Projects were developed within the EUCAR organisation and submitted to FP6. Of these 12 were accepted, 1 put on the reserve list and 2 rejected. In the development phase, these proposals were organised into three Programmes: Fuels and Powertrain; Materials, Processes & Manufacturing and Integrated Safety. Of these, the first two cover CO<sub>2</sub> reduction related research.

In the Fuels and Powertrain Programme the following projects were accepted during 2003:

**RENEW:** Producing fuels from biomasses

**NICE:** New Integrated Combustion System for Future Passenger Car Engines

**HyICE:** Internal Combustion Engine fuelled by hydrogen

**StorHy:** Storage system for hydrogen

**HyTRAN:** Fuel Cell based propulsion system and Auxiliary Power Unit

**HyWays:** Infrastructure issues for the hydrogen fuelled road transport system

In the Materials, Processes & Manufacturing Programme a proposal is under preparation for low weight vehicle body in white to be submitted in 2004.

The proposals submitted to the FP6 programme of course start from state-of-art and make use of the progress reached in earlier research projects. Here the powertrain network PREMTECH, initiated in FP5 by the Commission, continues - in FP6 - to play an important role to achieve co-ordination and dissemination.

#### 4.6. Other measures - telematics, infrastructure, education

Comment on impact of the issue and on implication for the Commitment

Nothing new to report.

#### 4.7. Economic situation of the car industry

Comment on impact of the issue and on implication for the Commitment

ACEA stresses that the performance of the automotive industry and its capability to invest in and sell technological innovations is highly dependent on a strong and healthy macro-economy. This also facilitates the market take-up of advanced, and typically more expensive, technologies. ACEA believes that, since 2001, the European economic environment has been particularly weak, and 2003 was the third consecutive year of subdued GDP growth. The economy's performance was also poor across a wide-range of key indicators including: unemployment; capital investment; capacity utilisation; and consumer and business confidence. In ACEA's views Europe generally continued to face wide-ranging structural problems, such as persistent labour market rigidities, a regulatory framework that weighs-down on competitiveness, inappropriate social security systems, innovation and higher education deficiencies, etc.

ACEA underlined that in this environment, ACEA new car registrations in the EU have fallen by more than 7 % since 2001. Falling demand has been accompanied - in ACEA's view - by a continued decline in real car prices, a mounting regulatory burden and global competitiveness concerns for ACEA manufacturers. A particular ACEA concern has been that competitors with more profitable home markets have been able to selectively penetrate the European market – and ACEA's market share has declined (to some 84 % in 2003, compared to 87 % in 2001).

The overall result has been a further weakening in the financial position of Europe's manufacturers, whose operating margins have thinned, and European margins are now much lower than those in other major manufacturing regions of the world. It is these margins that underpin the European industry's investments in research, new product & process technological developments -- which are needed both to undertake environmental projects and strengthen global competitiveness.

The Commission agrees that the general economic growth has been depressed in the period mentioned above. The Commission would also agree that economic uncertainty may influence consumer behaviour as well as total consumer demand. Coupled with over capacity and ever increasing competition among the manufacturers it can give the sector concerns.

Although these conditions are likely to have effects on the margins in the sector it is also noted that, in the same period, some manufacturers have actually increased sales and enjoyed quite favourable profits. Manufacturers from third regions have increased their market shares in Europe.

## **5 CONCLUSIONS**

### **5.1. Progress statement on delivering the Commitment**

Since 1995, ACEA has maintained an unbroken trend of CO<sub>2</sub> emission reduction. In 2003 - taking the official EU data - the average specific emissions of ACEA's new car fleet registered in the EU was 163 g CO<sub>2</sub>/km. This means that ACEA more than achieved the 2003 estimated intermediate target range of 165 - 170 g CO<sub>2</sub>/km specified in its Commitment, and ACEA has already met the first of its CO<sub>2</sub> commitments ("some members of ACEA will introduce in the EU market, not later than 2000, models emitting 120 g CO<sub>2</sub>/km or less"). In fact, 2003 saw registrations of cars emitting 120 g CO<sub>2</sub>/km or less again rise sharply (even though car registrations in total fell). The volume & share of cars emitting 140 g CO<sub>2</sub>/km or less also rose in 2003. In compliance with the provision of the Commitment to carry out a "Major Review" based on 2003 data and Article 10 of Decision 1753/2000/EC, issues related to the means actually used to achieve the identified reductions are discussed in Annex II. The results of these investigations should be taken into account when interpreting the data and statements of this report.

### **5.2. Statement on expected future progress of the Commitment**

In 2003 ACEA moved well past the half-way point to attaining the 140g CO<sub>2</sub>/km-level. To reach 140 g CO<sub>2</sub>/km in 2008, ACEA must achieve an annual average reduction rate of between 2.6 % and 2.8 % a year during the remaining period of the Commitment.

The 2003 monitoring report shows that ACEA is fully in line with its 2008 commitment. However, ACEA stresses that the 2008 target remains extremely ambitious, both technically and economically.

The Commission Services acknowledge that ACEA has met, or is even ahead of, all its targets set out in its Commitment on CO<sub>2</sub> emissions from passenger cars. They also acknowledge that ACEA has reconfirmed their firm determination to make the best possible efforts to live up to their CO<sub>2</sub> commitment, but take note of the fact that ACEA no longer wishes to confirm the concluding statement made in earlier reports.

## **DATA ANNEXES (2003)**

*(Note: EU official data)*

- A1: SPECIFIC FUEL EFFICIENCY (l/100km) AND EMISSIONS OF CO<sub>2</sub> (g/km) AVERAGED OVER ALL NEWLY REGISTERED PASSENGER CARS FOR EACH DIFFERENT FUEL-TYPE, FOR THE EU AND EACH MEMBER STATE
- A2: THE DISTRIBUTION OF CO<sub>2</sub> EMISSIONS (g/km) IN THE NEW PASSENGER CAR FLEET FOR EACH DIFFERENT FUEL TYPE, FOR THE EU
- A3: THE DISTRIBUTION OF AVERAGED MASS, POWER AND ENGINE CAPACITY OF NEW PASSENGER CARS FOR EACH FUEL TYPE FOR THE EU-15 AND EACH MEMBER STATE

**ANNEX II: MAJOR REVIEW OF ACEA'S COMMITMENT ON CO<sub>2</sub> EMISSION REDUCTIONS FROM PASSENGER CARS, INCLUDING AN ASSESSMENT IN ACCORDANCE WITH ARTICLE 10 OF DECISION 1753/2000/EC: JOINT CONCLUSIONS OF THE EUROPEAN AUTOMOBILE MANUFACTURERS ASSOCIATION AND THE COMMISSION SERVICES**



**A1: SPECIFIC FUEL EFFICIENCY (l/100km) AND EMISSIONS OF CO<sub>2</sub> (g/km) AVERAGED OVER ALL NEWLY REGISTERED PASSENGER CARS<sup>11</sup> FOR EACH DIFFERENT FUEL-TYPE FOR THE EU AND EACH MEMBER STATE (CO<sub>2</sub> emissions are corrected by 0.7 %) ACEA MEMBERS - 2003**

	TOTAL	Identified version													Unknown version
		All Fuels		Petrol			Diesel			Petrol+Diesel			AFV		
		Number	average CO <sub>2</sub>	Number	average fuel	average CO <sub>2</sub>	Number	average fuel	average CO <sub>2</sub>	Number	average fuel	average CO <sub>2</sub>	Number	average CO <sub>2</sub>	
<b>EU</b>		<b>11,462,09</b>	<b>163</b>	<b>6,000,47</b>	<b>7.2</b>	<b>171</b>	<b>5,446,24</b>	<b>5.8</b>	<b>154</b>	<b>11,446,72</b>	<b>6.5</b>	<b>163</b>	<b>15,377</b>	<b>162</b>	
Å	239,295	239,010	160	58,344	7.2	170	180,637	5.9	156	238,981	6.2	160	29	150	285
B	396,319	395,975	155	111,842	7.0	165	284,133	5.7	152	395,975	6.1	155			344
DK	n.d.	73,274	168	53,325	7.5	178	19,949	5.3	141	73,274	6.9	168			n.d.
F	n.d.	1,805,095	152	575,046	6.8	162	1,228,23	5.5	147	1,803,279	5.9	152	1,816	139	n.d.
FIN	n.d.	96,054	178	79,105	7.7	181	16,949	6.1	163	96,054	7.4	178			n.d.
GER	2,804,358	2,735,993	174	1,575,10	7.6	179	1,158,09	6.3	167	2,733,202	7.0	174	2,791	144	68,365
GR	n.d.	126,866	169	124,934	7.1	169	1,932	5.7	153	126,866	7.1	169			n.d.
IRE	95,500	94,317	164	73,699	7.0	166	20,618	5.9	158	94,317	6.8	164			1.183
IT	1,894,186	1,893,234	150	931,608	6.4	151	954,994	5.6	149	1,886,602	6.0	150	6,639	171	952
LUX	n.d.	37,120	171	11,619	8.0	190	25,501	6.1	162	37,120	6.7	171			n.d.
NL	n.d.	374,461	172	274,957	7.4	176	99,504	6.0	160	374,461	7.1	172			n.d.
POR	n.d.	162,510	148	82,003	6.5	153	80,501	5.4	143	162,504	5.9	148	6	158	n.d.
SP	1,237,621	1,148,335	153	412,030	7.0	165	736,305	5.5	146	1,148,335	6.0	153			89,286
SW	207,274	207,075	198	188,732	8.4	200	17,390	7.0	185	206,122	8.3	199	953	189	199
UK	n.d.	2,072,778	170	1,448,12	7.4	175	621,501	6.0	160	2,069,628	7.0	170	3,150	166	n.d.

n.d. no data delivered

<sup>11</sup> Due to possible data implausibility the following vehicles from Member States data were not taken into account: 114 petrol fuelled vehicles with emissions below 100g/km, 45 diesel fuelled vehicles with emissions higher than 351g/km and 20 electric vehicles, which are obviously retrofitted vehicles

**A2: THE DISTRIBUTION OF CO<sub>2</sub> EMISSIONS<sup>12</sup> (g/km) IN THE NEW PASSENGER CAR FLEET<sup>13</sup> FOR EACH DIFFERENT FUEL TYPE**

ACEA MEMBERS - 2003

CO <sub>2</sub> - Category	All fuels		Petrol		Diesel		Petrol + Diesel		AFV	
	Number	Average CO <sub>2</sub>	Number	Average CO <sub>2</sub>	Number	Average CO <sub>2</sub>	Number	Average CO <sub>2</sub>	Number	Average CO <sub>2</sub>
<60	<b>92</b>	<b>0</b>							<b>92</b>	<b>0</b>
60-80										
81-100	<b>24,884</b>	<b>90</b>			<b>24,884</b>	<b>90</b>	<b>24,884</b>	<b>90</b>		
101-120	<b>762,737</b>	<b>115</b>	<b>66,647</b>	<b>116</b>	<b>695,347</b>	<b>115</b>	<b>761,994</b>	<b>115</b>	<b>743</b>	<b>119</b>
121-140	<b>1,791,720</b>	<b>135</b>	<b>735,572</b>	<b>136</b>	<b>1,054,442</b>	<b>134</b>	<b>1,790,014</b>	<b>135</b>	<b>1,706</b>	<b>127</b>
141-160	<b>3,945,155</b>	<b>149</b>	<b>1,911,387</b>	<b>149</b>	<b>2,027,405</b>	<b>149</b>	<b>3,938,792</b>	<b>149</b>	<b>6,363</b>	<b>148</b>
161-180	<b>2,323,950</b>	<b>170</b>	<b>1,563,878</b>	<b>169</b>	<b>757,696</b>	<b>170</b>	<b>2,321,574</b>	<b>170</b>	<b>2,376</b>	<b>171</b>
181-200	<b>1,157,382</b>	<b>190</b>	<b>782,055</b>	<b>190</b>	<b>374,162</b>	<b>190</b>	<b>1,156,217</b>	<b>190</b>	<b>1,165</b>	<b>188</b>
201-250	<b>1,108,857</b>	<b>220</b>	<b>713,009</b>	<b>221</b>	<b>392,978</b>	<b>218</b>	<b>1,105,987</b>	<b>220</b>	<b>2,870</b>	<b>219</b>
251-300	<b>259,923</b>	<b>270</b>	<b>146,799</b>	<b>272</b>	<b>113,067</b>	<b>267</b>	<b>259,866</b>	<b>270</b>	<b>57</b>	<b>262</b>
301-350	<b>61,229</b>	<b>320</b>	<b>54,955</b>	<b>319</b>	<b>6,270</b>	<b>327</b>	<b>61,225</b>	<b>320</b>	<b>4</b>	<b>324</b>
351-450	<b>25,046</b>	<b>378</b>	<b>25,045</b>	<b>378</b>			<b>25,045</b>	<b>378</b>	<b>1</b>	<b>378</b>
>450	<b>1,130</b>	<b>494</b>	<b>1,130</b>	<b>494</b>			<b>1,130</b>	<b>494</b>		

<sup>12</sup> The data of table A2 are not adjusted by 0.7% for cycle change because not all Member States submitted the necessary data. The effect of the adjustment would be for volumes to move into lower categories (e.g. 140 g & less cars would increase in volume as a % of total).

<sup>13</sup> Due to possible data implausibility the following vehicles from Member States data were not taken into account: 114 petrol fuelled vehicles with emissions below 100g/km, 45 diesel fuelled vehicles with emissions higher than 351g/km and 20 electric vehicles, which are obviously retrofitted vehicles

**A3: THE DISTRIBUTION OF AVERAGED MASS<sup>14</sup>, POWER AND ENGINE CAPACITY OF NEW PASSENGER CARS<sup>15</sup> FOR EACH FUEL TYPE FOR THE EU 15 AND EACH MEMBER STATE**

ACEA MEMBERS - 2003

Member State	Mass [kg]					Power [kW]					Capacity [cm <sup>3</sup> ]				
	Total	Petrol	Diesel	Petrol+ Diesel	AFV	Total	Petrol	Diesel	Petrol+ Diesel	AFV	Total	Petrol	Diesel	Petrol+ Diesel	AFV
<b>EU-15</b>	<b>1406</b>	<b>1296</b>	<b>1522</b>	<b>1405</b>	<b>1685</b>	<b>79</b>	<b>77</b>	<b>82</b>	<b>79</b>	<b>74</b>	<b>1753</b>	<b>1584</b>	<b>1933</b>	<b>1754</b>	<b>1625</b>
A	1430	1232	1494	1430	1577	78	74	79	78	75	1863	1599	1948	1863	1710
B	1365	1175	1440	1365		74	69	77	74		1775	1491	1887	1775	
DK	1348	1330	1396	1348		80	82	75	80		1747	1708	1851	1747	
F	1298	1149	1368	1298	1130	74	70	75	74	53	1749	1490	1872	1750	1304
FIN	1357	1323	1517	1357		86	85	90	86		1788	1732	2048	1788	
GER	1388	1275	1541	1388	1510	88	84	93	88	75	1866	1714	2073	1866	1683
GR	1277	1282	1032	1277		73	73	86	73						
IRE	1279	1221	1468	1279		74	71	82	74		1588	1478	1979	1588	
IT	1652	1445	1851	1651	2017	68	57	79	68	73	1589	1314	1857	1589	1578
LUX	1449	1310	1512	1449		93	99	91	93		1994	1906	2034	1994	
NL	1320	1260	1486	1320		80	79	83	80		1749	1654	2012	1749	
POR	1253	1119	1389	1253	1478	67	58	76	67	76	1525	1293	1761	1525	1721
SP	1305	1200	1364	1305		75	73	77	75		1764	1551	1884	1764	
SW	1492	1472	1704	1492	1613	106	106	103	106	95	2014	1995	2206	2012	2346
UK	1392	1319	1546	1392	1480	91	90	94	91	83	1746	1642	1989	1746	1773

<sup>14</sup> There is some implausibility with regard to mass data for Italy. Thus, for ~10% of new registrations in EU15 the weight might be ~20% too high.

<sup>15</sup> Due to possible data implausibility the following vehicles from Member States data were not taken into account: 114 petrol fuelled vehicles with emissions below 100g/km, 45 diesel fuelled vehicles with emissions higher than 351g/km and 20 electric vehicles, which are obviously retrofitted vehicles

## ANNEX II

### **Major Review of ACEA's Commitment on CO<sub>2</sub> Emission Reductions from Passenger Cars, including an assessment in accordance with Article 10 of Decision 1753/2000/EC**

#### **Joint Conclusions of the European Automobile Manufacturers Association and the Commission Services**

### **Section 1: Background**

ACEA undertook in their voluntary Commitment to reduce new passenger car CO<sub>2</sub> emissions to carry out, based on 2003 data, a "Major Review" addressing the following:

*"ACEA is willing to contribute to a periodic monitoring of its commitments, jointly undertaken by ACEA and the Commission ----. This should include a joint "Major Review" – covering both ACEA and non-ACEA developments. This would incorporate the results of CO<sub>2</sub> emission reductions up to and including calendar year 2003, including comparison of that year's fleet average to the estimated target range."*

With regard to this 'estimated target range', the ACEA Commitment states:

*"For 2003, ACEA considers an estimated target range of 165-170 g CO<sub>2</sub>/km to be appropriate. – This translates into a reduction of 9-11 % compared to the reference year 1995."*

Moreover the Annex of the voluntary Commitment states:

*"The reduction in CO<sub>2</sub> emissions will not be linear; the pace will notably depend on the timing of availability of the enabling fuels on the market as well as on the lead-times for new technologies and products and their market penetration. The reduction profile is therefore expected to be relatively slow initially and to gather pace later."*

Article 10 of Decision 1753/2000/EC<sup>16</sup> requires that:

*"The reports for intermediate target years and the final target year will indicate whether the reductions are due to technical measures taken by the manufacturers or to other measures such as changes in consumer behaviour."*

Since the evaluations to be carried out under the "Major Review" and under Article 10 are partly overlapping a joint assessment by ACEA and the European Commission has been carried out. Apart from ACEA's and the European Commission's own contributions this work was supported by studies and service contracts<sup>17</sup>.

### **Section 2: Observed CO<sub>2</sub> values and main ACEA Achievements with respect to its CO<sub>2</sub> Commitment**

Without further analysis it can be clearly established that ACEA has met the following undertakings made in its Commitment:

- in 2000, many models were brought to market of 120 g CO<sub>2</sub>/km or less, the number of models increased since then;
- before end of 2003 ACEA submitted, to the Commission, its "Potential Reduction Review" statement on moving further towards the Community target of 120 g CO<sub>2</sub>/km in 2012;
- ACEA contributed to a transparent monitoring of the Commitment.

<sup>16</sup> Decision No 1753/2000/EC of the European Parliament and of the Council of 22 June 2000 establishing a scheme to monitor the average specific emissions of CO<sub>2</sub> from new passenger cars. *Official Journal L 202*, 10/08/2000 P. 0001 - 0013

<sup>17</sup> DLR service contract contribution: "Preparation of the 2003 review of the commitment of car manufacturers to reduce CO<sub>2</sub> emissions from M1 vehicles - Final Report of Task A (Article 10)"

Concerning the observed CO<sub>2</sub> values they fell into the intermediate target range, considered by ACEA for 2003 of 165-170 g CO<sub>2</sub>/km, already in the year 2000. In 2003 the value was below this range (see 2003 data, as presented in the 2004 Joint Report). ACEA's prediction that the reduction in CO<sub>2</sub> emissions will not be linear has so far turned out to be correct. However, the expectation that the reduction profile would be relatively slow initially and gather pace later is not fully in line with the actual observations: the ACEA fleet data show that progress was very good initially but has slightly slowed down in the last two years. However, ACEA's expectation covered the period until 2008 so no real conclusion can be drawn from this observation.

Two crucial questions have been addressed in the course of the "Major Review"/Article 10 work:

- 1) Have there been obstacles in the operating environment, for which ACEA cannot be held accountable, but which hampered its efforts to meet the Commitment, or which caused underperformance? This question is addressed in Section 3.
- 2) Have factors other than technological developments by ACEA members resulted in changes of the specific CO<sub>2</sub> emissions of new passenger cars? This question is addressed in Section 4.

The answers to these questions are important in answering whether or not the observed CO<sub>2</sub> reductions can be fully counted towards the achievement of the ACEA members, and whether or not ACEA could have achieved more but for obstacles in the operating environment.

### **Section 3: Operating Environment**

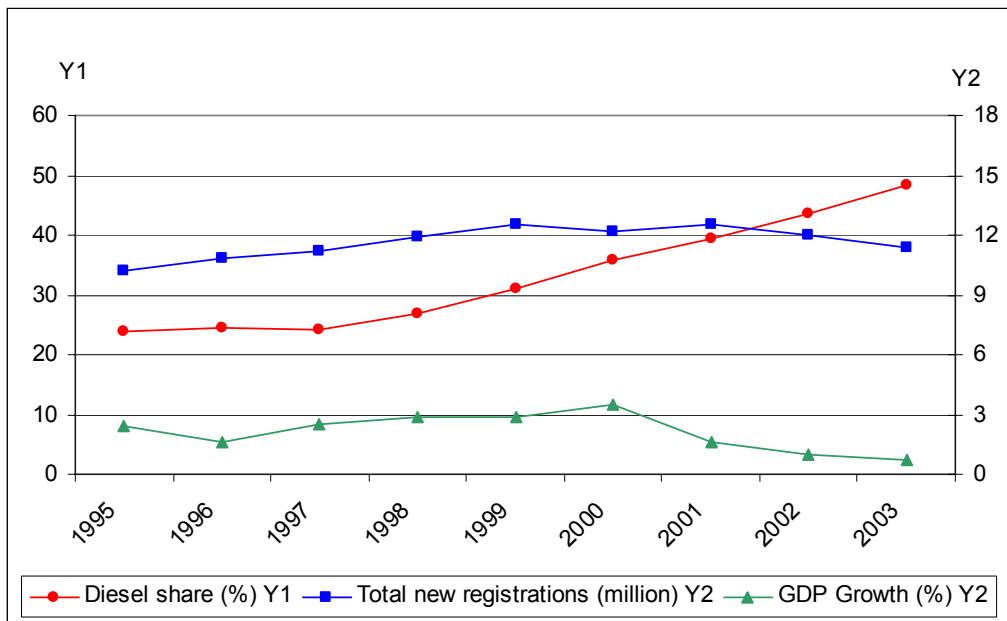
The text of the Commitment lists a number of assumptions made by ACEA at the point of departure. These assumptions mainly concern:

- i. The economic situation
- ii. Enabling fuels
- iii. Regulatory conditions
- iv. Unhampered diffusion of technology and acceptance of innovations

If the assumptions are met it is assumed that no obstacles have occurred in the period covered by the "Major Review".

#### **Economic Situation**

ACEA and the Commission agree that the performance of the automotive industry and its capability to invest in technological innovations is dependent on a strong and healthy macro-economy. This also facilitates the market take-up of advanced, and typically more expensive, technologies. While the economic conditions were favourable in the beginning of the review period, since 2001 the European economic environment has been weak and 2003 was the third consecutive year of subdued GDP growth. The recent economic performance has very likely contributed to a fall of total sales.



Although ACEA is of the opinion that it is working in an increasingly difficult economic environment there are no indications that this should have had a significant adverse effect on the implementation of the Commitment within the review period.

### Enabling Fuels

The Commitment is based on fuel qualities as laid down in Directive 98/70/EC (50 ppm sulphur content)). ACEA says in its assumptions that it expects marketed fuels to have a sulphur content of 30 ppm in 2005 (which is beyond the review period). The Commission's fuel quality monitoring<sup>18</sup> shows full compliance with Directive 98/70/EC. Moreover, a few Member States have started to introduce low sulphur fuels with a sulphur content of 10 ppm.

EU	Average Sulphur Content, ppm			
	Fuel / Year	2001	2002	2003*
	<i>Petrol</i>	68	51	31
	<i>Diesel</i>	223	169	102

\*Excludes Belgium, France, Luxembourg and Spain.

Although ACEA had preferred to see 30 ppm or 10 ppm fuels homogeneously made available on the EU market, and regrets the limited availability of alternative fuels (e.g. CNG / LPG / bioethanol), it is in general satisfied with the fuel qualities provided in the review period. Nevertheless, ACEA points out that in 1998, it forecasted that 30 ppm fuels would be sufficient to enable full lean burn gasoline direct injection engines to come to market in volume. The evolution of exhaust treatment systems has not evolved as forecasted: it has become clear that 10 ppm is needed for these CO<sub>2</sub> efficient engine concepts.

### Automotive Regulations

The Commitment was made in 1999. According to the Commission, since that point of time, in the review period no new EU regulation relevant for CO<sub>2</sub> emissions came into effect.

<sup>18</sup> COM(2004)310

ACEA is currently investigating this issue focusing on the potential impacts of legislation on emissions, safety, recycling and other legislative developments over the whole Commitment period as well as their implications for the move towards the Community objective of 120 g/km in 2012.

### **Technologies and innovations**

Over the 1995 to 2003 period, ACEA members introduced a wide range of technologies and technically-advanced product developments to reduce CO<sub>2</sub> emissions that have progressively penetrated the EU market. New technological developments have ranged across all the relevant areas of vehicle engineering: combustion efficiency, engine improvements, transmission developments, weight reduction, aerodynamics, chassis friction reduction, etc. – as well as the introduction of alternative-fuelled vehicles. Set-out below are leading examples of CO<sub>2</sub>-reducing technologies introduced by ACEA manufacturers.

- Direct injection diesel engine technologies with the launch of a "new generation" of technically advanced diesels, notably incorporating highly efficient pump-nozzle and common rail technology as well as exhaust gas turbochargers with variable nozzle turbine and cooled exhaust gas recirculation
- Gasoline engines with port-injection also saw major improvements in efficiency, via technical improvements such as multi-valves, 2-step variable valve lift and valve timing rollers, fully variable valve lift and timing (e.g. valvetronic), fully variable intake manifold, as well as Gasoline direct injection engines.
- Optimisation/detailing-related technical advances improved fuel efficiency across all model-ranges; examples have included evolution of intelligent engine management systems, reduction of friction losses, new energy control management systems and alternator efficiency improvements.
- Advanced gearboxes and auxiliaries were also introduced and refined. Specific developments included Continuous Variable Transmission, robotized gearboxes, 6-gear manual boxes, dual clutch transmission, 6- and 7-speed automatic gearbox, electric power and electro-hydraulic power assisted steering systems
- Other vehicle technologies - for example utilisation of lightweight materials (e.g. aluminium front structure assembly, door panels & hoods; new low-weight/alloy engines, aluminium chassis, carbon body parts), reduced tyre friction - are increasingly applied.
- Alternative Fuelled Vehicles (AFV) have been introduced- and by 2003 a wide offering existed (electric, LPG Bi-fuel, CNG/Biogas Bi-fuel, vehicles running on biodiesel)

Overall, these technological developments have been well received on the market, and there are really no signs of hesitation among consumers in accepting innovations. Having said that, according to ACEA, the markets for alternatively fuelled vehicles could have been larger if these fuels were widely available. However, ACEA and the Commission agree in the judgement that this has not had a major impact on the average specific CO<sub>2</sub> values achieved with the review period.

### **Section 4: Other factors beside technological developments**

On behalf of the Commission DLR has investigated whether other factors beside technological developments by ACEA members have contributed to the observed reductions of the CO<sub>2</sub> emissions of new passenger cars. For this purpose DLR applied descriptive and econometric methods. The conclusions drawn from these investigations are as follows:

#### **Technical influences**

Remarkable changes in the use of technologies for the reduction of the fuel consumption for new passenger cars have been observed within the period under investigation. In this regard the analysis of

DLR confirms the observations presented under Section 3. The identified improvement in diesel technology is larger than in petrol technology. While the identified improvement in the individual segments ranges from 0.1 % to 17.6 % for petrol vehicles, it ranges from 5.5 % to 20.6 % for diesel vehicles. However, a quantification of the influence of individual technologies on the specific fleet average was not possible.

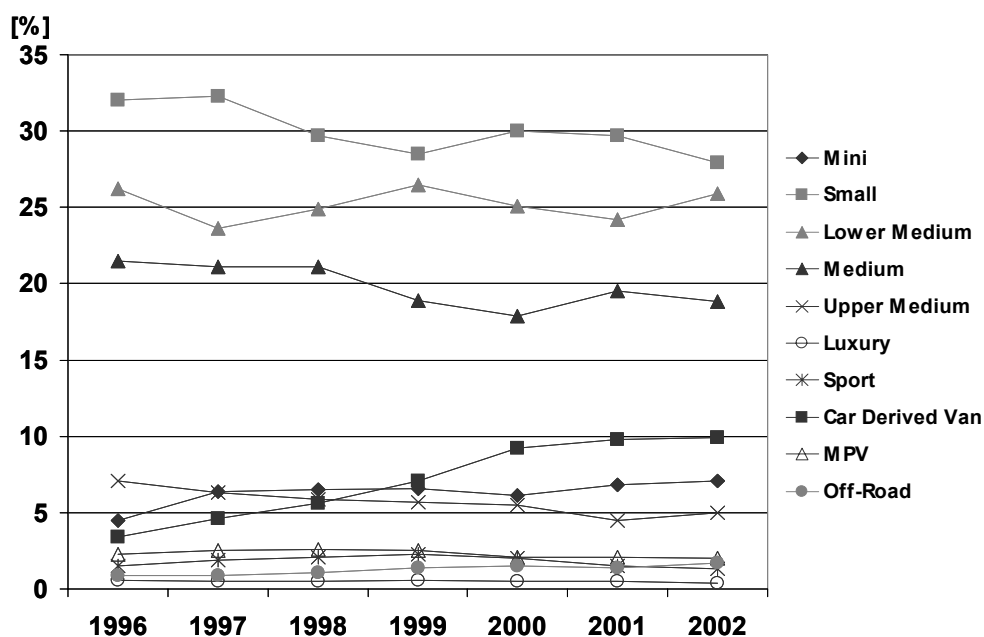
### Non-technical influences

Non-technical influences with a potential to affect the behaviour of car purchasers were analysed: politically motivated measures such as taxes and car labelling but also socio-economic trends, e.g. fuel prices, per capita GDP, and other factors like the model range demanded by consumers and/or offered by the manufacturers. The effects of these variables on ACEA's average specific CO<sub>2</sub> emissions were analysed with the following results:

### Influences with respect to the model range

Concerning ACEA's car fleet some changes have been observed between 1996 and 2002<sup>19</sup>. Most significant is the growth of Car Derived Vans, which represented only 3.4 % of all new registrations in 1996 but nearly 10 % in 2002. Further considerable growth appeared for the Mini segment (4.5 to 7.1 %) and, on to a smaller extent, for Off-Road cars (0.9 to 1.7 %).

On the other hand, a decreasing trend is seen for the share of Medium cars as well as for Upper Medium cars. Trends of the major segments Small and Lower Medium mirror each other to some extent, but the aggregate of the two underwent a slight decrease (from approx. 58 to 54 % market share). Luxury, Sport and MPV show slight decreases.



A trend towards higher powered cars, in particular among diesel cars and towards an increase in the number of versions has been observed. Reductions in the specific CO<sub>2</sub> emissions appeared for all segments with a tendency of above average reductions for those segments which gained market shares. Furthermore, for the largest segment – Small cars – high specific CO<sub>2</sub> reduction rates were recorded.

Overall, this resulted in a “compensatory” effect: the identified average CO<sub>2</sub> reduction rates for segments with a growth in their registration share (Mini, Off-Road and Car Derived Van)

<sup>19</sup> Due to high inconsistencies data for 1995 could not be used. Detailed registrations data for 2003 were not available in due time.



compensated for the somewhat higher absolute CO<sub>2</sub> emissions of the “off road” and “MPV” segments and the under average reduction in specific CO<sub>2</sub> emissions in the middle class segments.

The most significant effect results from the overall increase in the diesel share since, as mentioned above, diesel performed better than petrol. In practice, this shift helped to achieve the more than average reduction in observed specific CO<sub>2</sub> emissions in those segments which gained market shares.

If the segment structure, as proposed by the DLR, had not changed between 1996 and 2002, but the specific emissions per segment had developed according to the actual observed values, the total specific emissions of ACEA’s fleet would have been 2.2 g CO<sub>2</sub>/km higher than the monitored value. However, if in addition the increase of the diesel share is taken into account, this tendency would be overcompensated as the total emissions of ACEA’s fleet would then be reduced by 4.5 g CO<sub>2</sub>/km, resulting in an average emissions value that is 2.3 g CO<sub>2</sub>/km lower than monitored. Hence, while the structural composition of the segments had a slightly increasing effect on average CO<sub>2</sub> emissions, the share of diesel cars had a stronger and opposing effect. The main reason for this effect is the increase in average power of diesel car in all segments.

Influences with respect to car labelling: The effectiveness of the car labelling Directive 1999/94/EC is currently being assessed as part of the implementation of Article 9 of this Directive. Although no final assessment is available at this point of time, all information indicates that the car labelling Directive had, up to now, only negligible effects on consumer’s car choice and did therefore not contribute to the observed reduction in specific CO<sub>2</sub> emissions.

Influences with respect to the GDP per capita, fuel prices and circulation taxes:

Several attributes were included as variables in the models and, after a pre-assessment of results, the parameters per capita GDP, fuel prices and circulation taxes were selected for more detailed scenario analysis to understand the extent to which changes in these variables could affect average CO<sub>2</sub> emissions. DLR’s analysis calculates differences in hypothetical CO<sub>2</sub> values that would result in that year given different values for per capita GDP, fuel prices and circulation taxes. Overall, the investigation finds some evidence of positive and negative influences of non-technical factors on average CO<sub>2</sub> emissions in the period analysed. Given the magnitude and mixture of effects, as well as the associated uncertainties, DLR could not identify any significant influence of the pre-selected variables.

In summing up all the factors DLR could not find evidence that the observed total reductions of ACEA’s CO<sub>2</sub> fleet average was significantly influenced by other factors than technological developments.

## **Section 5: Outlook**

ACEA used the occasion of the “Major Review” to draw attention to a number of aspects which it considers important for the achievement of the 140 g CO<sub>2</sub>/km target in 2008:

- Fuels: ACEA underlines that a satisfactory availability of 10 ppm fuels is essential, starting in January 2005, in order to comply with the stringent EU emission regulations.
- Safety measures: ACEA aims at complying with EURO NCAP and expects that even more requirements concerning safety are likely in the future that may act as negative factors on the reduction of CO<sub>2</sub>.
- Emission regulations: EURO 4 was known when the Commitment was signed and will take effect in 2005. However, future regulations (EURO 5) might have negative effects on CO<sub>2</sub> emissions, especially with regard to the fuel-efficiency of diesel vehicles.

In addition ACEA mentioned that regulations concerning recycling and noise may lead to an increase of CO<sub>2</sub> emissions either by impacting on some fuel efficiency parameters like combustion process and air resistance or by increasing the weight of the vehicle.

The Commission and ACEA agree that the repercussions of such regulations are and will be taken into account in the monitoring process.

## **Section 6: Conclusions**

The Commission and ACEA agree that, over the 1995-2003 period:

- a) The reduction in specific CO<sub>2</sub> emissions has been overwhelmingly achieved by technological developments. The small market changes observed did not influence the CO<sub>2</sub> emissions significantly. In any case it is very difficult to distinguish between market changes caused by technology and market changes caused by other factors, e.g. general consumer behaviour, economic situation, fuel prices, fiscal measures, availability of consumer information, mainly for two reasons: the market changes observed in the period 1995 to 2003 are relatively small and CO<sub>2</sub> relevant technological developments penetrated practically all vehicle categories.
- b) In the light of these findings it can be stated that all applicable undertakings specified in ACEA's CO<sub>2</sub> Commitment have been met, and in some cases over achieved.
- c) The assumptions listed by ACEA in its Commitment have been met and the environment under which its members are operating has not prevented ACEA from meeting its Commitment.
- d) ACEA draws attention to a number of points which are of importance for the delivery of the 140 g CO<sub>2</sub>/km target.

In summary, ACEA and the Commission conclude that ACEA has, during the period 1998 to 2003, met all the obligations stated in their Commitment. The European car industry has, in doing so, delivered a sizeable contribution to the EU's strategy for reducing greenhouse gas emissions and to its Kyoto reduction objectives.

**Monitoring of JAMA's commitment on CO<sub>2</sub> Emission  
Reduction from Passenger Cars  
(2003)**

**Final Report  
05.10.2004**

**Joint Report  
of the  
Japan Automobile Manufacturers Association  
and  
the Commission Services**

**Monitoring of JAMA Commitment<sup>20</sup> on CO<sub>2</sub> Emission Reduction from Passenger Cars**  
**JOINT REPORT OF JAMA AND THE COMMISSION SERVICES<sup>21</sup>: YEAR 2003 REPORT**

**ES SUMMARY OF PROGRESS IN DELIVERING THE AGREEMENT**

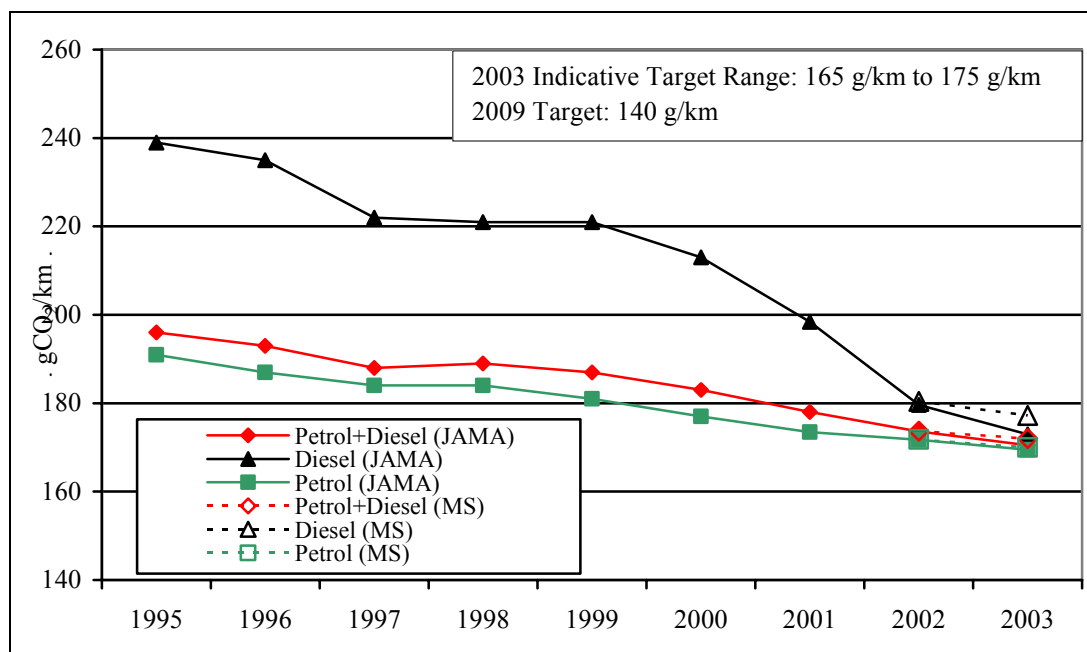
**E1 Trends in specific emissions of CO<sub>2</sub> (g/km)**

In 2003 -using official EU data - JAMA members decreased the averaged specific CO<sub>2</sub> emissions of passenger cars (petrol +diesel) registered within the EU by about 2g CO<sub>2</sub>/km from 174 to 172 g CO<sub>2</sub>/km. This is a 1.0 % drop from 2002<sup>22</sup>. Consequently JAMA accomplished the intermediate target (165 – 175 g CO<sub>2</sub>/km) set for the year 2003.

For petrol-fuelled cars, specific emissions dropped from 172 g CO<sub>2</sub>/km to 170 g CO<sub>2</sub>/km in 2003 – a 1.0 % reduction compared to 2002. For diesel-fuelled cars, the 2003 value is 177 g CO<sub>2</sub>/km, compared to 180 g CO<sub>2</sub>/km – a 1.7 % reduction compared to 2002.

According to JAMA’s data, its average new car CO<sub>2</sub> emissions in 2003 were 171 g CO<sub>2</sub>/km (petrol +diesel), a reduction of 1.7 %. There was therefore 1 g CO<sub>2</sub> deviation between overall official and JAMA (petrol +diesel) figures in 2003.

Official EU data only became available 2002. There are underlying differences between this new data source, and the prior source, supplied by JAMA (see Section 2.10). It is therefore not correct to simply adjoin official data for the most recent years, onto JAMA’s historical data (from 1995). For this and other reasons, JAMA data is still also used for monitoring purposes, particularly where longer-term trends (say between 1995 and 2003) are needed.



**Figure 3: EU Trends of JAMA members’ fleet in average specific emissions of CO<sub>2</sub>**

<sup>20</sup> As recognized by the European Commission in the Recommendation of 13 April 2000 on the reduction of CO<sub>2</sub> emissions from passenger cars (2000/304/EC). Hereafter referred to as “The Commitment”

<sup>21</sup> Hereafter often referred to as “The Commission”

<sup>22</sup> All percentage figures are based on rounded numbers.

Using JAMA's time-series between 1995 and 2003, JAMA achieved an overall reduction in new car CO<sub>2</sub> emissions of 12.8%; petrol-cars were down by 11.0 %, and diesel cars were down by 27.6 %. The two data points based on Member States data (MS) are coherent with JAMA's trend data but differ somewhat in the absolute values.

## E2 Trends in specific fuel consumption by fuel type (l/ 100 km)

Fuel efficiency in 2003 improved on 2002 for both petrol and diesel cars. 2002 values were 7.3 l/100km for petrol, 6.8 l/100km for diesel and 7.1 l/100km for all JAMA members' new registrations<sup>23</sup>. In 2003 comparable values were 7.2 l/100km, 6.7l/100km and 7.0 l/100km. Petrol passenger cars, which counted for the majority of JAMA member's passenger cars registered within the EU over the full 1995 to 2003 reporting period, consumed about 8.0 l/100 km in 1995. Their average fuel consumption decreased to 7.2 l/100 km in 2003. Diesel cars consumed an average of 9.0 l/100 km in 1995, and achieved an average fuel consumption of 6.7 l/100 km in 2003 (see Figure 2).

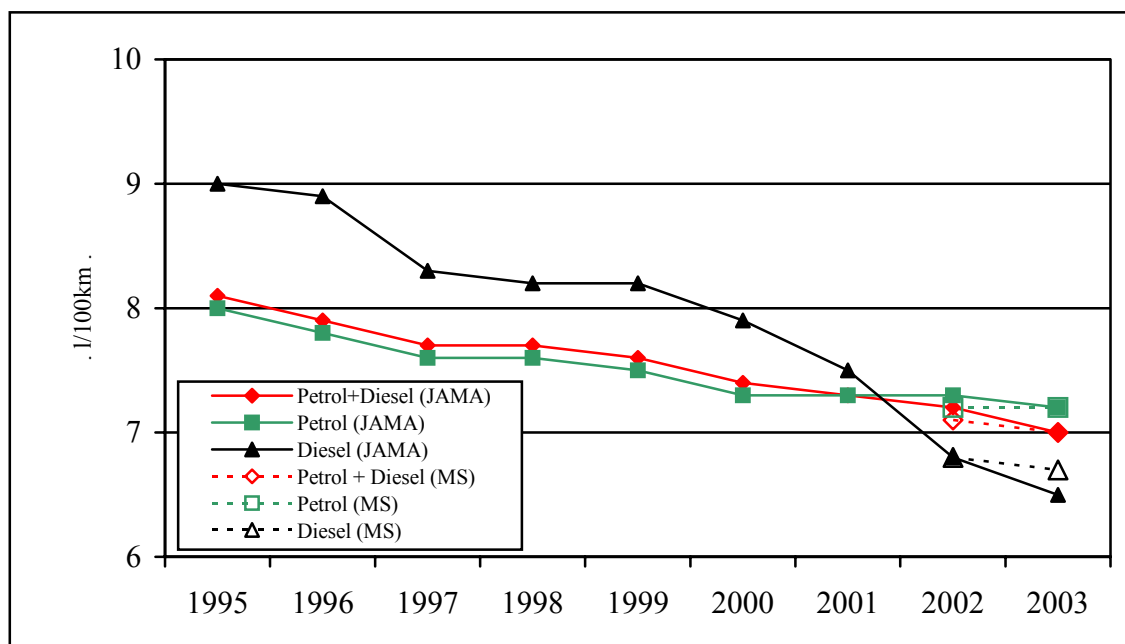


Figure 4: Trends of JAMA member's fleet in average specific fuel consumption by fuel (l/100km)

## E3 Trends in physical fleet characteristics

Based on JAMA data, the average mass<sup>24</sup> of new petrol cars increased slightly from 2002 to 2003 – from 1146 kg to 1174 kg; for diesel the values decreased from 1468 kg to 1458 kg. When all new registrations are combined the average mass was 1220 kg in 2002 and 1252 kg in 2003. Average engine power of new registrations increased slightly, from 77 kW in 2002 to 79 kW in 2003. Average engine capacity increased slightly, from 1666 cm<sup>3</sup> in 2002 to 1688 cm<sup>3</sup> in 2003.

The general trends in physical characteristics over the whole reporting period from 1995 to 2003 show an increase, notably in mass (+ 15 %). This is mainly due to increasing petrol car weight (+ 14 %) and increased diesel passenger car registrations (+ 401 %) over the reporting period. Average engine capacity increased by 4.1 % over the period from 1995 to 2003. The engine power increased by 12.9 % over the same period.

## E4 Technical developments introduced to reduce CO<sub>2</sub> emissions

The main new technologies introduced since 1995 include the petrol and diesel direct injection engines. The Continuous Variable Transmission Technology (CVT) has already been introduced and continues to be used

<sup>23</sup> The following conversion factors were used for the calculation of specific fuel consumption (l/100km) from specific CO<sub>2</sub> emissions (g/km): petrol 23.7, diesel 26.6.

<sup>24</sup> JAMA's data are based on the kerb weight of the vehicle.

on cars sold on the market. JAMA has also introduced hybrid cars in 2002 and idling stop mechanism in 1999.

<b>E5      Brief overall assessment on progress in relation to the target</b>
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In 2003, JAMA decreased the averaged specific CO<sub>2</sub> emissions of passenger cars registered within the EU by about 2 g CO<sub>2</sub>/km to 172 g CO<sub>2</sub>/km. This is a 1.0 % drop compared to 2002. This means that JAMA accomplished the 2003 intermediate target (165 to 175 g CO<sub>2</sub>/km).

Using JAMA's 1995-2003 data set, CO<sub>2</sub> emissions have been cut from 196 g CO<sub>2</sub>/km in 1995 to 171 g CO<sub>2</sub>/km in 2003. JAMA has produced passenger cars achieving lower specific CO<sub>2</sub> emission levels since 1995, achieving in that period a 12.8 % decrease in average CO<sub>2</sub> specific emissions.

The share of diesel cars in JAMA fleets have increased over the reporting period. While in 1995 petrol cars accounted for 89.6 % of the fleet and diesel cars for 10.4 %, in 2003 the shares were 71.8 % and 28.2 % respectively.

An important achievement before the 2003 review is the launch on the EU market of petrol cars emitting 120 g CO<sub>2</sub>/km or less. Although sales remain small (74679 vehicles in 2003), this shows a positive effort made by JAMA.

To achieve the CO<sub>2</sub> emission targets agreed upon in the commitment by 2009, JAMA will further explore various technologies namely Direct Injection (DI), hybrid vehicles and Continuous Variable Transmission Technology (CVT) etc. JAMA emphasizes the difficulty of planning and managing of CO<sub>2</sub> reduction due to unknown factors such as changes of consumer demands.

In compliance with the provision of the Commitment to carry out a "Major Review" based on 2003 data and Article 10 of Decision 1753/2000/EC, issues related to the means actually used to achieve the identified reductions are discussed in Annex 3. The results of these investigations should be taken into account when interpreting the data and statements of this report.

In summary, while the 2009 target remains extremely ambitious for JAMA, the 2003 monitoring report shows that JAMA is fully in line with its 2009 Commitment and, in the present circumstances, the Commission and JAMA have no reason to believe that JAMA would not live up to its Commitment.

## 1. MONITORING OF TECHNOLOGICAL DEVELOPMENTS AFFECTING THE COMMITMENT

### 1.1 Commitment Initiatives

Brief Description of current R & D programs

Sections 1.2 and 2.5 cover JAMA technological developments and research activities.

### 1.2 Technological developments

- 1.2.1 Description of fuel efficiency characteristics of new technologies, alternative concepts
- 1.2.2 Availability of New Technologies in the EU and Member States
- 1.2.3 Availability of alternative concepts passenger cars in the EU
- 1.2.4 Availability of low emission passenger cars (e.g. emitting less than 120g/km) in the EU

JAMA has committed itself to achieving a 140 g CO<sub>2</sub>/km emission target by 2009 and JAMA's members are continuing CO<sub>2</sub> emission reduction R&D toward this goal. Ongoing efforts are made to make technological improvements successively available to the market. The main new technologies introduced since 1995 include the petrol and diesel direct injection engines. The Continuous Variable Transmission Technology (CVT) has already been introduced and continues to be used on cars sold on the market. JAMA members have also introduced hybrid cars in 2002 and idle stop mechanism in 1999.

The CO<sub>2</sub> emission reduction technologies made available by JAMA to the market are shown in Figure 7 in Section 2.5. A direct injection gasoline model has been on the market since 1997. A direct injection diesel car debuted on the market in 1998 and has seen a very quick uptake by the markets in 2003 (approximately 26 % of JAMA member's first registrations in 2003).

Several low-emission passenger cars have been put on the EU market in recent years, achieving 120 g CO<sub>2</sub>/km or less. In 2000, JAMA member companies have put 80 g CO<sub>2</sub>/km petrol-hybrid car and another 119 g CO<sub>2</sub>/km car with idle stop mechanism on the market. A new 104 g CO<sub>2</sub>/km petrol-hybrid model was launched in the autumn of 2003.

### 1.3 Description of market trends in physical fleet characteristics

For JAMA new cars as a whole, based on JAMA's figures, the average mass of vehicles increased by around 15 % in 2003 as compared with 1995. The main factor is the increase in the weight of petrol-fuelled cars (mass increased by around 14 %). Engine capacity of JAMA new cars showed a shift towards an increase by approximately 4.1 % and their engine power presented an increase by approximately 12.9 % in 2003 as compared with 1995. CO<sub>2</sub> emission levels, however, showed a decrease of approximately 11.4 % for JAMA new cars as a whole in 2003 as compared with 1995<sup>25</sup>, a sign that the cars available on the market have benefited from CO<sub>2</sub> reduction technologies (see Section 2.4 for further details and linkage to CO<sub>2</sub>). Data from Member States are presented in Annex 1; a comparison with JAMA's data is presented in Annex 2.

## 2 STATISTICAL MONITORING (1995-2003)

### 2.1 Trends in specific emissions of CO<sub>2</sub> (g/km)

In 2003, taking the official EU data, the average specific emissions of JAMA's new car fleet registered in the EU was 172 g CO<sub>2</sub>/km.

Compared to official EU data from 2002 to 2003 the average specific emissions from JAMA new car registration in the EU dropped by 1.0 % to 172 g CO<sub>2</sub>/km. For petrol-fuelled cars the corresponding reduction was 1.0 %, and for diesel cars average specific emissions were 1.7 % lower in 2003 than in 2002.

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<sup>25</sup> Taking 1995 JAMA data and 2003 official data)

The average specific CO<sub>2</sub> emission levels of JAMA new cars over the entire reporting period showed a downward trend (see Figure 3). According to JAMA's data, their average specific CO<sub>2</sub> emission levels decreased by an average of roughly 1.6 % each year and fell from 196 g CO<sub>2</sub>/km in 1995 to 171 g CO<sub>2</sub>/km in 2003 (marking an 12.8 % reduction as compared with 1995). The averaged specific CO<sub>2</sub> emission levels of petrol-fuelled cars recorded a decrease from 191 g CO<sub>2</sub>/km in 1995 to 170 g CO<sub>2</sub>/km in 2003 - a 11.0 % reduction as compared with 1995. This gives an average annual reduction of around 1.4 %. The averaged specific CO<sub>2</sub> emission levels of diesel cars recorded a decrease from 239 g CO<sub>2</sub>/km in 1995 to 173 g CO<sub>2</sub>/km in 2003 - a 27.6 % reduction. This amounts to a 3.5 % average reduction over the period.

Total average fuel consumption decreased within the reporting period from 1995 to 2003, using JAMA's historical time-series, the diesel fuel consumption decreased from about 9.0 l/100 km to 6.5 l/100km, and the petrol fuel consumption from 8.0 l/100 km to 7.2 l/100km. For all vehicles, the average fuel consumption was 7.0 l/100km.

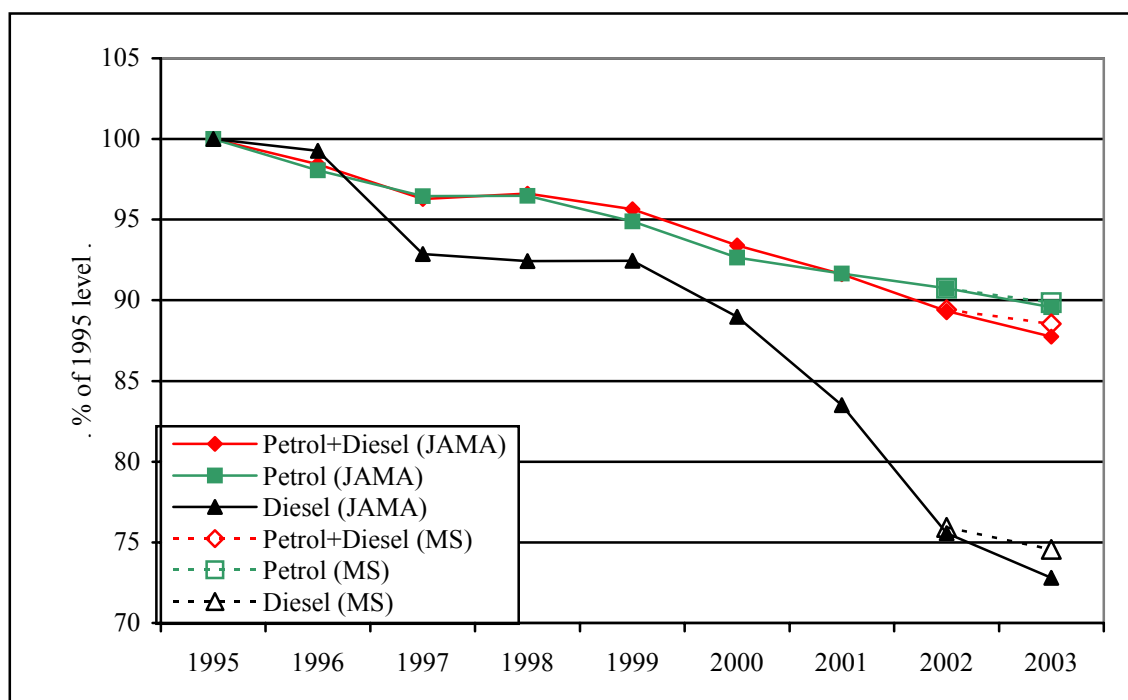


Figure 3: JAMA members' CO<sub>2</sub> Reduction Index (1995=100)

## 2.2 Number of newly registered passenger cars

Based on JAMA data, the number of registered petrol passenger cars increased from 1013138 vehicles in 1995 to 1200215 vehicles in 2003 (+18.5 %). Petrol cars represent about 71.8 % of total first registrations of petrol and diesel cars produced by JAMA.

The number of registered diesel passenger cars increased from 117577 in 1995 to 471202 in 2003 (+400.8 %), - showing the much bigger increment than petrol cars (see Figure 4).

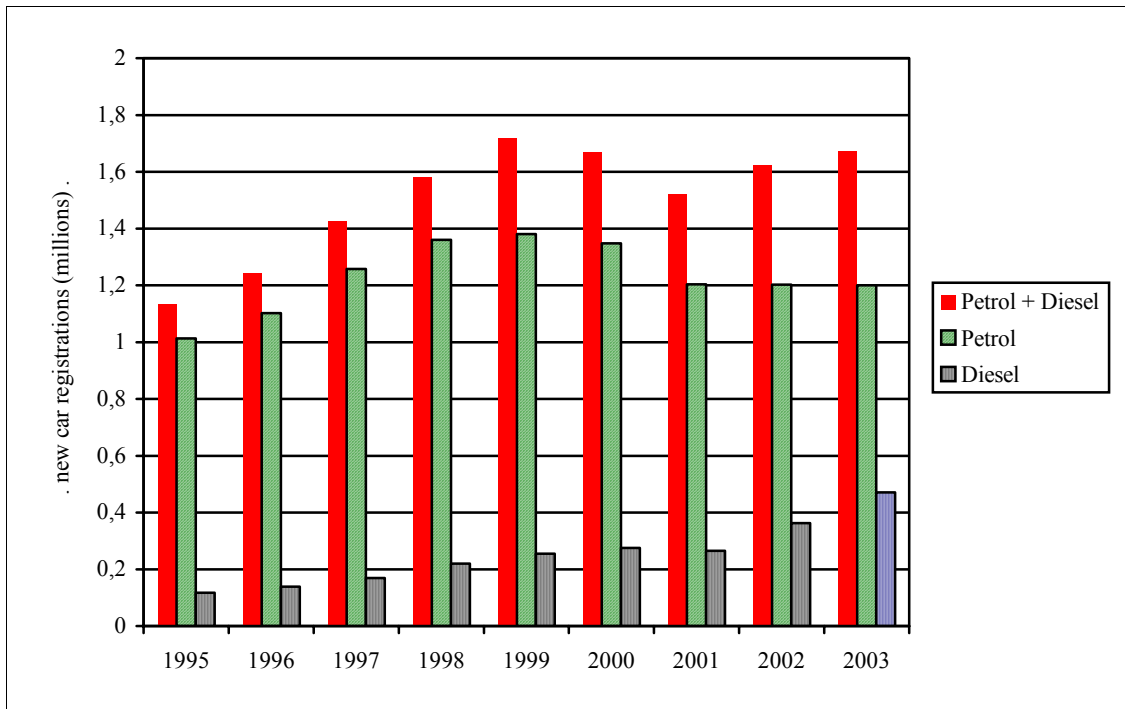
The number of all passenger cars registered in 2003 is 1791228.

Corresponding values for 2002 were: 1202578 petrol cars, 362891 diesel cars, and 1621240<sup>26</sup> for all car registrations<sup>27</sup>.

<sup>26</sup>For 2003, petrol and diesel cars together amount to 1671417 cars; total vehicles were 1791228. "Unknown vehicles" are 119811, increasing from 55771 of 2002. For 2002, petrol and diesel cars together amount to 1565469 cars. "Unknown vehicles" make up the difference with the total vehicles (1621469).

<sup>27</sup> First registration numbers are taken from JAMA

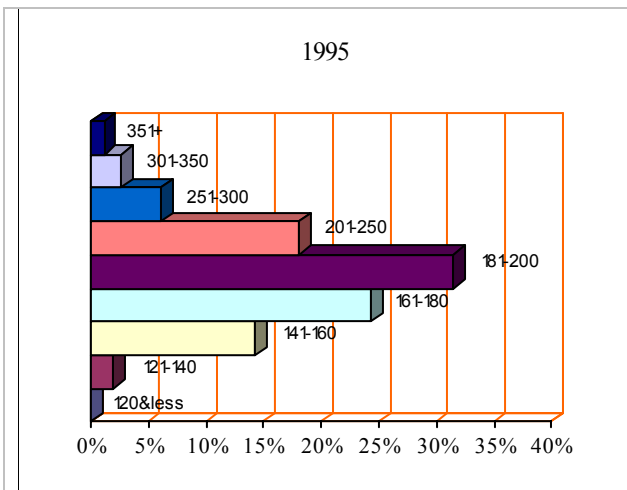




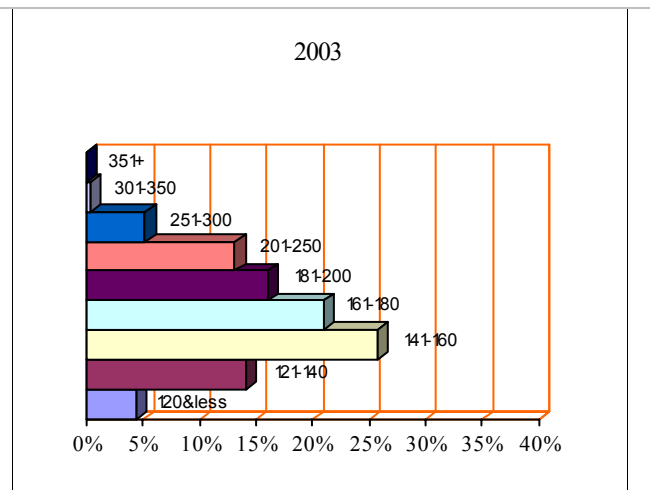
**Figure 4: New Car Registrations by JAMA (million units)**

### 2.3 Fleet Composition

The share of cars emitting categories 160 g CO<sub>2</sub>/km and less has increased from 16.2 % in 1995 to 45.6 % in 2003, while the share of the car emitting more than 161 g CO<sub>2</sub>/km decreased from 83.8 % to 54.4 %. (using JAMA data)



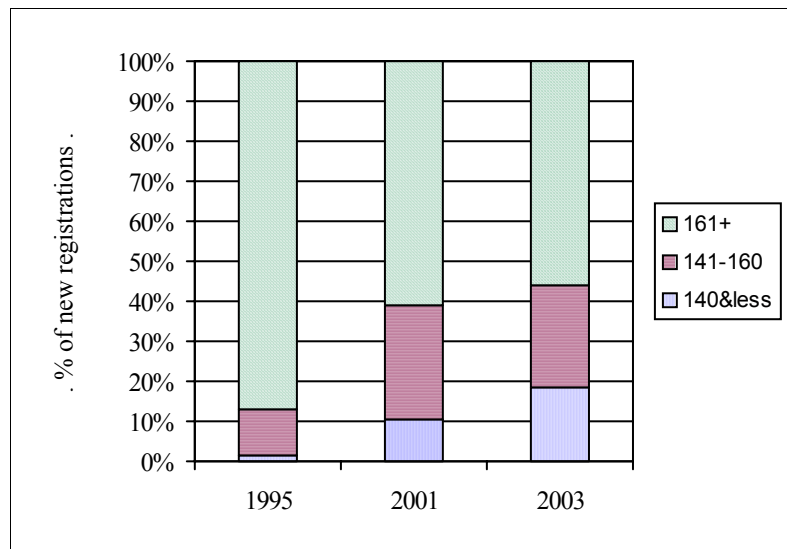
**Figure 5a : JAMA's Fleet Composition per CO<sub>2</sub> Category in Shares of Total (petrol +diesel) in 1995**



**Figure 5b : JAMA's Fleet Composition per CO<sub>2</sub> Category in Shares of Total (petrol +diesel) in 2003**

Furthermore, as Figures 5a and 5b show, a significant increase in registrations can be seen in the category "121 to 140 g CO<sub>2</sub>/km"; there were 209341 new registrations for this category in 2003, up from 22055 in 1995. Figure 5c shows the rapid growth in the 140 g CO<sub>2</sub>/km or less and 141 g CO<sub>2</sub>/km to 160 g CO<sub>2</sub>/km ranges over the reporting period. Over the same period, there was a significant drop in the registration of

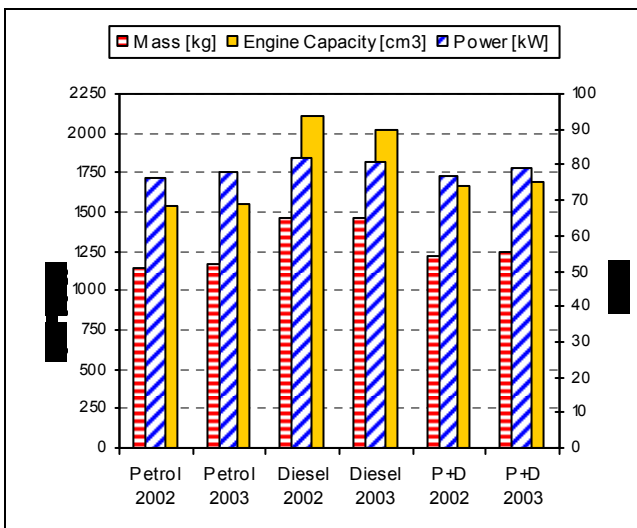
vehicles in the 181g CO<sub>2</sub>/km to 200 g CO<sub>2</sub>/km range, as well as reduction in shares in all higher emissions ranges.



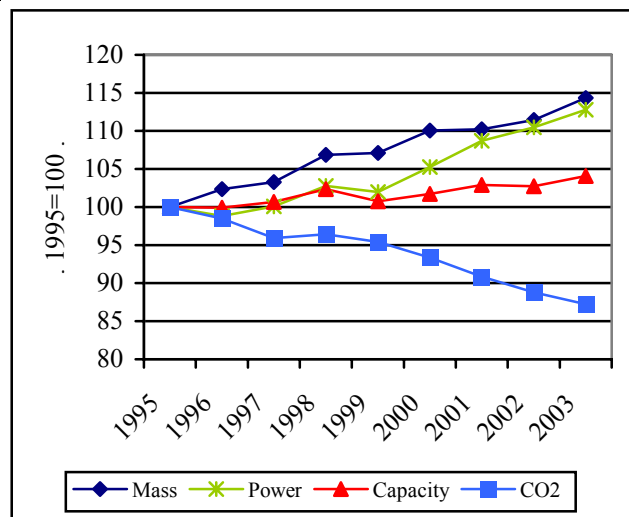
**Figure 5c: Change in JAMA's Fleet Composition by "aggregated CO<sub>2</sub> Categories"**

**2.4 EU trends in physical fleet characteristics**

Using JAMA time-series data, changes in physical characteristics - engine power and cylinder capacity - showed an upward trend from 2002 to 2003, continuing the overall trend present from 1995 (see Figures 6a and 6b). The average mass of new car registrations rose slightly from 1220 kg in 2002 to 1252 kg in 2003; engine capacity increased slightly from 1666 cm<sup>3</sup> to 1688 cm<sup>3</sup>; and power rose from 77 kW to 79 kW in 2003. Average diesel-fuelled car mass was over a third higher than that for petrol, and the capacity was 30 % higher for diesel-fuelled cars than for petrol cars.



**Figures 6a: Physical JAMA members' fleet characteristics for 2002 & 2003**  
(All based on JAMA data)



**Figures 6b: Physical JAMA fleet characteristics**  
(All based on JAMA data)

Average total automobile mass was 1095 kg in 1995 and increased by 14.3 % over the reporting period (1252 kg in 2003). Petrol automobiles' average mass has increased by 11.2 % within the reporting period,

from 1056 kg in 1995 to 1174 kg in 2003. Diesel automobiles' average mass reached the minimum of 1447 kg in 1997 (against 1461 kg in 1995) but increased up to 1557 kg in 2001, then decreased again to 1458 kg in 2003; i.e. a 0.2 % increase over the reporting period from 1995 to 2003.

Total engine capacity has increased by 4.1 % within the reporting period, from 1621 cm<sup>3</sup> in 1995 to 1688 cm<sup>3</sup> in 2003. Petrol engine capacity reached a peak of 1558 cm<sup>3</sup> capacity in 1998 (against 1543 cm<sup>3</sup> in 1995) and slightly decreased to 1554 cm<sup>3</sup> in 2003. Diesel engine capacity decreased to 2027 cm<sup>3</sup> capacity in 2003 (against 2298 cm<sup>3</sup> in 1995). The overall trend shows only a marginal growth in average engine capacity over the reporting period.

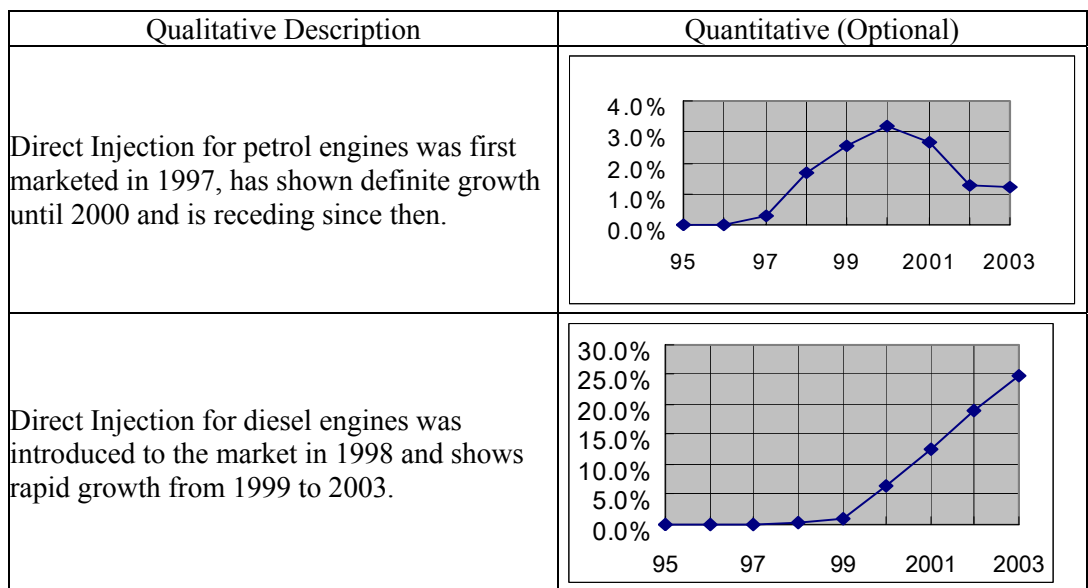
While total engine power was 70 kW in 1995, and rose to 79 kW by 2003, 11.3 % increase in EU average over this eight years period. Petrol engine power has increased from 70 kW in 1995 to 78 kW in 2003. Diesel engine power has steadily increased by 22.7 % within the reporting period, i.e. from 66 kW in 1995 to 81 kW in 2003.

The physical characteristics increased over the period, however, average specific CO<sub>2</sub> emissions dropped by 12.8 % in the same time (see Figure 6b).

**2.5 Trends in new technologies in the EU**

JAMA's members have introduced several new technologies on the EU market over the monitoring period (see description in 1.2). Trends in sales vary across technologies, but overall, with the exception of direct injection diesel engines the shares of these technologies remain small. The shares of cars equipped with direct injection diesel engines have increased from 0 % to 19.2 % since their respective launch in 1998. It's also included the hybrid cars and Idle stop mechanism since 2000.

The trends for each technology, as well as the share of new passenger cars equipped with these technologies in total new passenger car sales by JAMA members, are shown in Figure 7. (Based on JAMA data)

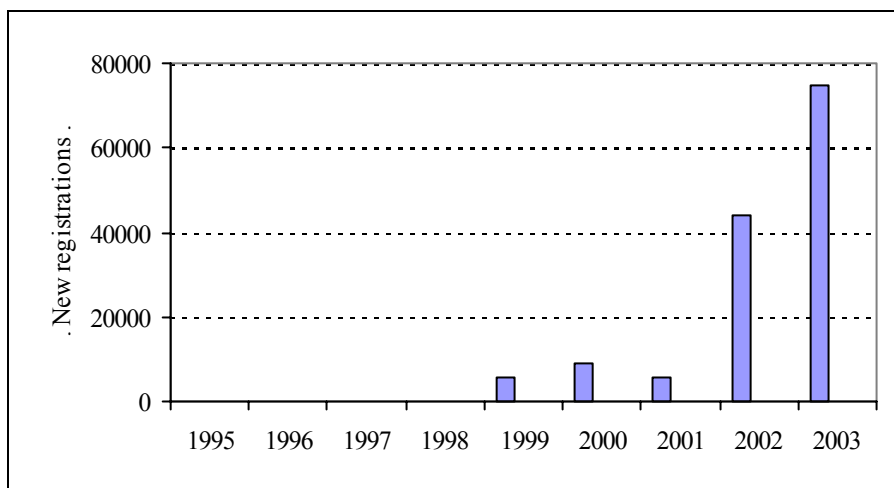


**Figure 7: Trends in New Technologies launched by JAMA members on the EU market**

**2.6 Trends in low emission passenger cars in the EU**

JAMA released its first “120 g CO<sub>2</sub>/km or less” car on the EU market in 1999. In 2000, JAMA has launched a 119 g CO<sub>2</sub>/km car and an 80 g CO<sub>2</sub>/km petrol-hybrid car. Furthermore, JAMA released a 104 g CO<sub>2</sub>/km petrol-hybrid model in the autumn of 2003 (see Section 1.2.4).

In 2003, 74679 JAMA cars with emissions of 120 g CO<sub>2</sub>/km or less were registered in the EU, up from 5544 cars in 1999. Previously there had been no registrations of vehicles in this emissions category.



**Figure 8: JAMA members Sales of Vehicle with Specific Emission of 120 g CO<sub>2</sub>/km or less**  
(2003 based on Member States data)

**2.7 Trends in alternative concepts passenger cars in the EU**

Nothing to report.

**2.8 Trends in innovative concepts passenger cars in the EU**

Nothing to report.

**2.9 Brief Description of the degree of occurrence of Grey Areas between M1 and N1 vehicles**

Based on own data JAMA estimates the number of M1 vehicles with a type approval for M1 and N1 which are potentially registered as N1 in the EU is equal to a total of 74803 vehicles or 6.2 % of total registrations in 2003.

**2.10 Data methods, data sources, and data confidence levels**

EU data differs 1.55 g CO<sub>2</sub>/km to JAMA data in 2003. As seen in Figure 9, the difference between EU data and JAMA data exceeds over 2 g CO<sub>2</sub>/km in eight countries. For example, the official CO<sub>2</sub> values for Spain are 10.34 g CO<sub>2</sub>/km higher than the JAMA data and for Denmark they are 6.31 g lower.

The official EU data comprise 1.2 % more identified registrations than the JAMA data (last year the JAMA data comprise 7.5 % more identified registrations). The biggest differences in the number of identified vehicles occur for Greece (21.1 % more identified registrations in JAMA data) and Austria (8.7 % less identified registrations in JAMA data)

The rate of unidentified vehicles in JAMA data is ~7 % as average for EU15. Similar data are not available for EU15 from Member States because some Member States did not deliver the number of total new registrations (identified + unidentified)<sup>28</sup>. Because of the higher number of identified registrations in the Member States data (1.2 %) it can be expected that the identification rate in the Member States data is slightly higher than in JAMA data.

JAMA and the Commission tried to clarify the reason of these differences, and to fix them. JAMA and the Commission agree that the credibility of data is of great importance. JAMA and the Commission undertake great efforts in order to improve the data quality.

Some improvement with regard to the identification rate and the combination of registration data and corresponding CO<sub>2</sub> values will be achieved when the CO<sub>2</sub> values become part of the registration document.

<sup>28</sup> Further explanation and training might be necessary for some Member States in order to change this situation for the coming years.

	All fuels				Difference			
	Official EU data		JAMA data		Official EU - JAMA		Relation to Official-EU	
	Number	average CO <sub>2</sub>	Number	average CO <sub>2</sub>	Number	average CO <sub>2</sub> (g/km)	Percentage of number	Percentage of CO <sub>2</sub>
<b>EU 15</b>	<b>1,692,806</b>	<b>172.0</b>	<b>1,671,613</b>	<b>170.5</b>	<b>21.193</b>	<b>1.54</b>	<b>1.3 %</b>	<b>0.9%</b>
A	50,725	173.9	46,663	171.8	4.062	2.14	8.0 %	1.2%
B	50,030	165.4	48,002	163.7	2.028	1.69	4.1 %	1.0%
DK	21,746	165.6	23,530	171.9	-1.784	-6.34	-8.2 %	-3.8%
F	150,789	174.4	148,954	173.7	1.835	0.74	1.2 %	0.4%
FIN	44,740	174.8	44,411	174.7	329	0.06	0.7 %	0.0%
GER	356,172	177.1	351,339	174.2	4.833	2,93	1.4 %	1.7%
GR	46,691	167.3	59,782	170.0	-13.091	-2.7	-28.0 %	-1.6%
IRE	41,519	165.4	41,935	167.7	-416	-2.32	-1.0 %	-1.4%
IT	261,475	158.2	261,555	158.7	-80	-0.55	-0.1 %	-0.3%
LUX	4,462	182.5	4,387	180.0	75	2.49	1.7 %	1.4%
NL	79,055	169.6	75,862	168.7	3.193	0.88	4.0 %	0.5%
POR	25,561	152.1	27,841	151.6	-2.280	0.49	- 8.9 %	0.3%
SP	108,297	178.6	99,243	168.2	9.054	10.36	8.4 %	5.8%
SW	39,611	190.3	38,293	187.7	1.318	2.56	3.3 %	1.3%
UK	411,933	175.5	399,816	174.7	12.117	0.83	2.9 %	0.5%

**Figure 9: Comparison between official data and JAMA data**

Additional comparisons of official data and JAMA data are shown in Annex 2.

### **2.11 Description of measurement issues for CO<sub>2</sub> Emission Factors**

The JAMA Commitment specified that new car CO<sub>2</sub> emissions would be measured according to Directive 93/116/EC. Since the establishment of the JAMA Commitment, the mandatory type approval method of measuring CO<sub>2</sub> emissions has been revised by Directive 99/100/EC. In 2003 JAMA and the Commission reached a consensus on a correction factor adjustment; it was agreed that a 0.7 % reduction should be applied to "measured" emissions to align them with the Commitment's basis. In this report, this adjustment has been applied to 2001 to 2003 data. For future years it was also agreed that this 0.7 % adjustment should be maintained unless new data is provided by the associations, that proves its inappropriateness.

### **2.12 Other Issues**

Nothing to report.

## **3 KEY ASSUMPTIONS TO THE AGREEMENT**

### **3.1 Availability of Enabling Fuels**

Statement on implication for the Commitment and justification

Nothing to report

<b>3.2 Distortion of Competition</b>
Statement on implication for the Commitment and justification

Nothing to report.

<b>3.3 Promotion of CO<sub>2</sub> efficient technologies</b>
Statement on implication for the Commitment and justification

Nothing to report.

<b>3.4 Acceptance of innovation</b>
Statement on implication for the Commitment and justification

Nothing to report.

#### **4 OTHER ISSUES**

<b>4.1 New Measures affecting CO<sub>2</sub></b>
Comment on impact of the issue and on implication for the Commitment

Nothing to report.

<b>4.2 New regulatory measures</b>
Comment on impact of the issue and on implication for the Commitment

JAMA anticipates that the End of Life Vehicle (ELV) Directives will have adverse implications for the fuel efficiency of cars, as it may limit in its opinion the use of certain light materials and technologies, while burdening significantly the companies. The Commission does not expect negative repercussions of the ELV Directive on the commitment.

<b>4.3 Fiscal Measures</b>
Comment on impact of the issue and on implication for the Commitment

Nothing to report.

<b>4.4 Breakthrough technologies</b>
Comment on impact of the issue and on implication for the Commitment

Nothing to report.

<b>4.5 Research programmes: Description and Future Potential</b>
Comment on impact of the issue and on implication for the Commitment

Nothing to report.

<b>4.6 Other measures - telematics, infrastructure, education</b>
Comment on impact of the issue and on implication for the Commitment

JAMA believes that measures such as the promotion of trade in purchase of new cars, presentations of correct and proper car maintenance methods, driver training, optimization of infrastructure, effective and efficient land use, and efforts to achieve a smoother traffic road will have a beneficial effect on CO<sub>2</sub> reduction. JAMA thinks that such measures should therefore be embraced in a positive manner under government lead and with the co-operation of the industrial sectors involved.

<b>4.7 Economic situation of the car industry</b>
Comment on impact of the issue and on implication for the Commitment

Nothing to report.

## 5 CONCLUSIONS

### 5.1 Progress Statement on Delivering the Agreement

In 2003, JAMA achieved the intermediate target range of 165 - 175 g CO<sub>2</sub>/km.

JAMA members continue to put more CO<sub>2</sub> efficient vehicles, which are also more attractive to the customers, in both petrol-fuelled cars and diesel cars.

In compliance with the provision of the Commitment to carry out a “Major Review” based on 2003 data and Article 10 of Decision 1753/2000/EC, issues related to the means actually used to achieve the identified reductions are discussed in Annex 3. The results of these investigations should be taken into account when interpreting the data and statements of this report.

### 5.2 Statement on Expected Future Progress of the Agreement

JAMA achieved the intermediate target range of 165 - 175 g CO<sub>2</sub>/km in 2002, one year earlier than estimated. The final target value of 140 g CO<sub>2</sub>/km in 2009 requires further serious effort to JAMA members. Emissions reductions will have to fall faster for the 2009 target (140 g CO<sub>2</sub>/km) to be met. For the 2009 target, annual emissions reductions will have to increase to an average reduction rate of between 3.0 % and 3.6 % per year over the period until 2009.

Importantly, and as agreed upon, this target will mainly be achieved by technological developments affecting different car characteristics and market changes linked to these developments. Regarding technological developments, JAMA reiterated that its members would aim at a high share of new cars equipped with CO<sub>2</sub> efficient technologies. Japanese automobile manufacturers have agreed to make every endeavor to contribute to the achievement of JAMA’s goals.

In summary, while the 2009 target remains extremely ambitious for JAMA, the 2003 monitoring report shows that JAMA is fully in line with its 2009 Commitment and, in the present circumstances, the Commission and JAMA have no reason to believe that JAMA would not live up to its Commitment.

**JAMA**  
**Data Annexes**



## **DATA ANNEXES (2003)**

### **Annex 1**

A1: SPECIFIC FUEL EFFICIENCY (L/100km) AND EMISSIONS OF CO<sub>2</sub> (g/km) AVERAGED OVER ALL NEWLY REGISTERED PASSENGER CARS FOR EACH DIFFERENT FUEL-TYPE, FOR THE EU AND EACH MEMBER STATE

A2: THE DISTRIBUTION OF CO<sub>2</sub> EMISSIONS (g/km) IN THE NEW PASSENGER CAR FLEET FOR EACH DIFFERENT FUEL TYPE, FOR THE EU

A3: THE DISTRIBUTION OF AVERAGED POWER AND ENGINE CAPACITY OF NEW PASSENGER CARS FOR EACH FUEL TYPE FOR THE EU-15 AND EACH MEMBER STATE

### **ANNEX 2: KEY DATA COMPARISON**

**ANNEX 3: MAJOR REVIEW OF JAMA'S COMMITMENT ON CO<sub>2</sub> EMISSION REDUCTIONS FROM PASSENGER CARS, INCLUDING AN ASSESSMENT IN ACCORDANCE WITH ARTICLE 10 OF DECISION 1753/2000/EC: JOINT CONCLUSIONS OF THE JAPAN AUTOMOBILE MANUFACTURERS ASSOCIATION AND THE COMMISSION SERVICES**

**A1: SPECIFIC FUEL EFFICIENCY (l/100km) AND EMISSIONS OF CO<sub>2</sub> (g/km)<sup>14</sup> AVERAGED OVER ALL NEWLY REGISTERED PASSENGER CARS<sup>29</sup> FOR EACH DIFFERENT FUEL-TYPE FOR THE EU AND EACH MEMBER STATE (CO<sub>2</sub> emissions are corrected by 0.7%)**

JAMA MEMBERS - 2003

	TOTAL	Identified version											Unknown		
		All Fuels		Petrol			Diesel			Petrol+Diesel				AFV	
		Number	average CO <sub>2</sub>	Number	average fuel	average CO <sub>2</sub>	Number	average fuel	average CO <sub>2</sub>	Number	average fuel	average CO <sub>2</sub>		Number	average CO <sub>2</sub>
<b>EU 15</b>		<b>1,692,807</b>	<b>172</b>	<b>1,215,679</b>	<b>7.2</b>	<b>170</b>	<b>477,128</b>	<b>6.7</b>	<b>177</b>	<b>1,692,807</b>	<b>7.0</b>	<b>172</b>			
A	50,762	50,725	174	22,066	7.1	169	28,659	6.7	178	50,725	6.9	174		37	
B	50,134	50,030	165	25,862	7.0	167	24,168	6.2	164	50,030	6.6	165		104	
DK	n.d.	21,746	166	18,990	7.1	168	2,756	5.5	146	21,746	6.9	166		n.d.	
F	n.d.	150,789	174	62,679	6.8	162	88,110	6.9	184	150,789	6.9	174		n.d.	
FIN	n.d.	44,740	175	41,548	7.4	175	3,192	6.7	179	44,740	7.3	175		n.d.	
GER	366,788	356,172	177	268,069	7.4	176	88,103	6.8	182	356,172	7.3	177		10,616	
GR	n.d.	46,691	167	45,809	7.1	168	882	5.9	158	46,691	7.0	167		n.d.	
IRE	41,794	41,519	165	38,347	6.9	164	3,172	7.0	185	41,519	6.9	165		275	
IT	261,690	261,475	158	156,946	6.5	154	104,529	6.2	164	261,475	6.4	158		215	
LUX	n.d.	4,463	183	2,148	7.6	181	2,315	6.9	184	4,463	7.3	183		n.d.	
NL	n.d.	79,055	170	70,545	7.2	169	8,510	6.4	171	79,055	7.1	170		n.d.	
POR	n.d.	25,561	152	18,197	6.4	151	7,364	5.9	156	25,561	6.2	152		n.d.	
SP	144,594	108,297	179	48,533	7.3	172	59,764	6.9	184	108,297	7.1	179		36,297	
SW	39,688	39,611	190	38,683	8.0	190	928	8.4	222	39,611	8.0	190		77	
UK	n.d.	411,933	176	357,257	7.3	174	54,676	7.0	187	411,933	7.3	176		n.d.	

n.d. no data delivered

<sup>29</sup> Due to possible data implausibility the following vehicles from Member States data were not taken into account: 557 vehicles with an emission below 80 g/km, 766 retrofitted AFV

A2: THE DISTRIBUTION OF CO<sub>2</sub> EMISSIONS (g/km)<sup>30</sup> IN THE NEW PASSENGER CAR FLEET<sup>31</sup> FOR EACH DIFFERENT FUEL TYPE

JAMA MEMBERS – 2003

CO <sub>2</sub> - Category	All fuels		Petrol		Diesel		Petrol + Diesel		AFV	
	Number	Average CO <sub>2</sub>	Number	Average CO <sub>2</sub>	Number	Average CO <sub>2</sub>	Number	Average CO <sub>2</sub>	Number	Average CO <sub>2</sub>
<60										
60-80										
81-100	41	99	38	99	3	97	41	99		
101-120	74,638	117	29,779	117	44,859	117	74,638	117		
121-140	238,660	133	192,188	134	46,472	128	238,660	133		
141-160	435,614	152	343,349	151	92,265	153	435,614	152		
161-180	355,879	171	251,649	171	104,230	171	355,879	171		
181-200	272,330	190	164,691	189	107,639	190	272,330	190		
201-250	221,905	218	205,075	217	16,830	236	221,905	218		
251-300	87,693	271	24,816	277	62,877	269	87,693	271		
301-350	5,586	326	3,641	319	1,945	340	5,586	326		
351-450	434	391	427	391	7	378	434	391		
>450	26	472	26	472			26	472		

<sup>30</sup> The data of table A2 are not adjusted by 0.7 % for cycle change because not all Member States submitted the necessary data. The effect of the adjustment would be for volumes to move into lower categories (e.g. 140 g & less cars would increase in volume as a % of total).

<sup>31</sup> Due to possible data implausibility the following vehicles from Member States data were not taken into account: 557 vehicles with an emission below 80 g/km, 766 retrofitted AFV

**A3: THE DISTRIBUTION OF AVERAGED POWER AND ENGINE CAPACITY OF NEW PASSENGER CARS<sup>32</sup> FOR EACH FUEL TYPE FOR THE EU-15 AND EACH MEMBER STATE<sup>33</sup>**

JAMA MEMBERS - 2003

Member state	Power [kW]					Capacity [cm <sup>3</sup> ]				
	Total	Petrol	Diesel	Petrol+Diesel	AFV	Total	Petrol	Diesel	Petrol+Diesel	AFV
<b>EU-15</b>	<b>77</b>	<b>75</b>	<b>82</b>	<b>77</b>		<b>1700</b>	<b>1550</b>	<b>2062</b>	<b>1700</b>	
A	78	72	83	78		1810	1494	2054	1810	
B	76	74	78	76		1704	1501	1922	1704	
DK	77	78	71	77		1610	1586	1777	1610	
F	79	71	84	79		1834	1427	2124	1834	
FIN	84	85	83	84		1692	1658	2128	1692	
GER	82	81	86	82		1743	1629	2089	1743	
GR	75	75	83	75		n.d.	n.d.	n.d.	n.d.	
IRE	58	57	72	58		1512	1457	2181	1512	
IT	69	65	76	69		1555	1327	1897	1555	
LUX	88	89	87	88		1915	1672	2139	1915	
NL	77	76	84	77		1608	1554	2054	1608	
POR	69	64	80	69		1478	1318	1873	1478	
SP	84	83	85	84		1929	1621	2179	1929	
SW	92	91	99	92		1851	1836	2574	1851	
UK	77	75	93	77		1679	1600	2196	1679	

<sup>32</sup> Due to possible data implausibility the following vehicles from Member States data were not taken into account: 557 vehicles with an emission below 80 g/km, 766 retrofitted AFV

<sup>33</sup> Because of some data implausibility with regard to the mass data submitted by Italy and its relevance for the EU15 overall average, mass data are not shown here.

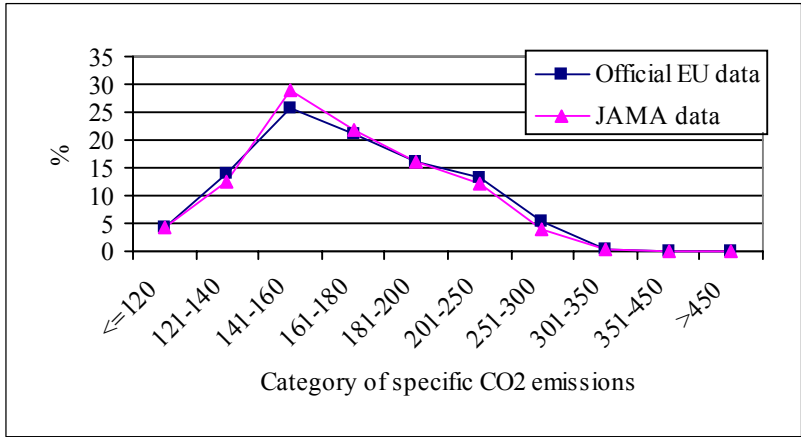
**ANNEX 2: Key Data Comparison**  
**EU 2003 & JAMA 2002 and 2003 key data**

	Differences JAMA 2003 and EU data	EU data: 2003	JAMA data: 2002	JAMA data: 2003
CO <sub>2</sub> emissions (CO <sub>2</sub> /g/km) <sup>34</sup>				
Petrol + Diesel	0.3 %	172.0	173.6	170.5
Petrol	0,3 %	170.0	171.7	169.5
Diesel	2.4%	177.2	179.6	173.0
Total Car Registrations (million units)	1.2%	1.69	1.57	1.67
Distribution of CO <sub>2</sub> emissions by CO <sub>2</sub> category (% share of petrol + diesel registrations) <sup>35</sup> :				
120g & less		4.4	2.8	4.3
121-140g		14.1	13.0	12.5
141-160g		25.7	26.4	28.9
161-180g		21.0	22.0	21.9
181-200g		16.1	16.5	16.2
201-250g		13.1	14.7	12.0
251-300g		5.2	3.9	3.8
301-350g		0.3	0.7	0.4
351-450g		0	0 (0.02)	0 (0.02)
Mass (kg) <sup>36</sup> :				
Petrol + Diesel	/		1220	1252
Petrol	/		1146	1174
Diesel	/		1468	1458
Power (kW):				
Petrol + Diesel	2.5%	77	77	79
Petrol	3.8%	75	76	78
Diesel	1.2%	82	82	81
Capacity (cm <sup>3</sup> ):				
Petrol + Diesel	0.7%	1700	1666	1688
Petrol	0.3%	1550	1533	1554
Diesel	1.7%	2062	2104	2027

<sup>34</sup> Data corrected by 0.7% for cycle adjustment.

<sup>35</sup> It is not possible to adjust the official EU CO<sub>2</sub> category distribution data for the 0.7 % cycle adjustment. If such an adjustment were feasible, the effect would be for volumes to move into lower categories (e.g. 140 g & less cars would increase in volume as a % of total).

<sup>36</sup> Comparison between data of JAMA and EU is not possible. Decision 1753/2000/EC defines the data to be delivered. EU data on mass is being re-checked by Commission. There is concern that in some Member States reporting of mass is not in compliance with Decision 1753/2000/EC. JAMA data are based on the basis of curb weight, and is not in accordance with the definition given in Decision 1753/2000/EC anyway.



**Figure 10: Distribution of CO<sub>2</sub> emissions by CO<sub>2</sub> categories – official EU data and JAMA data**

### **ANNEX 3: Major Review of JAMA's Commitment on CO<sub>2</sub> Emission Reductions from Passenger Cars, including an assessment in accordance with Article 10 of Decision 1753/2000/EC: Joint Conclusions of the Japan Automobile Manufacturers Association and the Commission Services**

#### **Section 1: Background**

JAMA's voluntary Commitment to reduce new passenger car CO<sub>2</sub> emissions contains the obligation to carry out, based on 2003 data, a "Major Review". This Major Review should address the following provision:

*"JAMA is willing to contribute to a periodic monitoring of its commitments, jointly undertaken by JAMA and the Commission ----. This should include a joint "Major Review" – covering both JAMA and non-JAMA developments. This would incorporate the results of CO<sub>2</sub> emission reductions up to and including calendar year 2003, including comparison of that year's fleet average to the estimated target range."*

With regard to this estimated target range, the JAMA Commitment states:

*"Given all uncertainties and the lead –time necessary for introducing new technologies and models, JAMA considers an appropriate estimated target for 2003 to be within the range of 165-175 g CO<sub>2</sub>/km."*

Moreover it is explained in the Annex that:

*"The reduction in CO<sub>2</sub> emissions will not be linear; the pace will notably depend on the timing of availability of the enabling fuels on the market as well as on the lead-times for new technologies and products and their market penetration. The reduction profile is therefore expected to be relatively slow initially and to gather pace later."*

Article 10 of Decision 1753/2000/EC<sup>37</sup> requires that:

*"The reports for intermediate target years and the final target year will indicate whether the reductions are due to technical measures taken by the manufacturers or to other measures such as changes in consumer behaviour."*

Since the evaluations to be carried out under the "Major Review" and under Article 10 are partly overlapping a joint assessment has been carried. This work was supported by studies and service contracts<sup>38</sup>.

#### **Section 2: Observed CO<sub>2</sub> values and main JAMA Achievements with respect to its CO<sub>2</sub> Commitment**

Without further analysis it can be clearly established that JAMA has met a number of the undertakings made in its Commitment:

- in 2000, several models were brought to market of 120 g CO<sub>2</sub>/km or less and the number of models increased since then;
- in late Autumn 2003, JAMA provided to the Commission, its Potential Reduction Review statement on the potential to move further towards the Community target of 120 g CO<sub>2</sub>/km in 2012;
- JAMA contributed to a transparent monitoring of the Commitment.

In addition the observed CO<sub>2</sub> values fell into the intermediate target range of 165-175 g CO<sub>2</sub>/km in Year 2002, and in 2003 the observed value was well below 175 g CO<sub>2</sub>/km (see 2003 data, as presented in the 2004 Joint Report). Moreover, JAMA's prediction that the reduction in CO<sub>2</sub> emissions will not be linear turned also out to be correct, although only slight variations in the reduction rates have been observed up to now.

<sup>37</sup> Decision No 1753/2000/EC of the European Parliament and of the Council of 22 June 2000 establishing a scheme to monitor the average specific emissions of CO<sub>2</sub> from new passenger cars. *Official Journal L 202*, 10/08/2000 P. 0001 - 0013

<sup>38</sup> DLR service contract contribution: "Preparation of the 2003 review of the commitment of car manufacturers to reduce CO<sub>2</sub> emissions from M1 vehicles - Final Report of Task A (Article 10)"

Two crucial question questions have been addressed in the course of the “Major Review”/Article 10 work:

- 3) Have there been obstacles in the operating environment, for which JAMA cannot be held accountable, but which hampered its efforts to meet the Commitment, or which caused underperformance? This question is addressed in Section 3.
- 4) Have factors other than technological developments by JAMA members resulted in changes of the specific CO<sub>2</sub> emissions of new passenger cars? This question is addressed in Section 4.

The answers to these questions are important in answering whether or not the observed CO<sub>2</sub> reductions can be fully counted towards the achievement of the JAMA members, and whether or not JAMA could have achieved more, but obstacles in the operating environment.

**Section 3: Operating Environment**

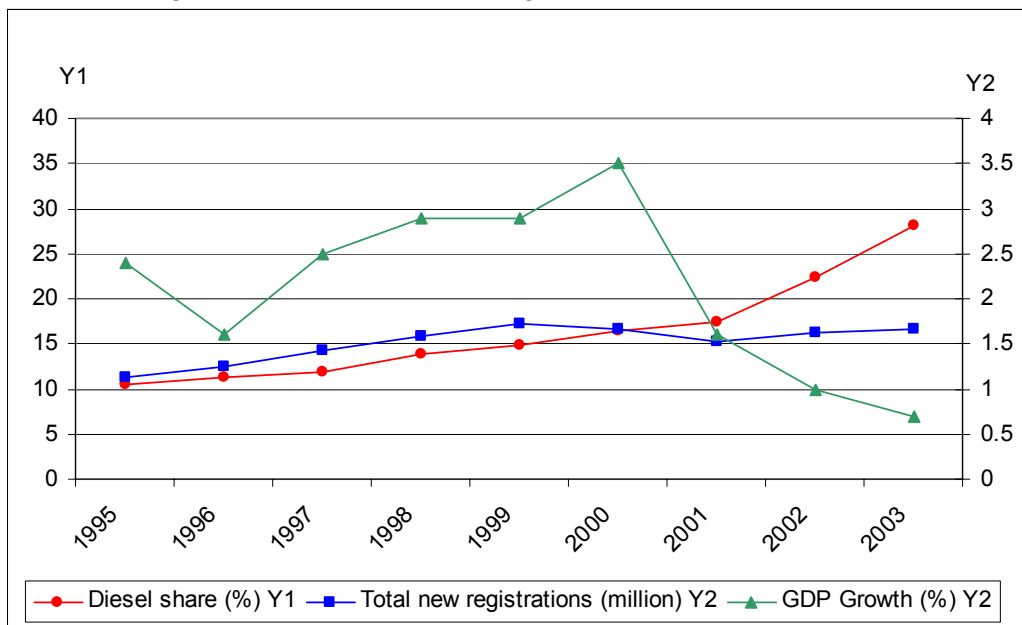
The text of the Commitment lists a number of assumptions made by JAMA at the point of signature. These assumptions mainly concern:

- i. The economic situation
- ii. Enabling fuels
- iii. Regulatory conditions
- iv. Unhampered diffusion of technology and acceptance of innovations

If the assumptions are met it is assumed that no obstacles have occurred in the period cover by the “Major Review”.

**Economic Situation**

The performance of the automotive industry and its capability to invest in technological innovations is dependent on a strong & healthy macro-economy. This also facilitates the market take-up of advanced, and typically more expensive, technologies. While the economic conditions were favourable in the beginning, since 2001 the European economic environment has been weak and 2003 was the third consecutive year of subdued GDP growth. This caused a levelling-off of total sales.



This resulted in a slight levelling-off of the sales of JAMA’s member companies which, however, could at the same time increase their share of the EU 15 market.



## **Enabling Fuels**

The Commitment is based on fuel qualities as laid down in Directive 98/70/EC. Moreover, JAMA assumed that the marketed fuels would have a sulphur content of 30 ppm in 2005 (instead of 50 ppm as laid in the Directive). The Commission's fuel quality monitoring<sup>39</sup> shows full compliance with Directive 98/70/EC. Moreover, a few Member States already started to introduce low sulphur fuels with a sulphur content of 10 ppm, i.e. better than assumed by JAMA.

<b>EU</b>	<b>Average Sulphur Content, ppm</b>		
<b>Fuel / Year</b>	<b>2001</b>	<b>2002</b>	<b>2003*</b>
<i>Petrol</i>	68	51	31
<i>Diesel</i>	223	169	102

\*Excludes Belgium, France, Luxembourg and Spain.

JAMA is in general satisfied with the fuel qualities provided in the Review period.

## **Automotive Regulations**

The Commitment was made in 1999. According to the Commission, since that point of time, in the review period no new EU regulation relevant for CO<sub>2</sub> emissions came into effect.

JAMA is currently investigating this issue focusing on the potential impacts of legislation on emissions, safety, recycling and other legislative developments over the whole Commitment period as well as their implications for the move towards the Community objective of 120 g/km in 2012.

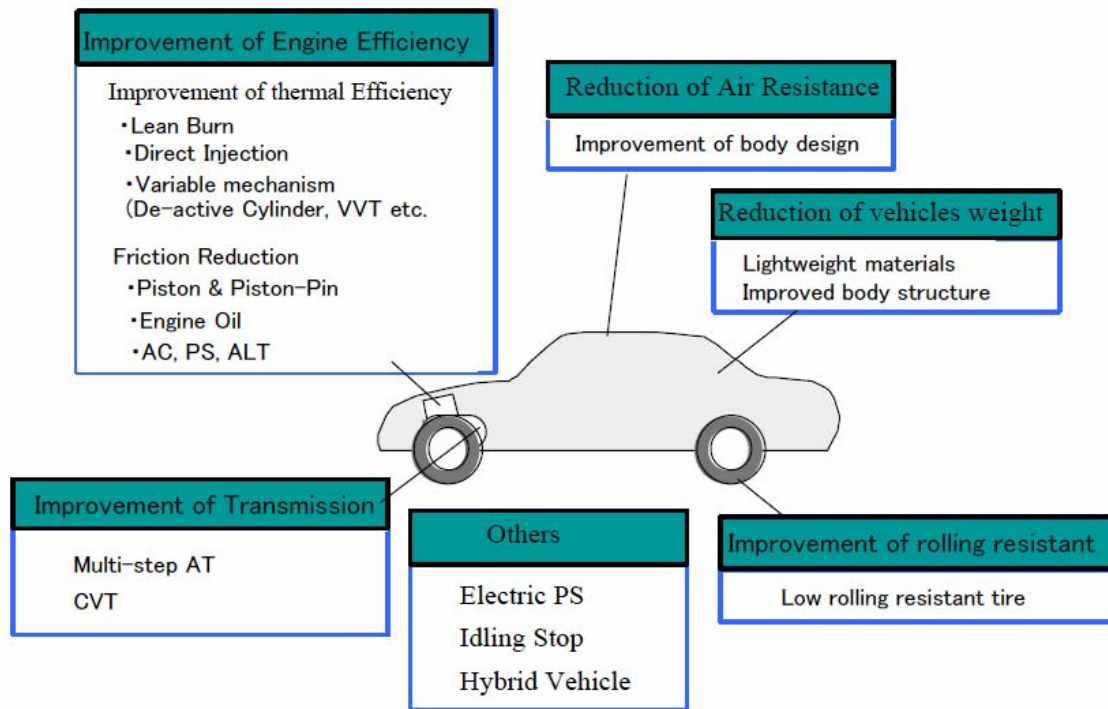
## **Technologies and innovations**

Since 1995, JAMA members have been launching a wide range of fuel efficiency improvement technologies such as direct-injection diesel engines, direct-injection gasoline engines, Continuous Variable Transmission (CVT), and other improvements in engine efficiency as well as reductions in vehicle weight, as shown in the Figure below. The direct-injection diesel engine has achieved a penetration ratio of 78%, making it the main diesel engine technology. Moreover, several gasoline hybrid vehicles with low CO<sub>2</sub> emissions have been

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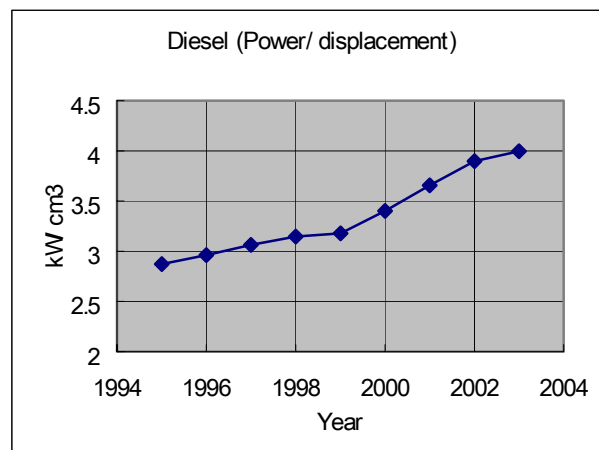
<sup>39</sup> COM(2004)310

introduced.



JAMA draws special attention to the great improvements of diesel-powered vehicles. For example, as shown in the Figure below, trends in specific output power, which is one of the features that appeals to customers, reveals an improvement of approximately 50 %, from 2.9 kW/cm<sup>3</sup> in 1995 to 4 kW/cm<sup>3</sup> in 2003.

Figure: Power/Displacement of Diesel Vehicles



**Section 4: Other factors than technological developments**

On behalf of the Commission DLR has investigated whether other factors beside technological developments have contributed to the observed reductions of the CO<sub>2</sub> emissions of new passenger cars. For this purpose DLR applied descriptive and econometric methods. The conclusions drawn from these investigations are as follows:

## Technical influences

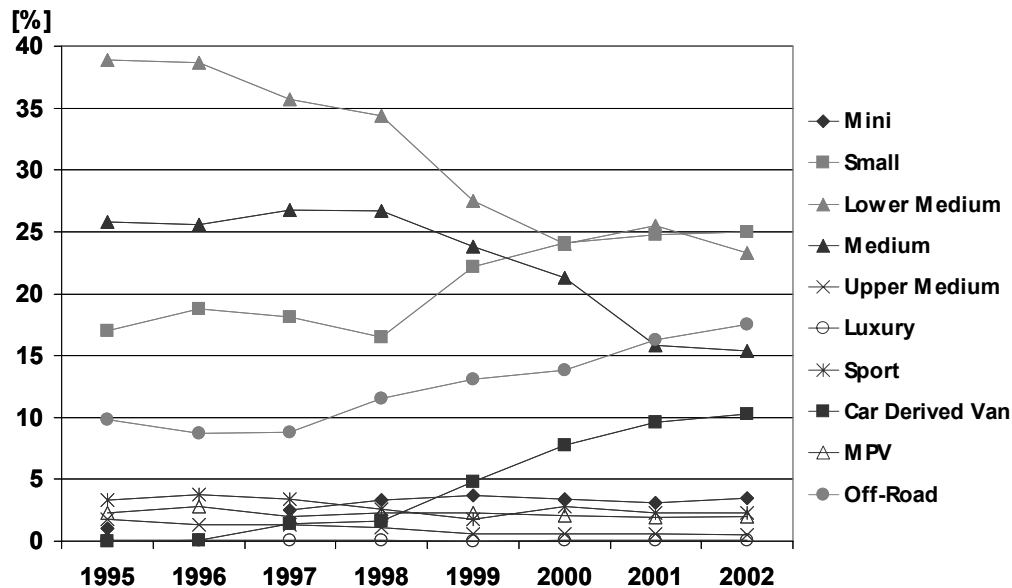
Remarkable changes in the use of technologies for the reduction of the fuel consumption for new passenger cars have been observed within the period under investigation. In so far DLR confirms the observations presented under Section 3. The identified improvement in diesel technology is larger than in petrol technology. While the identified improvement in the individual segments ranges from 1.2 % to 19.9 % for petrol vehicles, it ranges from 6.5 % to 35.5 % for diesel vehicles<sup>40</sup>. However, a quantification of the influence of individual technologies on the specific fleet average was not possible.

## Non-technical influences

Non-technical influences with a potential to affect the behaviour of car purchasers were analysed: politically motivated measures such as taxes and car labelling but also socio-economic trends, e.g. fuel prices, per capita GDP, and other factors like the model range offered by the manufacturers. The effect of these variables on JAMA's average specific CO<sub>2</sub> emissions was analysed with the following results:

### Influences with respect to the model range:

For JAMA's car fleet some changes have been observed between 1996 and 2002<sup>41</sup>. Most significant is the growth of Car Derived Vans (from 0.1 % of all new registrations in 1996 to 10.3% in 2002) and Off-Road cars (8.5 % to 17.5 %). On the other hand a decreasing trend is seen for the share of the Lower Medium (38.2 % to 23.3 %) and Medium segment (25.3 % to 15.4 %)



Moreover, a trend towards higher powered cars (except Off-Road cars) and towards an increase in diesel versions has been observed. Furthermore, gaps in model range were closed. Reductions in the specific CO<sub>2</sub> emissions appeared for nearly all segments. The Off-Road and the Small segment show above average reduction rates. Overall, CO<sub>2</sub> reductions of diesel cars were on a much higher level than for petrol cars but the absolute emission value remained still above the petrol number in 2002.

Holding the shares of segment and power groups fixed by 1996 and attributing them to the specific emissions of 2002, does not affect the average petrol emission significantly. Diesel emissions, however, jump up from 180.5 to 193.7 g/km. Here, the absence of relatively low emitting diesel segments like Small and Car Derived Vans is reflected. Due to the low proportion of diesel cars, the overall average emission for JAMA changed only slightly by 0.7 g to 174.7 g/km.

<sup>40</sup> This calculation excludes segments that do not have a representative number of registrations

<sup>41</sup> Due to high inconsistencies data for 1995 could not be used. Detailed registrations data for 2003 were not available in due time.

Taken the increasing diesel share into account, the average value would increase further by 2.6 g to 177.3 g/km. Therefore, the total average CO<sub>2</sub> emissions would have been 3.3 g higher than the original value if specific CO<sub>2</sub> reductions and the diesel share had developed as they did but the segment structure remained constant.

Considerable changes in consumer behaviour for JAMA automobiles could not be identified. Those changes that are observed corresponded primarily to the structure of the model range. Hence, observed changes in CO<sub>2</sub> are rather influenced by the model policies of manufacturers.

Influences with respect to car labelling: The effectiveness of the car labelling Directive 1999/94/EC is currently being assessed as part of the implementation of Article 9 of this Directive. Although no final assessment is available at this point of time, all information indicates that the car labelling Directive had, up to now, only negligible effects on consumer's car choice and did therefore not contribute to the observed reduction in specific CO<sub>2</sub> emissions.

Influences with respect to the GDP per capita, fuel prices and circulation taxes:

Several attributes were included as variables in the models and, after a pre-assessment of results, the parameters per capita GDP, fuel prices and circulation taxes were selected for more detailed scenario analysis to understand the extent to which changes in these variables could affect average CO<sub>2</sub> emissions. DLR's analysis calculates differences in hypothetical CO<sub>2</sub> values that would result in that year given different values for per capita GDP, fuel prices and circulation taxes. Overall, the investigation finds some evidence of positive and negative influences of non-technical factors on average CO<sub>2</sub> emissions. Given the magnitude and mixture of effects, as well as the associated uncertainties, DLR could not identify any significant influence of the pre-selected variables.

In summary, taking all investigations carried out together, DLR could not find evidence that the observed total reductions of JAMA's CO<sub>2</sub> fleet average was significantly influenced by other factors than technological developments.

## **Section 5: Outlook**

JAMA used the occasion of the "Major Review" to draw attention to a number of aspects which are of importance for the achievement of the 140 g/km target in 2009:

- Fuels: JAMA underlines that a satisfactory availability of 10 ppm fuels is essential, starting in January 2005, in order to comply with the stringent EU emission regulations.
- Safety measures: JAMA aims at complying with EURO NCAP and expects that in future is likely to see even more requirements concerning safety in future that may act as negative factors on the reduction of CO<sub>2</sub>.
- Emission regulations: EURO 4 was known when the Commitment was signed and will take effect in 2005. However, future regulations (EURO 5) might have negative effects on CO<sub>2</sub> emissions, especially with regard to the fuel-efficiency of diesel vehicles.

The Commission and JAMA agree that the repercussions of such regulations are and will taken into account in the monitoring process.

Drawing attention to these points does not mean that JAMA has currently any reason to believe that it would not live-up to its Commitment.

## **Section 6: Conclusions**

The Commission and JAMA agree that, over the 1995-2003 period:

- a) The reduction in specific CO<sub>2</sub> emissions has been overwhelmingly achieved by technological developments. The market changes observed did not influence the CO<sub>2</sub> emissions significantly. In any case it is very difficult to distinguish between market changes caused by technology and market changes caused by other reasons, e.g. general consumer behaviour, economic situation, fuel prices, fiscal measures, availability of consumer information, mainly for two reasons: the market changes observed in the period 1995 to 2003 are relatively small and CO<sub>2</sub> relevant technological developments penetrated nearly all vehicle categories.
- b) In the light of these findings it can be stated that all applicable undertakings specified in JAMA's CO<sub>2</sub> Commitment have been met.
- c) The assumptions listed by JAMA in its Commitment have been met and the environment under which its members are operating has not prevented JAMA from meeting its Commitment.
- d) JAMA draws attention to a number of points which are of importance for the delivery of the 140 g CO<sub>2</sub>/km target. In the light of these and other factors, the 2009 target remains extremely ambitious for JAMA. On the other hand, the 2003 monitoring report shows that JAMA is fully in line with its 2009 Commitment and, in the present circumstances, the Commission and JAMA have no reason to believe that JAMA would not live up to its Commitment..

In summary, JAMA and the Commission conclude that JAMA has, during the period 1998 to 2003, met all the obligations stated in their Commitment. The Japanese car industry has, in doing so, delivered a sizeable contribution to the EU's strategy for reducing greenhouse gas emissions and to its Kyoto reduction objectives.

**Monitoring of KAMA's Commitment on CO<sub>2</sub> Emission  
Reduction from Passenger Cars  
(2003)**

**Final Report  
5 October 2004**

**Joint Report  
of the  
Korea Automobile Manufacturers Association  
and  
the Commission Services**

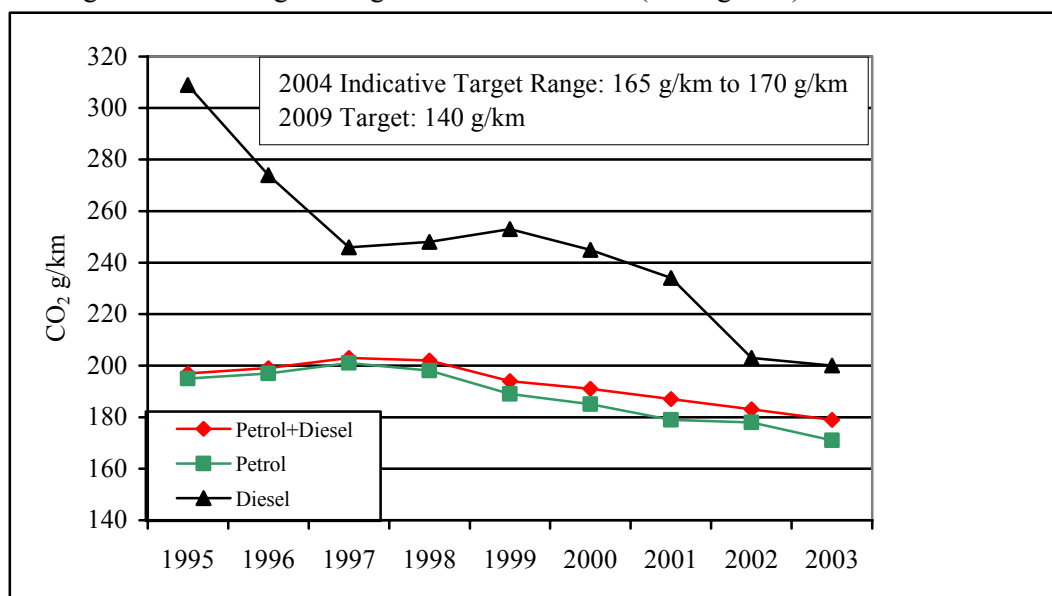
**Monitoring of KAMA<sup>42</sup>'s Commitment<sup>43</sup> on CO<sub>2</sub> Emission Reduction from Passenger Cars  
JOINT REPORT OF KAMA AND THE COMMISSION SERVICES<sup>44</sup>: YEAR 2003 REPORT**

*1.1.1.1 ES SUMMARY OF PROGRESS IN DELIVERING THE COMMITMENT*

**E1 Trends in specific emissions of CO<sub>2</sub> (g/km)**

KAMA reduced the average CO<sub>2</sub> emission of its new passengers car fleet registered in the EU market to 179 g CO<sub>2</sub>/km in 2003,<sup>45</sup> from 197 g CO<sub>2</sub>/km in 1995 and 183 g CO<sub>2</sub>/km in 2002. This represents a reduction of 9.1 % over the whole monitoring period of 1995 to 2003 and 2.2 % over the period<sup>46</sup> 2002 to 2003<sup>47</sup>.

Average specific CO<sub>2</sub> emission from petrol-fuelled cars fell from 195 g CO<sub>2</sub>/km in 1995 to 171 g CO<sub>2</sub>/km in 2003 (a 12.3 % drop). Even though average specific CO<sub>2</sub> emissions from diesel-fuelled cars fell from 309 g CO<sub>2</sub>/km in 1995 to 201 g CO<sub>2</sub>/km in 2003 (a significant 35.0 % drop), it should be reduced more by using fuel-efficient engines for meeting the targets of 2004 and 2009 (see Figure 1).



**Figure 1: EU Trends of KAMA's Fleet in Specific Average Emissions of CO<sub>2</sub>**

**E2 Trends in specific fuel consumption by fuel type (l/100km)**

Specific fuel consumption (litres/100 km) of petrol engine and diesel engine is proportional to their CO<sub>2</sub> emissions - the lower the fuel consumption, the lower the emissions.

Total fuel consumption for petrol and diesel fuelled cars combined decreased from 8.2 l/100 km in 1995 to 7.3 l/100 km in 2003.<sup>48</sup>

<sup>42</sup> KAMA represents the Korea Automobile Manufacturers Association of Hyundai Motor Company, KIA Motors Corporation, GM Daewoo Auto & Technology Company, Renault Samsung Motor Company, and Ssangyong Motor Company.

<sup>43</sup> As recognized by the European Commission in the Recommendation of 13 April 2000 on the reduction of CO<sub>2</sub> emissions from passenger cars (2000/303/EC). Hereafter referred to as "The Commitment".

<sup>44</sup> Hereafter often referred to as "The Commission".

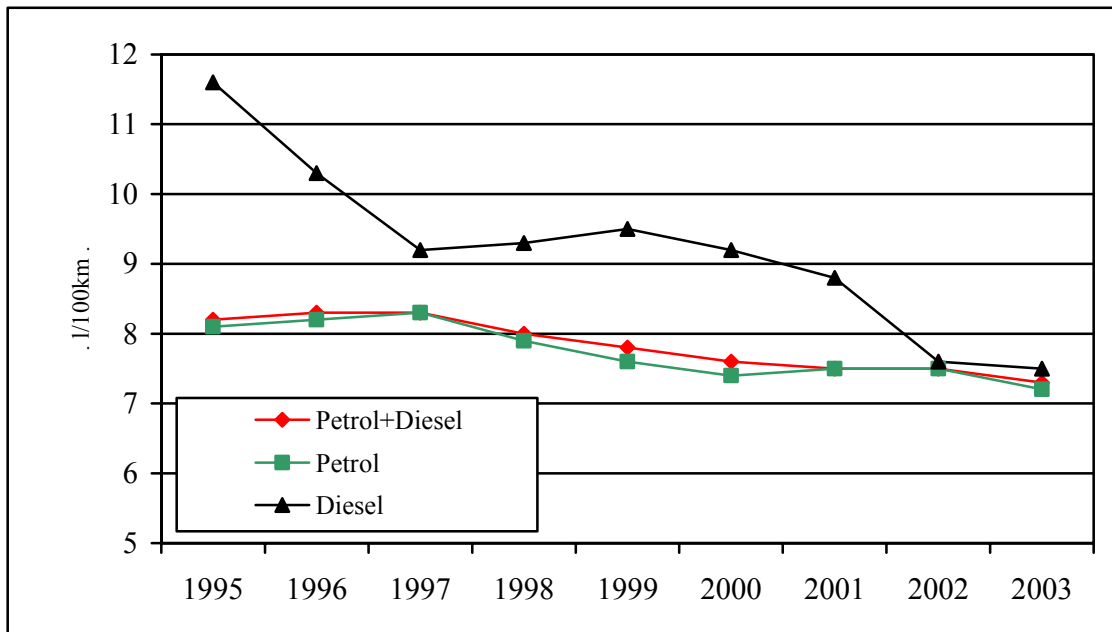
<sup>45</sup> All CO<sub>2</sub> performance figures from 2001 for KAMA have been corrected by 0.7% under the consideration of new test cycle, as to bring them in line with the amended Directive 93/116/EC on which the Commitment is based (see Section 2.11).

<sup>46</sup> All percentage figures are based on rounded numbers.

<sup>47</sup> For 2002 and 2003, official EU data are used in the Joint Monitoring Report since, according to the Joint Monitoring System, the monitoring has to be based on the data delivered under Decision 1753/2000EC. According to this scheme prior 1995-2001 monitoring was based on data provided by KAMA.

<sup>48</sup> The following conversion factors were used for the calculation of specific fuel consumption (l/100km) from specific

Petrol passenger cars, which occupied most of KAMA's sales volumes over the reporting period, consumed about 8.1 l/100 km in 1995, which decreased to 7.2 l/100 km in 2003. Diesel cars consumed an average of 11.6 l/100 km in 1995, decreasing to 7.5 l/100 km in 2003 (see Figure 2).



**Figure 2: Trends in KAMA's Fleet in Specific Average Fuel Consumption, by Fuel Type**

### **E3 Trends in physical fleet characteristics**

The average power for newly registered cars has increased by 2.9 % between 2002 and 2003. As regards power increase, even though fuel-efficiency improvements were made, KAMA believes that customers also sought better vehicle driveability and performance that led to the overall power increase from 68 kW in 2002 to 70 kW in 2003. While the average power of petrol cars increased from 62 kW to 64 kW between 2002 and 2003, the power of diesel cars rose from 85 kW to 87 kW for the same period.

There are no official average mass data available for 2002. Moreover, the mass data presented by the association for the period 1995 to 2001 are based on a different definition of mass. Therefore it is difficult to show continuous trend data.

The average engine capacity has increased by 5.6 %– from 1,546 cm<sup>3</sup> in 2002 to 1,632 cm<sup>3</sup> in 2003. While the engine capacity of petrol cars increased from 1,357 cm<sup>3</sup> to 1,404 cm<sup>3</sup> between 2002 and 2003, the engine capacity of diesel cars slightly increased from 2,195 cm<sup>3</sup> to 2,209 cm<sup>3</sup> for the same period. As regards average engine capacity increase, even though fuel-efficiency improvements were made, the increase of medium size vehicles during the monitoring period of 2002 and 2003 mainly contributed to the increase of engine capacity.

Although general trends in physical characteristics show an overall increase in engine power and capacity within the monitoring period, total fuel consumption for petrol- and diesel-fuelled cars combined decreased with reduction of average mass and application of various technological developments.

### **E4 Technical developments introduced to reduce CO<sub>2</sub> emissions**

In addition to meeting emission regulations (EURO III & IV) and OBD (On Board Diagnostics) regulation in place in the EU, KAMA members tried to reduce CO<sub>2</sub> emissions and improve fuel economy with various technical developments.

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CO<sub>2</sub> emission (g/km) : petrol 23.7 and diesel 26.6



KAMA members tried to reduce CO<sub>2</sub> emissions by applying new technologies such as advanced torque based actuator control, advanced knock control, combustion improvement, engine friction reduction, variable geometry intake system, variable geometry timing system, variable geometry turbocharger, CVVT (Continuously Variable Valve Timing), cooled EGR (Exhaust Gas Recirculation), fuel-cut range increase, weight reduction, swirl control system, multi-hole injector, low friction piston ring, High Speed Diesel Injection (HSDI) engine with cooled EGR and VGT (Variable Geometry Turbocharger), motor driven power steering, drag reduction, low friction tire, and FGR (Final Gear Ratio) tuning, and automatic transmission efficiency improvement within the reporting period.

KAMA members introduced these newly developed vehicles in the EU market from 2001. As a result, the share of diesel cars with CO<sub>2</sub> level of 121 - 160 g CO<sub>2</sub>/km category has increased from 1,455 units in 2001 and 15,919 units in 2002 to 21,615 units (up by 1,386 %) in 2003. HSDI diesel engines were introduced in 2001, increasing from a 0.4 % to 26.2 % share of total KAMA sales volume in the period 2001 to 2003; the volume will steadily increase and contribute to a remarkable reduction of CO<sub>2</sub> in the EU market.

In order to introduce low emission cars, KAMA members developed diesel passenger cars of small displacement with common rail (2<sup>nd</sup> generation HSDI engines) that was launched on the EU market in 2003.

#### **E5 Brief overall assessment on progress in relation to the target**

Mainly due to the application of new technologies such as advanced torque based actuator control, variable combustion improvement, variable intake manifold system, CVVT (Continuously Variable Valve Timing) system, advanced knock control, swirl control system, six-hole injector, increase the range of fuel-cut, weight reduction, low friction piston ring, and HSDI diesel engine with cooled EGR and VGT, etc. on the EU market, a reduction of average specific CO<sub>2</sub> emissions was accomplished from 197 CO<sub>2</sub> g/km to 179 g CO<sub>2</sub>/km between 1995 and 2003.

To achieve the CO<sub>2</sub> emission targets agreed upon in the Commitment by 2004 and 2009, KAMA members have begun to concentrate on developing fuel-efficient car technologies such as, inter alia, 2<sup>nd</sup> generation HSDI engine, GDI (Gasoline Direct Injection) engine, DCT (Dual Clutch transmission), CVT (Continuously Variable Transmission), 5&6-speed automatic transmission, weight reduction, and reduction of drag force.

As the total sales volume in 2003 rose by 30.2 %, the sales volume of petrol vehicles increased by 23.5 % and diesel registrations rose sharply by 54.3 % in the period 2002 to 2003. Even though the sales volume is very small, KAMA members launched one car model emitting less than 120 g CO<sub>2</sub>/km on the EU market in 2003. In doing so KAMA met an important point of its Commitment.

As the fleet composition in the EU is mainly composed of fuel-efficient diesel and the sales volume of diesel has been constantly increased to over 47 % of total sales in 2003, so KAMA manufacturers will introduce the 2<sup>nd</sup> generation HSDI engine for small size passenger cars to reduce the CO<sub>2</sub> emission. To meet the target in 2004 and 2009, it is necessary for KAMA members to increase the number of cars emitting less than 120g/km and KAMA members have to increase their annual average reduction rates to around 3.9 % by 2004 and 3.6 % by 2009<sup>49</sup> during the remaining period of the Commitment. As the Commission and KAMA agree that only with significant and additional efforts will the targets be met, KAMA members will try to invest in development of the fuel-efficient car segments to meet the target in 2004 and 2009.

In summary, KAMA has currently no reason to believe that KAMA will not live up to its Commitment. However, KAMA and the Commission are aware of the fact that KAMA has to accelerate significantly the introduction of fuel-efficient technologies for petrol and diesel engines for this purpose.

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<sup>49</sup> This value is not a compound rate value but a simple arithmetic average value.

# 1. MONITORING OF TECHNOLOGICAL DEVELOPMENTS AFFECTING THE COMMITMENT

## 1.1 Commitment Initiatives

1.1.1 Brief Description of current R&D programmes

1.1.2 Other

KAMA members consider investments into R&D as a key element for meeting the CO<sub>2</sub> emissions targets of 2004 and 2009. They have already started new R&D projects aiming at reducing passenger car's CO<sub>2</sub> emission as well as other emissions.

Korean government implemented plans to allow the domestic sale of diesel passenger cars satisfying EURO-III emission regulation from 2005 and EURO-IV emission regulation from 2006. So far KAMA members launched diesel passenger cars on the EU market without the base of a domestic market due to stringent emission regulation of diesel passenger car in Korea. Hereafter the R&D activities of KAMA members will be increased and low CO<sub>2</sub> emitting diesel passenger cars are expected to be of relative popularity in Korea in future. This is expected to contribute remarkably to CO<sub>2</sub> reduction.

## 1.2 Technological Developments

1.2.1. Description of fuel efficiency characteristics of new technologies, alternative concepts

1.2.2. Availability of New Technologies

1.2.3. Availability of low emission passenger cars (e.g. emitting 120 g/km or less)

1.2.4. Availability of alternative concept passenger cars

1.2.5. Availability of innovative concept passenger cars

KAMA members have committed themselves to achieve the target and are running several R&D programmes. KAMA is convinced that these programmes will contribute to further reducing specific CO<sub>2</sub> emission to meet the target.

The technological activities can be divided into 5 major categories; Engine Programme, Transmission Programme, After-Treatment Improvement Programme, Car Weight Reduction Programme, and Reduction of Resistances Programme.

KAMA members have a plan to reduce CO<sub>2</sub> emission by 2004 and 2009 with some strategies such as applying new specific technologies to petrol and diesel engines, transmission, reducing resistance and drag, and weight reduction, etc.

### Engine Programme

In order to meet the targets by 2004 and 2009, KAMA members have a plan to reduce CO<sub>2</sub> significantly with applying new technologies to petrol engine such as dual CVVT, aluminium cylinder block, engine friction reduction and direct injection, and also applying new technologies to diesel engine such as downsizing, combustion improvement, engine friction reduction, and ISG (Idle Stop & Go) system.

KAMA members are trying to develop higher performance and lower CO<sub>2</sub> emission engines. KAMA members have introduced various kinds of technological developments to reduce CO<sub>2</sub> emissions over the monitoring period as follows.

- Advanced torque based actuator control
- Variable geometry intake system
- Combustion improvement
- CVVT
- Advanced knock control
- Fuel-cut range increase

- Swirl control system
- Six-hole injector
- Low friction piston ring
- Weight reduction
- HSDI diesel engine with cooled EGR and VGT

The new technologies and products launched by KAMA members have resulted in recent CO<sub>2</sub> reduction performance. KAMA members also have strategies of CO<sub>2</sub> reduction with developing the fuel-efficient engines such as Multi Port Injection (MPI) engine, GDI engine, and HSDI engine, which have potentials of CO<sub>2</sub> reduction in 5–25 %, 13–33 %, and 10–30 % compared to conventional engines respectively.

KAMA members actually started to launch HSDI diesel cars onto the EU market from the end of 2000 and will increase the portion of diesel cars in taking the place of petrol cars. Small displacement passenger cars with 2<sup>nd</sup> generation HSDI engine was launched in 2003.

### **Transmission Programme**

Transmission is one of the major factors affecting CO<sub>2</sub> emission. Its efficiency and speed are the main factors to be improved so as to reduce emissions. KAMA members are focusing on reducing CO<sub>2</sub> by 5 % with self-development of Dual Clutch Transmission (DCT), automatic transmission with variable line pressure control, Continuously Variable Transmission (CVT) for the EU market.

KAMA members launched passenger cars with applied technologies such as the line-up variable control system for the improvement of efficiency with 6-speed manual transmission onto the EU market in 2002. KAMA members are also trying to develop 5 & 6-speed automatic transmission, DCT, technology of FGR tuning and Automated Selected Gearbox (ASG) for the EU market during the monitoring period.

### **After-Treatment Improvement Programme**

KAMA members are investigating several after-treatment systems for fuel-efficient diesel engines to be used in the near future, e.g. 4-way catalyst and photo catalyst systems. These will be applied to different car classes such as small and/or medium size cars and KAMA expects these cars will be launched onto the EU market in near future. Development of after-treatment system in parallel with CO<sub>2</sub> reduction to meet the stringent emission regulation, along with European OBD system for diesel cars in the EU was accomplished at the end of 2001 and was launched in 2002.

As the allowance of the domestic sale of diesel passenger cars from 2005, new after-treatment system in parallel with CO<sub>2</sub> reduction to meet the stringent emission regulation will be increased, which will remarkably contribute to CO<sub>2</sub> reduction.

### **Car Weight Reduction Programme**

This programme is one of the major measures to contribute to CO<sub>2</sub> emission reduction. KAMA members are developing aluminium bodies and chassis for lightweight vehicles. This activity will consist of extrusion, three-dimensional bending, casting as well as tube hydro-forming. In the case of chassis, the suspension system is a promising area where new technology can be applied. Vehicle weight will be continuously reduced as long as the regulation on safety permits.

### **Reduction of Resistances Programme**

KAMA members tried to develop new technologies such as reduction of engine friction and motor driven power steering for reducing CO<sub>2</sub> emission (by 5-15 %) which were launched into the EU market in 2003. Aerodynamic drag may be improved by reducing drag coefficient or modifying frontal area shape that have an effect on CO<sub>2</sub> reduction. Drag coefficient has been decreased significantly in recent years through expanded use of vehicle wind tunnel during research and development. Tire rolling resistance has been also decreased by each KAMA member's special specification for CO<sub>2</sub> reduction, along with low friction silica tire, preserve tire life, ride quality, brake distance, and handling under a variety of road conditions. KAMA members have already set to work for getting further gains of 5-10 % on this programme.

### **1.3 Description of market trends in physical fleet characteristics**

There has been no significant market trend with regard to the physical fleet characteristics within the reporting period. KAMA members have achieved some improvements in new car CO<sub>2</sub> reduction, even though most parameters have increased in general (see Section 2.4).

Averaged engine capacity decreased steadily after 1996 to 1,416 cm<sup>3</sup> in 1999 but increased to 1,546 cm<sup>3</sup> in 2002 and 1,632 cm<sup>3</sup> in 2003 due to the increase of medium size diesel cars.

Averaged engine power reached the peak 71 kW in 1997 and decreased to 68 kW in 2002 and then increased to 70 kW in 2003.

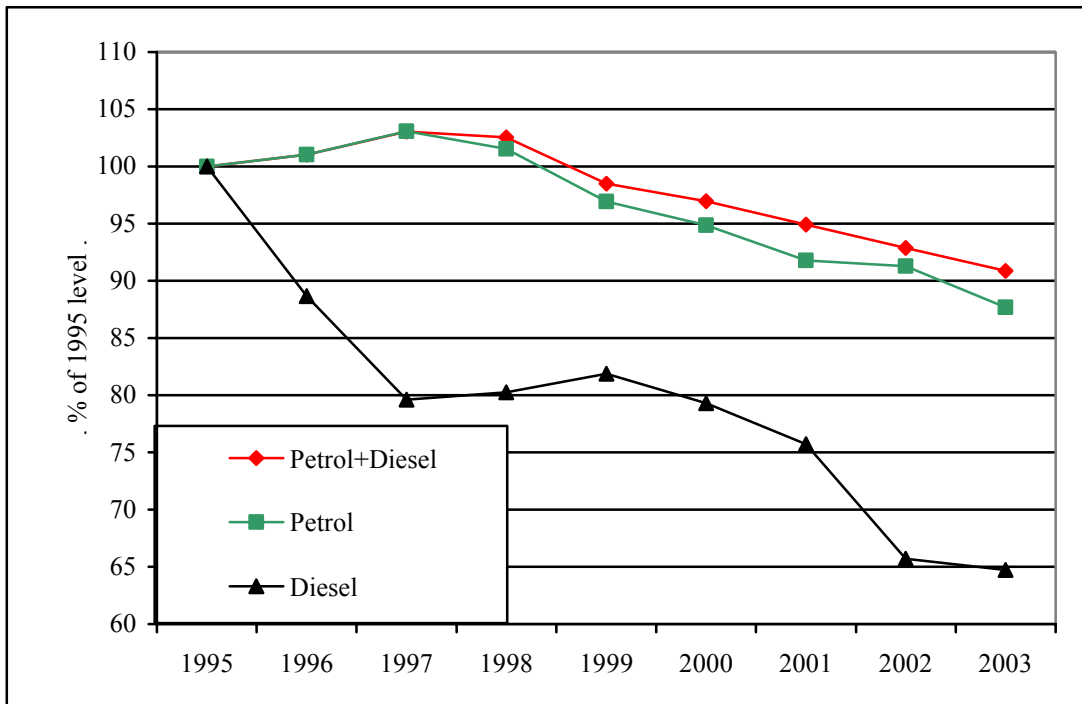
## **2. STATISTICAL MONITORING (1995-2003)**

### **2.1 Trends in specific emission of CO<sub>2</sub> (g/km)**

As shown in Figure 1, the average specific CO<sub>2</sub> emission of passenger cars sold by KAMA members on the EU market increased from 197 g CO<sub>2</sub>/km in 1995 to 203 g CO<sub>2</sub>/km in 1997. After 1997 it decreased to 183 g CO<sub>2</sub>/km in 2002 and 179 g/km in 2003. KAMA members in the EU market achieved an average reduction in specific CO<sub>2</sub> emission of about 9.1 % over the period 1995 to 2003. Specific CO<sub>2</sub> emission from petrol cars, which occupied most sales volumes, reached the highest (201 g CO<sub>2</sub>/km) in 1997 and decreased afterwards due to the increase of petrol mini car (<1000 cm<sup>3</sup>) sales. But after 2001, number of diesel car sales increased from 55,219 units in 2001 and 71,708 units (up by 29.9 %) in 2002 to 110,679 units (up by 54.3 %) in 2003, which affected the reduction of CO<sub>2</sub> emission.

Diesel cars with higher CO<sub>2</sub> emissions due to its heavier weight showed a sharp decrease of CO<sub>2</sub> emission within reporting period. Although the thermal efficiency of diesel engines is better than that of petrol engines, their fuel efficiency was lower for diesel than for petrol engines, due to the larger size of diesel vehicles. The overall trend in total fuel consumption shows a significant decrease from 1997 onward, mainly driven by the decrease of fuel consumption in petrol cars and by the increased sales of segment A/B diesel cars (see Figure 3). KAMA expects that the reduction rate of CO<sub>2</sub> emission will be definitely increased due to the increasing number of small diesel cars.

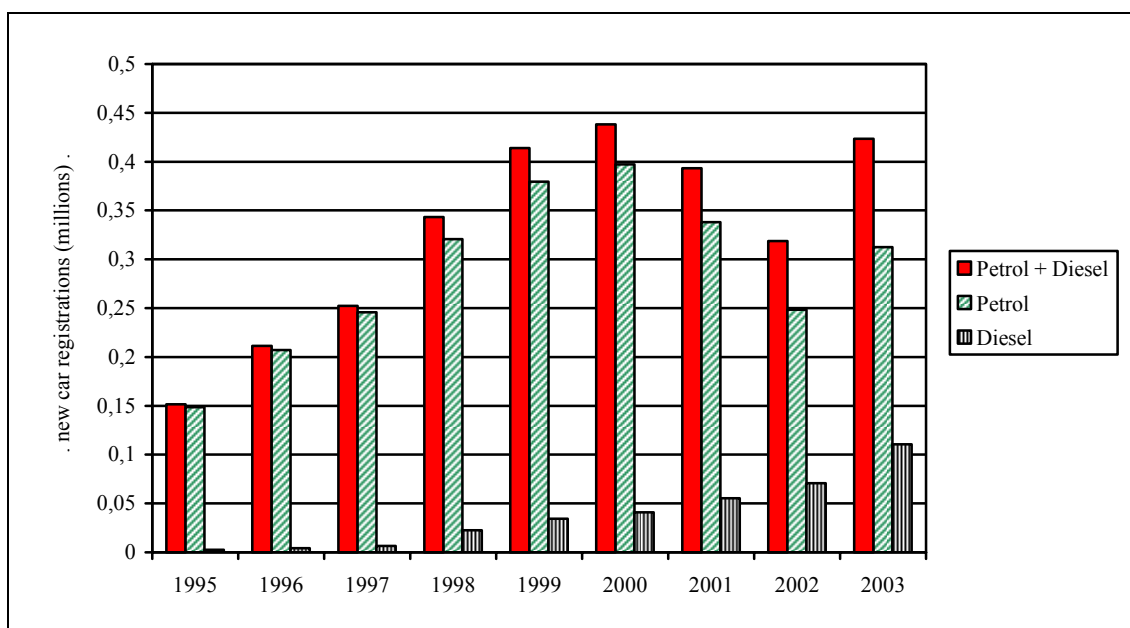
The overall CO<sub>2</sub> emission of KAMA shows a steady decrease since 1998 and the CO<sub>2</sub> reduction rate of KAMA will be increased with increasing the number of diesel passenger cars by 2004 and 2009.



**Figure 3: KAMA's CO<sub>2</sub> Reduction Index (1995= 100)**

**2.2 Number of newly registered passenger cars**

Total new car registration by KAMA was 423,281 units in 2003, increased by 30.2 % from 2002 registrations (325,206 units). Even the share of petrol cars in 2003 decreased a little bit compared to share in 2002, petrol cars still represented the largest share of new registrations – 73.9 % in 2003 (compared to 77.8 % in 2002) (see Figure 4). The number of petrol cars with CO<sub>2</sub> emitting less than 140 g CO<sub>2</sub>/km that were not shown in the EU market before 2002 reached 5,855 units (1.8 % share) in 2002 and 38,121 units (9.0 % share) in 2003. The number of diesel passenger cars sold increased from 55,219 units in 2001 and 71,708 units in 2002 (up by 29.9 %) to 110,679 units in 2003 (up by 54.3 %) (see Figure 4).

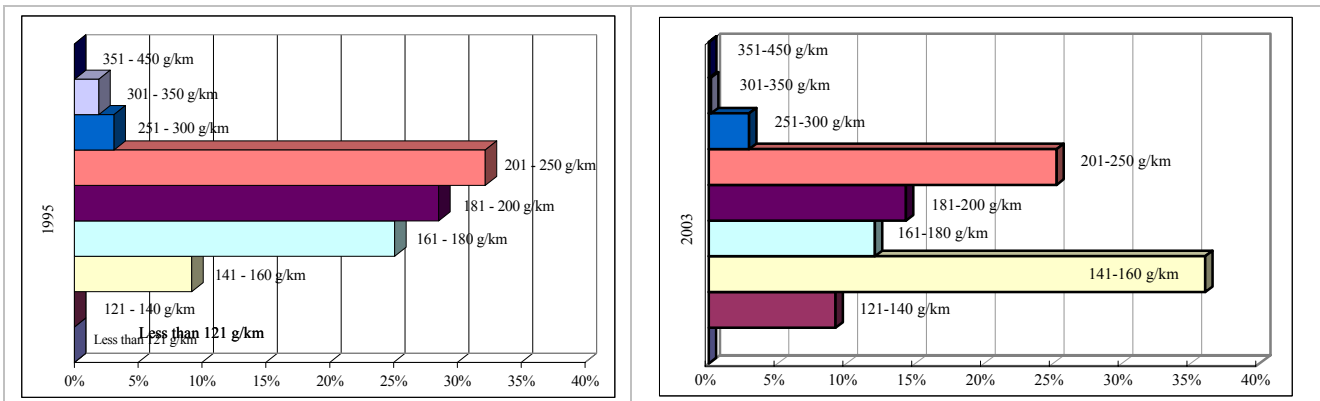


**Figure 4: Number of Newly Registered Passenger Cars by KAMA**

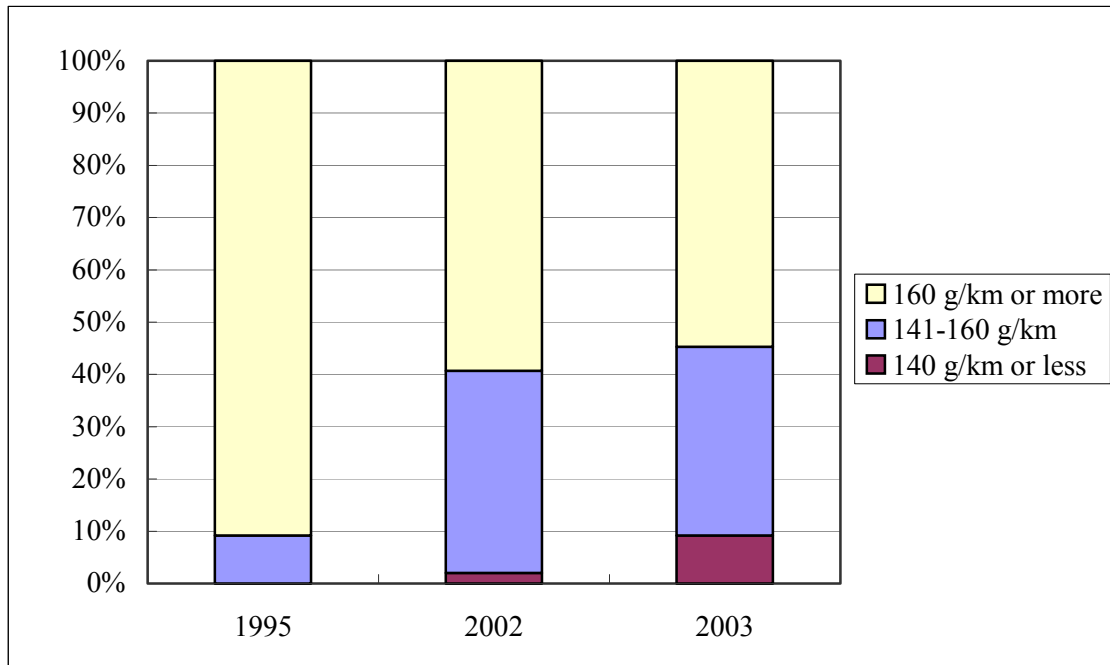
## 2.3 Fleet Composition

KAMA's fleet composition has changed towards more fuel-efficient cars over the monitoring period.

In 2003, KAMA's CO<sub>2</sub>-related fleet composition continued to show a move towards more fuel-efficient cars, with 160 g CO<sub>2</sub>/km or below car sales rising to 45.2 % in 2003. The share of the 181-200 g/km category declined by 14.2 % over the period 1995 to 2003 (from 28.5 % to 14.3 %). The share of cars emitting 160 g CO<sub>2</sub>/km or less has increased from 9.2 % in 1995 to 40.3 % in 2002 and 45.2 % in 2003, which mainly contributed to reducing CO<sub>2</sub> emission (see Figure 5). Especially the number of cars in the low categories of 140 g CO<sub>2</sub>/km or less has reached to 38,926 units (9.2 % share). Even though the share of more than 200 g CO<sub>2</sub>/km categories declined from 35.1 % in 2002 to 28.4 % in 2003, it should be moved to lower categories more by using fuel-efficient engines for meeting the targets of 2004 and 2009.



**Figure 5a : KAMA's Fleet Composition per CO<sub>2</sub> Category (% share of total registrations) in 1995 and 2003**



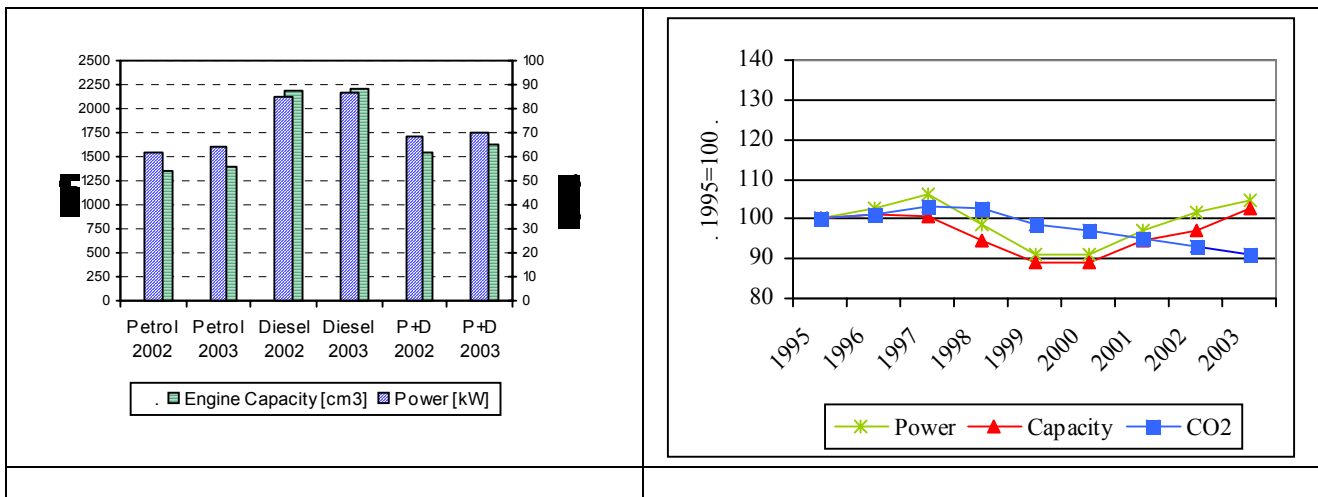
**Figure 5b Change in KAMA's Fleet Composition between 1995, 2002 and 2003 by "aggregated CO<sub>2</sub> Categories":**

## 2.4 EU trends in physical fleet characteristics

A trend analysis of the mass of vehicles could not be carried in 2003 due to inconsistencies of the data provided by KAMA for the period 1995 to 2001 and the official EU data. Moreover, the 2002 official EU data are inconsistent in themselves.<sup>50</sup>

Total engine capacity has steadily decreased from 1,589 cm<sup>3</sup> in 1995 to 1,416 cm<sup>3</sup> in 1999 (with a slight increase in 1996) and increased to 1,546 cm<sup>3</sup> in 2002 and 1,632 cm<sup>3</sup> in 2003; i.e. increased by 2.7 % over the period 1995 to 2003 and increased by 5.6 % over the period 2002 to 2003. Petrol engine capacity reached the maximum 1,583 cm<sup>3</sup> in 1996 (against 1,568 cm<sup>3</sup> in 1995) and decreased to 1,357 cm<sup>3</sup> in 2002 and increased to 1,404 cm<sup>3</sup> in 2003; i.e. decreased by 10.3 % over the period 1995 to 2003. Diesel engine capacity reached the minimum 2,316 cm<sup>3</sup> in 1998 (against 2,735 cm<sup>3</sup> in 1995) and decreased to 2,195 cm<sup>3</sup> in 2002 and increased to 2,209 cm<sup>3</sup> in 2003; i.e. decreased by 19.2 % over the period 1995 to 2003. Even though a drop (-10.3 %) in petrol engine capacity and a drop (-19.2 %) in diesel engine capacity seem to affect to decrease overall engine capacity over the reporting period of 1995 to 2003, total engine capacity has increased from 1,589 cm<sup>3</sup> in 1995 to 1,632 cm<sup>3</sup> in 2003 (up by 2.7 %) mainly due to the increase of diesel cars market share from 1.6 % in 1995 to 26.1 % in 2003 (see Figure 6).

Total engine power reached the maximum 71 kW in 1997 (against 67 kW in 1995) and decreased to 68 kW in 2002 and increased to 70 kW in 2003; i.e. increased by 4.5 % over the reporting period 1995-2003. Petrol engine reached the maximum 71 kW in 1997 (against 67 kW in 1995) and decreased to 64 kW in 2003, i.e. decreased by 4.5 % over the reporting period. Diesel engine power has substantially increased by 31.8 % within the reporting period, i.e. from 66 kW in 1995 to 87 kW in 2003 (see Figure 6).



Figures 6a : Physical KAMA fleet characteristics for 2002 and 2003

Figures 6b : Physical KAMA fleet characteristics 1995 to 2003 (percent of 1995 values)

<sup>50</sup> Some Member States delivered data based on the maximum weight of the vehicle. This is inconsistent with the definitions given in Decision 1753/2000/EC.

## 2.5 Trends in new technologies

As noted in Section 1.2, KAMA members tried to apply several technologies to reduce CO<sub>2</sub> emission such as torque based actuator control, advanced knock control, variable geometry intake system, HSDI diesel engine, engine & driving friction reduction, and weight reduction etc. within the reporting period.

The share of cars applied with several kinds of technical developments introduced by KAMA to reduce CO<sub>2</sub> emissions over the monitoring period of 2002 and 2003 are as follows.

- Advanced torque based actuator control : 37.3 %
- Advanced knock control : 30.5 %
- Engine friction reduction : 35.5 %
- HSDI diesel engines : 24.9 %
- Variable geometry turbocharger : 3.9 %
- Combustion improvement : 30.5 %
- Variable geometry intake system : 7.6 %
- Variable geometry timing system : 5.8 %
- CVVT : 0.5 %
- Cooled EGR : 1.2 %
- Motor driven power steering : 20.2 %
- Drag reduction : 39.3 %
- Low friction tire : 36.8 %
- Gear ratio tuning : 21.3 %
- Automatic transmission efficiency improvement : 0.2 %
- Weight reduction : 12.2 %<sup>51</sup>

Hereafter the R&D activities of KAMA members will be increased and low CO<sub>2</sub> emitting diesel passenger cars will be expected to be of relative popularity, which will contribute to CO<sub>2</sub> reduction.

## 2.6 Trends in low emission passenger cars

One KAMA member launched the fuel-efficient cars emitting 120 g CO<sub>2</sub>/km or less onto the EU market in 2003.

## 2.7 Trends in alternative concept passenger cars

KAMA members are developing Hybrid Electric Vehicles (HEV) and planning to launch them on the EU market in near future.

## 2.8 Trends in innovative concept passenger cars

Nothing to report

## 2.9 Brief Description of the degree of occurrence of Grey Areas between M1 and N1 vehicles in the Member States

Nothing to report

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<sup>51</sup> The rates used in Section 2.5 are based on the KAMA's estimation number of cars shipped to the EU region in the monitoring period.



## **2.10 Data sources, data methods and data confidence levels**

### **2.10.1 Data Sources**

### **2.10.2 Data Methods**

### **2.10.3 Data confidence levels**

In this report EU official CO<sub>2</sub> statistics supplied by the Commission are used for the years 2002 and 2003. KAMA believes that there may be significant shortcomings related to data confidence in data supplied by the Commission, even though the Commission notes that the effects seem to be minor. For example the Commission supplied data which show (very few) registrations in the categories of 81-100 g CO<sub>2</sub>/km and of more than 450 g CO<sub>2</sub>/km. However, KAMA did not market such cars in the EU within the monitoring period.

KAMA expects that the Commission's future data shall be improved in the confidence.

## **2.11 Description of measurement issues for CO<sub>2</sub> Emission Factors**

KAMA's CO<sub>2</sub> emissions figures have been established according to Directive 93/116/EC<sup>52</sup>, which amended Directive 80/1268/EC. Among other changes, the new cycle includes for the first time a cold start period – the deletion of the initial 40 seconds of unmeasured engine idling prior to the commencement of the test, and consequently values for fuel consumption and CO<sub>2</sub> emissions are higher under the new system. The implementation of this new measuring procedure has led to an artificial average increase of the CO<sub>2</sub> emission figures, compared to the previously used Directive, whereas the CO<sub>2</sub> emissions from cars in the real world have not changed.

In 2002 it was also agreed that the data from 2001 onwards should be adjusted by 0.7 %.

## **3. KEY ASSUMPTIONS TO THE COMMITMENT**

### **3.1 Availability of Enabling Fuels**

Nothing to report

### **3.2 Distortion of Competition**

Nothing to report

### **3.3 Promotion of CO<sub>2</sub> efficient technologies**

Cars with low CO<sub>2</sub> emission technology like lean burn engine and CVT could not be launched to the EU market although they were introduced in 1998 to the Korean market, due to the stringent emission regulations of EU. KAMA members have high expectations for certain technologies; in particular those associated with fuel-efficient lean burn cars (with de-NO<sub>x</sub> catalyst) such as gasoline direct injection engines to contribute to reducing CO<sub>2</sub> emission in the near future.

### **3.4 Acceptance of innovation**

Nothing to report

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<sup>52</sup> The Directive in force at the time of the KAMA Commitment

## 4. OTHER ISSUES

### 4.1 New Measures affecting CO<sub>2</sub>

Nothing to report

### 4.2 New regulatory measures

Nothing to report

### 4.3 Fiscal Measures

Nothing to report

### 4.4 Breakthrough technologies

Nothing to report

### 4.5 Research Programmes: Description and Future Potential

KAMA members have committed themselves to achieve a target (140 g CO<sub>2</sub>/km of CO<sub>2</sub> emission in 2009) and are running several R&D programmes to investigate methods to reduce CO<sub>2</sub> emission with up to 20-30 % according to the car segments.

The activities can be divided into several major categories: The Engine Programme, the Transmission Programme, the After-Treatment Improvement Programme, the Car Weight Reduction Programme, and the Reduction of Resistances Programme (see Section 1.2). KAMA members tried to develop new technologies for reducing CO<sub>2</sub> emission during the monitoring period such as advanced torque based actuator control, advanced knock control, engine friction reduction, HSDI diesel engines, variable geometry turbocharger, combustion improvement, variable geometry intake system, variable geometry timing system, CVVT, cooled EGR, motor driven power steering, drag reduction, low friction tire, gear ratio tuning, automatic transmission efficiency improvement, and weight reduction.

These technologies will be combined and modified for more reducing CO<sub>2</sub> emission and launched step by step to the EU market in near future.

In addition to the above technologies, KAMA members are trying to develop new technologies such as dual CVVT, advanced reduction of engine friction, reduction of resistances (running and rolling) for reducing CO<sub>2</sub> emission, small vehicle with 2<sup>nd</sup> generation HSDI engine, idle stop-go system, and hybrid vehicle for reducing CO<sub>2</sub> emission; the number of cars which applied new technologies will be increased for meeting the targets of 2004 and 2009.

### 4.6 Other measures - telematics, infrastructure, education

KAMA members will consider implementing the driver education activities for more environmentally friendly driving in the EU. KAMA believes that such initiatives will encourage customer acceptance of CO<sub>2</sub> efficient technology and are one of the contributors to “market changes linked to technical development” as specified in the Commitment.

KAMA also believes that measures such as the promotion of trade in purchase of new cars, presentation of correct and proper car maintenance methods, driver training, optimisation of infrastructure, effective and efficient land use, and efforts to achieve a smoother traffic flow by using Intelligent Transportation Systems (ITS) will have a beneficial effect on CO<sub>2</sub> reduction. KAMA thinks that such measures should therefore be embraced in a positive manner under government lead and with the co-operation of the industrial sectors involved.

#### **4.7 Economic situation of the car industry**

Even though the economic situation in Korea has been getting recovered gradually, the long lasting effect of economic crisis at the end of 1997 has resulted in the lower rate of CO<sub>2</sub> reduction of cars from KAMA members than planned; actual investment for R&D for fuel-efficient car has been retarded significantly during the monitoring period.

KAMA notes that the development costs for technologies will be higher for their members than other associations that have large sales volume in the EU market, which is a disproportionate burden of investment to KAMA members during past several years after economic crisis.

KAMA draws attention to the fact; even though one Korean manufacturer achieved high profits in past several years, it can not invest for R&D for the other KAMA members.

The CO<sub>2</sub> reduction requires concerted efforts for R&D investments by all Korean car makers. One of KAMA members is still under the bank receivership, which is a burden to KAMA.

The Commission is aware of the economic difficulties of some Korean car manufacturers. However, in the past few years the situation has improved considerably. Sluggish sales on their home market has been replaced by very high export sales to, inter alia, Europe.

It's agreed that among the Korean car manufacturers profit margins are not uniform, however, this is the case among car manufacturers around the world.

### **5. CONCLUSIONS**

#### **5.1 Progress Statement on Delivering the Commitment**

KAMA members are committed to concentrate on additional CO<sub>2</sub> emission reductions by developing fuel-efficient cars. KAMA reduced the average CO<sub>2</sub> emission of its new passenger car fleet registered in the EU market from 197 g CO<sub>2</sub>/km in 1995 to 179 g CO<sub>2</sub>/km in 2003. This represents a reduction of 9.1 % over the whole monitoring period of 1995-2003 and 2.2 % over the period 2002 to 2003.

When the fleet composition is considered (see Section 2.3), an outstanding feature is the sharp increase of the share of low CO<sub>2</sub> cars emitting less than 160 g CO<sub>2</sub>/km (45.2 %), which shows the endeavour and will of KAMA members to meet the Commitment.

One KAMA member company introduced to the EU market one model which emits less than 120 g/km. In doing so KAMA complied with one of the points mentioned in its Commitment.

#### **5.2 Statement on Expected Future Progress of the Commitment**

It is encouraging to see that in 2003 KAMA's CO<sub>2</sub>-related fleet composition continued to show a move towards more fuel-efficient cars with 160 g CO<sub>2</sub>/km or below car sales rising to 45.2 % from 9.2 % in 1995. However, the estimated intermediate target range of 165-170 g CO<sub>2</sub>/km in 2004 and the final target value of 140 g CO<sub>2</sub>/km in 2009 require further serious efforts by KAMA members. Importantly, and as agreed upon, the targets will mainly be achieved by technological developments affecting different car characteristics and market changes linked into these developments. Regarding technological developments, KAMA will aim at achieving a high share of new cars equipped with CO<sub>2</sub> efficient technologies such as 2<sup>nd</sup> generation HSDI engine for small size passenger cars.

Although the current progress in fuel-efficient car technology development of KAMA members is relatively slower than that of European automobile manufacturers, they will increase the portion of fuel-efficient cars; for example they introduced the 2<sup>nd</sup> generation HSDI engine for small size passenger cars in 2003.

KAMA members launched diesel passenger car on the EU market and achieved CO<sub>2</sub> emission of 179 g CO<sub>2</sub>/km even in the condition without the sales of domestic market. Hereafter the R&D activities of KAMA

members will be accelerated and low CO<sub>2</sub> emitting diesel passenger cars will be expected to be of relative popularity, which will remarkably contribute to CO<sub>2</sub> reduction.

KAMA members must increase their annual average reduction by about 6 g/km. This will imply to develop more cars emitting less than 120g/km. KAMA expects that the reduction rates will be increased with the acceleration of technology development as time goes on.

In summary, KAMA currently has no reason to believe that it would not live up to its Commitment. However, the Commission and KAMA see a need to accelerate significantly the introduction of fuel-efficient technologies for petrol and diesel engines for this purpose.

## **DATA ANNEXES (2003)**

*(Note: EU official data)*

- A1: SPECIFIC FUEL EFFICIENCY (l/100km) AND EMISSIONS OF CO<sub>2</sub> (g/km) AVERAGED OVER ALL NEWLY REGISTERED PASSENGER CARS FOR EACH DIFFERENT FUEL-TYPE, FOR THE EU AND EACH MEMBER STATE
  
- A2: THE DISTRIBUTION OF CO<sub>2</sub> EMISSIONS (g/km) IN THE NEW PASSENGER CAR FLEET FOR EACH DIFFERENT FUEL TYPE, FOR THE EU
  
- A3: THE DISTRIBUTION OF AVERAGED MASS, POWER AND ENGINE CAPACITY OF NEW PASSENGER CARS FOR EACH FUEL TYPE FOR THE EU-15 AND EACH MEMBER STATE

A1: SPECIFIC FUEL EFFICIENCY (l/100km) AND EMISSIONS OF CO<sub>2</sub> (g/km) AVERAGED OVER ALL NEWLY REGISTERED PASSENGER CARS<sup>53</sup> FOR EACH DIFFERENT FUEL-TYPE FOR THE EU AND EACH MEMBER STATE (CO<sub>2</sub> emissions are corrected by 0.7 %)

	Identified version														Unknown version	
	TOTAL	All Fuels			Petrol			Diesel			Petrol+Diesel			AFV		
	Number	Number	average CO2	Number	average fuel	average CO2	Number	average fuel	average CO2	Number	average fuel	average CO2	Number	average CO2		
<b>EU 15</b>	<b>427,341</b>	<b>423,282</b>	<b>179</b>	<b>312,602</b>	<b>7.2</b>	<b>171</b>	<b>110,680</b>	<b>7.5</b>	<b>201</b>	<b>423,282</b>	<b>7.3</b>	<b>179</b>			<b>4,059</b>	
A	9,954	9,949	181	4,924	6.8	161	5,025	7.5	200	9,949	7.2	181			5	
B	12,079	11,912	177	7,363	7.1	168	4,549	7.2	192	11,912	7.1	177			167	
DK		7,103	176	6,612	7.4	175	491	7.1	189	7,103	7.4	176				
F		31,715	185	13,007	7.1	168	18,708	7.4	197	31,715	7.3	185				
FIN		2,610	181	2,501	7.6	180	109	7.3	194	2,610	7.6	181				
GER	63,765	60,424	192	41,708	7.7	183	18,716	8.0	214	60,424	7.8	192			3,341	
GR		28,734	164	28,283	6.9	164	451	7.7	206	28,734	6.9	164				
IRE	8,137	7,627	183	6,120	7.5	177	1,507	7.8	208	7,627	7.6	183			510	
IT	85,665	85,636	167	65,053	6.6	157	20,583	7.5	200	85,636	6.8	167			29	
LUX		2,141	178	1,085	7.0	165	1,056	7.2	192	2,141	7.1	178				
NL		32,968	181	31,068	7.6	179	1,900	8.1	215	32,968	7.6	181				
POR		5,584	164	3,712	6.4	153	1,872	7.0	185	5,584	6.6	164				
SP		62,182	173	41,824	7.1	167	20,358	6.9	184	62,182	7.0	173				
SW	10,332	10,325	198	9,652	8.3	197	673	8.3	221	10,325	8.3	198			7	
UK		64,372	187	49,690	7.6	179	14,682	8.0	214	64,372	7.7	187				

294 vehicles with an emission below 120 g/km, one vehicle with an emission higher than 450 g/km and 252 vehicles reported as AFV were not taken into consideration due to implausibility of data

n.d. no data delivered

<sup>53</sup> Due to possible data implausibility the following vehicles from Member States data were not taken into account: 295 vehicles with an emission below 120 g/km, 1 vehicle with an emission higher than 450 g/km, 252 retrofitted AFV

A2: THE DISTRIBUTION OF CO<sub>2</sub> EMISSIONS (g/km)<sup>54</sup> IN THE NEW PASSENGER CAR FLEET FOR EACH DIFFERENT FUEL TYPE

CO <sub>2</sub> -Category	All fuels		Petrol		Diesel		Petrol + Diesel		AFV	
	Number	Average CO <sub>2</sub>	Number	Average CO <sub>2</sub>	Number	Average CO <sub>2</sub>	Number	Average CO <sub>2</sub>	Number	Average CO <sub>2</sub>
<60										
60-80										
81-100										
101-120	<b>1</b>	<b>116</b>			<b>1</b>	<b>116</b>	<b>1</b>	<b>116</b>		
121-140	<b>38,926</b>	<b>138</b>	<b>38,121</b>	<b>138</b>	<b>805</b>	<b>130</b>	<b>38,926</b>	<b>138</b>		
141-160	<b>152,637</b>	<b>154</b>	<b>131,827</b>	<b>154</b>	<b>20,810</b>	<b>153</b>	<b>152,637</b>	<b>154</b>		
161-180	<b>51,024</b>	<b>170</b>	<b>47,984</b>	<b>171</b>	<b>3,040</b>	<b>169</b>	<b>51,024</b>	<b>170</b>		
181-200	<b>60,630</b>	<b>189</b>	<b>41,745</b>	<b>189</b>	<b>18,885</b>	<b>189</b>	<b>60,630</b>	<b>189</b>		
201-250	<b>106,892</b>	<b>221</b>	<b>42,488</b>	<b>222</b>	<b>64,404</b>	<b>221</b>	<b>106,892</b>	<b>221</b>		
251-300	<b>12,386</b>	<b>269</b>	<b>10,263</b>	<b>271</b>	<b>2,123</b>	<b>260</b>	<b>12,386</b>	<b>269</b>		
301-350	<b>648</b>	<b>309</b>	<b>36</b>	<b>314</b>	<b>612</b>	<b>309</b>	<b>648</b>	<b>309</b>		
351-450	<b>138</b>	<b>360</b>	<b>138</b>	<b>360</b>			<b>138</b>	<b>360</b>		
>450										

294 vehicles with an emission below 120 g/km, one vehicle with an emission higher than 450 g/km and 252 vehicles reported as AFV were not taken into consideration due to implausibility of data

<sup>54</sup> The data of table A2 are not adjusted by 0.7% for cycle change because not all Member States submitted the necessary data. The effect of the adjustment would be for volumes to move into lower categories (e.g. 140 g & less cars would increase in volume as a % of total).

A3: THE DISTRIBUTION OF AVERAGED MASS, POWER AND ENGINE CAPACITY OF NEW PASSENGER CARS FOR EACH FUEL TYPE FOR THE EU-15 AND EACH MEMBER STATE

Member State	Mass [kg]					Power [kW]					Capacity [cm <sup>3</sup> ]				
	Total	Petrol	Diesel	Petrol+ Diesel	AFV	Total	Petrol	Diesel	Petrol+ Diesel	AFV	Total	Petrol	Diesel	Petrol+ Diesel	AFV
<b>EU-15</b>	<b>1454</b>	<b>1292</b>	<b>1905</b>	<b>1454</b>		<b>70</b>	<b>64</b>	<b>87</b>	<b>70</b>		<b>1632</b>	<b>1404</b>	<b>2209</b>	<b>1632</b>	
A	1481	1148	1808	1481		74	59	88	74		1753	1326	2172	1753	
B	1315	1093	1678	1315		68	60	81	68		1551	1310	1950	1551	
DK	1273	1238	1756	1273		74	73	84	74		1594	1551	2163	1594	
F	1491	1122	1748	1491		76	64	85	76		1802	1394	2086	1802	
FIN	1256	1236	1707	1256		76	75	88	76		1605	1581	2165	1605	
GER	1485	1267	1971	1485		83	77	97	83		1896	1635	2479	1896	
GR	1135	1122	1933	1135		60	60	87	60						
IRE	1343	1100	1880	1343		64	57	87	64		1629	1506	2126	1629	
IT	1622*	1397	2333	1622		60	51	88	60		1389	1126	2219	1389	
LUX	1418	1158	1686	1418		73	65	81	73		1703	1419	1994	1703	
NL	1254	1212	1934	1254		71	70	95	71		1550	1499	2384	1550	
POR	1253	1079	1624	1253		60	52	75	60		1429	1189	1942	1429	
SP	1305	1144	1636	1305		68	62	80	68		1568	1363	1989	1568	
SW	1393	1355	1943	1393		86	85	95	86		1858	1825	2338	1858	
UK	1674	1586	1952	1674		74	66	93	74		1732	1523	2437	1732	

\* There is some implausibility with regard to mass data for Italy. Thus, for ~20% of new registrations in EU15 the weight might be ~20% too high.

294 vehicles with an emission below 120 g/km, one vehicle with an emission higher than 450 g/km and 252 vehicles reported as AFV were not taken into consideration due to implausibility of data