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Mileage of Motor Vehicles in 2004 Higher than Ever Before

Hartmut Kuhfeld and Uwe Kunert

2003 saw a slight decline in the mileage of vehicle kilometers driven annually by all German road passenger and freight vehicles.[1] This development did not continue in 2004; instead the mileage, at 697 billion vehicle kilometers, was higher than ever before, despite the fact that fuel prices continued to rise.

Where freight vehicles are concerned, the number of vehicles on the road hardly changed as compared to 2003; the volume of goods to be transported only rose marginally. Since, however, transport distances increased, the mileage of German freight and semitrailer trucks was 1.3% higher in 2004 as compared to the previous year.

The mileage of passenger cars registered in Germany even increased by 2.3% to 591 billion vehicle kilometers. The decline in 2003 was clearly not a shift in the trend, but rather one of the short-term adjustment reactions by consumers, as has often occurred in the past.

Average consumption of motor vehicles decreased only marginally in the past year; total consumption of fuel in the traffic sector increased by 1.6%. The amount of the climate-relevant CO_2 gas emitted even rose by 1.8%, since the increase of consumption was larger for diesel fuel with higher CO_2 exhaust per liter than gasoline.

Increase of mileage for freight vehicles...

The Kraftfahrt-Bundesamt (KBA, German Federal Bureau of Motor Vehicles and Drivers) and the Bundesamt für Güterverkehr (BAG, Federal Office for Goods Traffic)[2] records mileage of trucks with more than 3.5 t payload and semitrailer tractors jointly. At an overall 2.77 billion tonnes, the goods transport increased only marginally in 2004 as compared to the previous year; the number of trips even declined slightly to 381 million, this figure

[1] All motor vehicles registered in Germany and their mileage, including the distances driven abroad, are taken into account in this context. This does not include the mileage of motor vehicles registered abroad. Cf. Jutta Kloas, Hartmut Kuhfeld und Uwe Kunert: 'Straßenverkehr: Eher Ausweichreaktionen auf hohe Kraftstoffpreise als Verringerung der Fahrleistungen'. In: *Wochenbericht des DIW Berlin,* no. 41/2004, pp. 602-612.

[2] Statistical information published monthly by the KBA and the BAG, series 8.

includes 149 million trips without cargo. Since, however, there was a shift to longer trips and German trucks enjoyed a high growth rate (13%) in commercial transnational traffic in spite of having to deal with competition by foreign companies, the mileage of heavy trucks and semitrailer tractors rose by a good 3% (cf. table 1).

The mileage of the remaining freight vehicles likewise increased, albeit to a clearly lesser degree. As in 2003, the number of vehicle kilometers in omnibus traffic decreased slightly.[3]

... and for passenger cars

For the mileage of the remaining vehicle types, especially passenger cars, no annual records are available. This data is estimated by DIW Berlin using modelling approaches and other calculations. About 5 000 car types are broken down in a disaggregated calculation by numbers, average consumption and estimated average mileage. In this way, the necessary fuel quantities are determined and compared to an aggregated estimation of fuel consumption quantities. Thus, the existing fleet and its structure as well as fuel sales and consumption are important factors in depicting the development.

Just as in the past year, the number of passenger cars on the road has continued to grow and has increased to 45.3 million vehicles (1 July 2004). While the number of passenger cars with gasoline engines has decreased by half a million vehicles as compared to the previous year, the number of diesel-engine passenger cars has risen by 850 000; in the meantime one in five passenger cars has a diesel motor (see box).

Along with the type of drive, the development of vehicle segments[4] and passenger car size classes is an additional characteristic reflecting structural modifications in the market. While the medium-sized class and the smaller vehicles have lost in significance in the past years, the number of luxury class and SUV cars has increased. The vehicles in these segments have engine performance and consumption values above the average of all passenger cars (cf. table 2).

Despite engine and other technical innovations, the average consumption of the passenger car fleet has hardly decreased as a result of this shift to larger and heavier vehicles.[5] In 2004, with 8.4 l per 100 km for gasoline passenger cars and 6.9 l per 100 km for diesel passenger cars, it was the same as the preceding year. Only as a result of the modification of the existing vehicle fleet towards a greater share of diesel passenger cars was an overall slight decline recorded of 8.0 l to 7.9 l per 100 km.

A further component for determining the total mileage of motor vehicles is the development evidenced for vehicle use. From the changes registered in the vehicle fleet in favor of larger vehicles, an increase of the average mileage of diesel passenger cars by 1.6 % was estimated. With 11 300 km, the average annual mileage for gasoline engine passenger cars also remained constant in 2004. Thus, the average mileage increased for all passenger cars by 1.5% and, at a good 13 000 km per car, again achieved the value of the previous year.

Fuel sales and consumption on the rise

The domestic sales of diesel fuel from mineral oil in road traffic rose in 2004 by 4.2% to 30.3 billion liters. To be added to this is biodiesel, which is partially sold as an additive and partially as pure biodiesel. Production and sales of this regenerative fuel rose in 2004 by more than 50 % reaching 1.2 billion liters.[6]

Because of the difference in price of fuels as compared to Germany's neighboring countries, 'gray' imports are likely to play an increasing role. DIW Berlin published an estimate of the magnitude of these amounts last year (2 billion l of diesel fuel).[7] In the meantime, further investigations are available whose numbers confirm this magnitude.[8] In the estimation for 2004

[3] Cf. Beratergruppe Verkehr & Umwelt GmbH (BVU, Consulting Group for Traffic and the Environment), Deutsches Zentrum für Luft- und Raumfahrt (DLR, German Aerospace Center) and the Institut für Seeverkehrswirtschaft und Logistik (ISL, Institute for Shipping Economics and Logistics): 'Gleitende Mittelfristprognose für den Güter- und Personenverkehr, Kurzfristprognose Sommer 2005'. By commission of the Federal Ministry for Traffic, Construction and Housing, Freiburg 2005.

[4] Kraftfahrt-Bundesamt (KBA, German Federal Bureau of Motor Vehicles and Drivers) has broken down passenger car models into 10 segments with the objective of achieving better statistical comparability. Please access www.kba.de for further information (in German).

[5] This takes account of the actual average consumption on the roads, factoring in that large passenger vehicles are generally driven more than smaller ones and that everyday driving conditions do not correspond to those on the test bench. These consumption values are thus customarily higher than the norm consumption values ascertained under specific conditions, which do not provide, to quote an example, for trips at a greater speed than 120 km/h and trips with a roof luggage rack. The standard consumption of the vehicle fleet without taking into consideration the varying mileage has risen slightly according to calculations made by the Kraftfahrt-Bundesamt for diesel passenger vehicles; for passenger cars with gasoline engines, it has declined somewhat.

[6] Cf.: Verband der Deutschen Biokraftstoffindustrie e.V. (VDB, Association of the German Biological Fuels Industry), http://www2.biodieselverband.de/vdb/biodiesel/marktdaten.html

[7] Cf. Jutta Kloas et al.

[8] Cf. 'Tanktourismus kostet Milliarden'. In: *Deutsche Verkehrs-Zeitung*, (DVZ) 59/91 of 2 August 2005, p. 1.

Table 1

Mileage and Consumption Calculation for Vehicles in Germany 1994 to 2004

Group	Unit	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Motorized two-wheelers[1]												
Fleet[2]	1000	3 750	3 995	4 138	4 351	4 673	4 920	4 933	5 215	5 227	5 399	5 600
Average mileage[3]	1000 km	3.4	3.4	3.5	3.4	3.4	3.4	3.4	3.4	3.0	3.0	3.0
Total mileage[3]	Million km	12 812	13 615	14 299	14 871	15 692	16 662	16 845	17 816	15 921	16 457	16 971
Average consumption CF[4]/100 km	Liter	3.7	3.7	3.8	3.8	3.9	4.0	4.1	4.1	4.1	4.1	4.1
Consumption CF[4] total[5]	Million l	472	505	539	569	611	668	688	728	659	680	696
CO_2 discharge	Million t	1.1	1.2	1.3	1.3	1.4	1.6	1.6	1.7	1.5	1.6	1.6
Passenger vehicles												
Fleet[2]	1000	39 765	40 405	40 988	41 372	41 674	42 324	42 840	44 307	44 605	44 916	45 258
Of these, with CF consumption[4]	1000	34 407	34 860	35 357	35 785	36 187	36 691	36 879	37 608	37 297	36 950	36 446
Of these, with DF consumption[4]	1000	5 358	5 545	5 631	5 587	5 487	5 633	5 961	6 699	7 308	7 966	8 812
Average mileage[3]	1000 km	13.3	13.2	13.2	13.1	13.2	13.4	13.1	13.0	13.1	12.9	13.1
Av. mileage CF passenger cars[4]	1000 km	12.5	12.5	12.4	12.4	12.4	12.4	12.0	11.7	11.6	11.3	11.3
Av. mileage DF passenger cars[4]	1000 km	18.6	18.0	17.9	17.9	18.5	19.7	19.6	20.4	20.8	20.0	20.3
Total mileage[3]	Million km	528 142	535 131	539 473	542 727	550 779	566 222	559 467	575 539	583 560	577 848	591 158
Total mileage CF passenger cars[4]	Million km	428 477	435 423	438 564	442 957	449 475	455 080	442 855	438 928	431 246	418 325	411 831
Total mileage DF passenger cars[4]	Million km	99 665	99 708	100 909	99 771	101 304	111 142	116 612	136 611	152 315	159 523	179 327
Average consumption/100 km	Liter	8.9	8.8	8.7	8.7	8.6	8.5	8.3	8.1	8.1	8.0	7.9
Av. consump. CF passenger cars[4]	Liter	9.2	9.1	9.1	9.0	8.8	8.8	8.6	8.5	8.5	8.4	8.4
Av. consump. DF passenger cars[4]	Liter	7.5	7.5	7.4	7.3	7.3	7.2	7.1	6.9	6.9	6.9	6.9
CF consumption,[4] total[5]	Million l	39 579	39 816	39 691	39 679	39 747	39 895	38 129	37 380	36 633	35 332	34 583
DF consumption,[4] total[5]	Million l	7 467	7 447	7 498	7 332	7 389	8 050	8 260	9 494	10 529	10 958	12 383
CO_2 discharge	Million t	113	113	113	113	113	115	111	113	114	112	114
Trucks, Semitrailers[6]												
Fleet[2]	1000	1 876	1 994	2 074	2 134	2 207	2 323	2 405	2 535	2 547	2 539	2 537
Average mileage[3]	1000 km	29.6	29.3	28.7	28.6	28.8	29.0	28.4	27.8	27.1	27.2	27.6
Total mileage[3]	Million km	55 604	58 369	59 551	61 092	63 604	67 402	68 420	70 558	68 900	69 050	70 141
Average DF consumption[4]/100 km	Liter	25.0	25.3	24.9	24.7	24.6	24.5	24.3	23.9	23.6	23.0	23.1
DF consumption,[4] total5	Million l	13 900	14 760	14 807	15 061	15 637	16 547	16 598	16 889	16 231	15 848	16 200
CO_2 discharge	Million t	37	39	39	40	41	44	44	45	43	42	43
Other vehicles[7]												
Fleet[2]	1000	1 558	1 604	1 643	1 680	1 708	1 754	1 793	1 831	1 879	1 891	1 923
Of these, with CF consumption[4]	1000	536	518	496	475	454	438	419	414	389	362	335
Of these, with DF consumption[4]	1000	1 022	1 086	1 146	1 204	1 254	1 316	1 374	1 417	1 491	1 529	1 588
Total mileage[3]	Million km	17 045	17 369	17 572	17 896	17 964	18 335	18 570	18 828	18 943	18 859	18 877
CF consumption,[4] total[5]	Million l	805	784	746	714	675	644	616	600	560	519	478
DF consumption,[4] total[5]	Million l	3 119	3 233	3 351	3 500	3 571	3 696	3 804	3 886	3 987	4 039	4 123
CO_2 discharge	Million t	10	10	11	11	11	11	11	12	12	12	12
Total motor vehicles												
Fleet[2]	1000	46 949	47 998	48 843	49 537	50 262	51 321	51 970	53 888	54 258	54 744	55 318
Of these, with CF consumption[4]	1000	38 693	39 373	39 992	40 611	41 314	42 048	42 231	43 237	42 913	42 711	42 381
Of these, with DF consumption[4]	1000	8 256	8 626	8 851	8 926	8 948	9 272	9 739	10 651	11 345	12 034	12 937
Total mileage[3]	Million km	613 602	624 484	630 895	636 586	648 038	668 620	663 302	682 740	687 325	682 215	697 148
CF consumption,[4] total[5]	Million l	40 857	41 105	40 977	40 962	41 032	41 207	39 433	38 709	37 852	36 531	35 757
DF consumption,[4] total[5]	Million l	24 486	25 439	25 656	25 893	26 597	28 293	28 662	30 269	30 748	30 846	32 707
CO_2 discharge	Million t	161	164	164	165	167	171	168	171	170	167	170

1 Motorized bicycles, kick-start mopeds, mopeds and motorcycles. — 2 Number of vehicles in the fleet at halfway through the year, including the temporarily deregistered vehicles; from January 1, 2001 onwards decommissioning notice period increased from 12 to 18 months. — 3 Domestic mileage (including distances abroad). — 4 CF = Carburetor fuel; DF = Diesel fuel. — 5 In reference to domestic mileage. — 6 Only diesel vehicles. Trucks and tractors with gasoline engines (less than 10% of the truck numbers) are contained in the other motor vehicle [segments]. — 7 Including omnibuses, trucks with gasoline engines and working trucks released from registration without owner certificate with official registration number; without farming [vehicles].

Sources: IVT/Bundesanstalt für Straßenwesen (BAST, Federal Highway Research Institute); KBA; Mineralölwirtschaftsverband (MWV, Association of the German Petroleum Industry); Vereinigte Motor-Verlage GmbH; DIW Berlin calculations.

Box

Diesel passenger cars set to take over in Germany

In Europe, the affinity to the diesel passenger car varies considerably from country to country; currently the share of newly registered diesel-operated passenger cars ranges from less than 10% to more than 70%. The diesel-share in almost all countries has risen in the recent years (cf. figure 1). Within the European Union, three country groups may be distinguished:

- In Austria, Belgium, France and Spain two-thirds and more of newly registered passenger cars have a diesel engine. The share of diesel cars in the national fleet is already close to 50% in France, Belgium and Austria.
- With the rate of new registrations for diesel vehicles reaching 45% to 60%, Germany, Portugal and Italy take the middle path.
- In other EU countries, less than 30% of new passenger cars have a diesel engine.

However, the trend to driving diesel can only be partially explained by the price advantage of the fuel resulting from the lower tax rate. In Great Britain as well, where diesel fuel is as expensive as gasoline because the tax rate is identical for both fuels, the share of diesel engines in new passenger cars has clearly increased since 2000. In addition to the price advantage in terms of fuel, the normally lower fuel consumption as compared to a gasoline-powered vehicle results in operational cost advantages.[1]

In Germany the share of newly registered diesel-powered cars has been on the rise consistently since 1998. Commercial holders, whose cars are mostly acquired on the new vehicle market and have a higher mileage as compared to privately registered vehicles, quickly switched to diesel. In this group, the share of diesel passenger cars has already more than doubled, jumping from a quarter to more than half of the vehicle fleet. Since for the most part, private holders own their vehicles longer than commercial entities do, the share of diesel vehicles owned by private households thus far has 'only' increased by half – from 11% to 16%. Though the discussion concerning particulate matter this spring and the fact that passenger cars produced in Germany normally do not have a particle filter did cause the share of newly registered diesel cars to sink this spring, the monthly sales figures for diesel cars when viewed absolutely were, however, just as high as in 2004 as a result of the high sales figures of cars thus far this year. The crisis did indeed put the brakes on the diesel boom, but it did not reverse the trend.

In the private sphere, high-mileage drivers in particular have made the switch to diesel. Though in the meantime diesel engines are also offered for small passenger car models (for example Smart, VW Lupo, Peugeot 106), most registrations with diesel engines have been recorded with middle class models as well as for vans, utility vehicles and SUVs. From the latter vehicle type, in 2004 over 120 000 diesel vehicles were newly registered with an average curb weight of over 2 tonnes and an average consumption of more than 10 l per 100 km (cf. table 2).

Since the group of users of diesel passenger cars in Germany thus is (still, but perhaps not much longer) clearly distinguished from the average driver, the median driven mileage for diesel cars is, at 20 000 km annually, three-quarters higher than for cars with a gasoline engine. The differences in the usage between cars equipped with gasoline and diesel engines become even more pronounced if, instead of the average driven mileage, the mileage distribution is regarded. With the diesel car it is significantly more broadly distributed – for example, 50% of drivers who fill up with carburetor fuels record mileages of less than 10 000 km, as compared to only 20% of diesel drivers; only 7% of gasoline engine cars are driven more than 30 000 km annually, in contrast to a quarter of the diesel-powered cars (cf. figure 2).

[1] For an international comparison of the influence of federal taxes on the attractiveness of gasoline and diesel drive types, please cf. Hartmut Kuhfeld and Uwe Kunert: 'Große Unterschiede in der Abgabenbelastung von Personenkraftwagen in Europa.' (Major Differences in the Tax Burden of Passenger Cars in Europe) In: *Wochenbericht des DIW Berlin,* no. 47/2002.

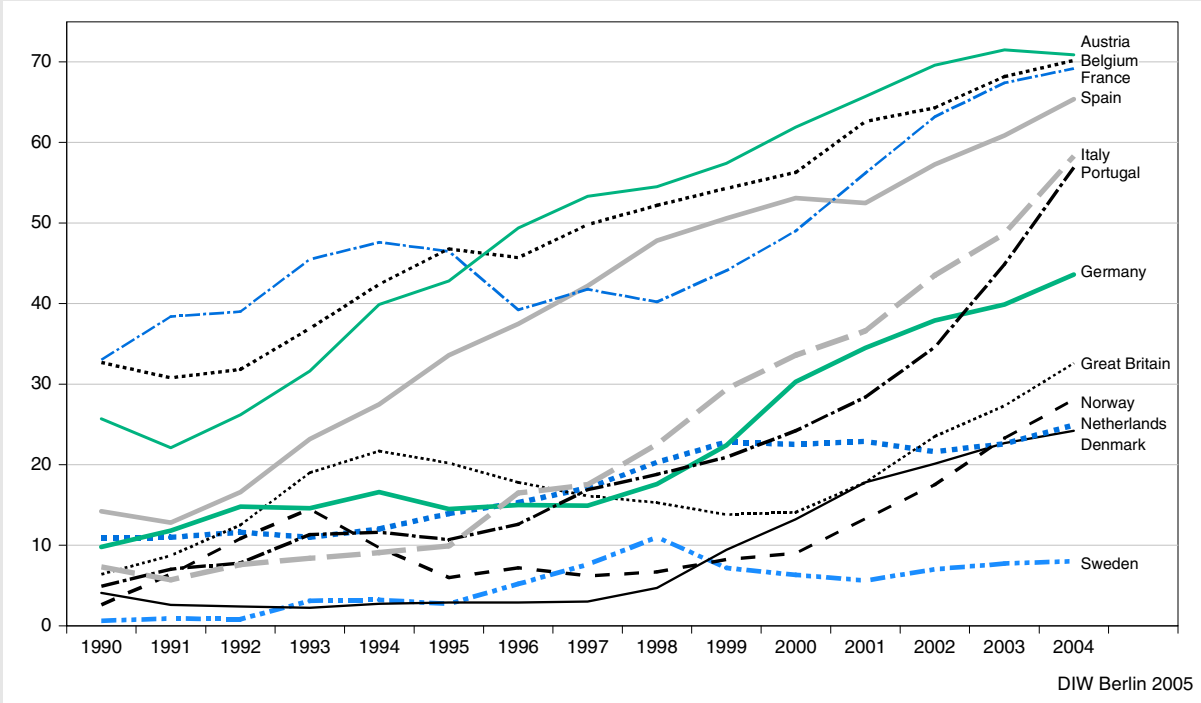
the current price relation to the neighboring countries was taken into consideration. In addition, with the accession of the Czech Republic and Poland into the European Union on May 1st, 2004, the import restriction of 200 liters at the borders of these countries no longer was applicable. The gray imports of diesel fuel in 2004, primarily in the fuel tanks of freight trucks and semi-trailers, are now estimated by DIW Berlin to be 2.2 billion liters. For overall transnational traffic, including the diesel fuel tanked abroad by German cars for international distances, 2.9 billion liters must be added to domestic sales, thus nearly 8% more than in the previous year. Overall, as compared to 2003, diesel consumption increased by almost 6% for diesel motor vehicles registered domestically.

The domestic sales of carburetor fuels in road traffic has been on the decline since 2000. In 2004 this trend continued; sales regressed by 2.6% to 33.1 billion liters.[9] The causes can be seen on the one hand in the reduction in the number of passenger cars with gasoline engines, which consume the bulk of carburetor fuels. On the other hand, along with diesel, gasoline is also being increasingly imported in the fuel tanks of German motor vehicles as gray imports. For 2004, DIW Berlin estimates the quantity at 1.4 billion liters, 8% more than in 2003. Together with the carburetor fuel quantities for distances tanked abroad by German motor vehicles, primarily during vacations, a domestic consumption of

[9] This includes the energy quantities for natural gas vehicles and other alternative fuels. In terms of quantity, these motor vehicles still have no significance for mileage and energy consumption given in the traffic sector. Cf. Dominika Kalinowska: 'Alternative Kraftstoffarten im Straßenverkehr'. In: *Wochenbericht des DIW Berlin,* no. 5/2005 pp. 87-94.

Figure 1

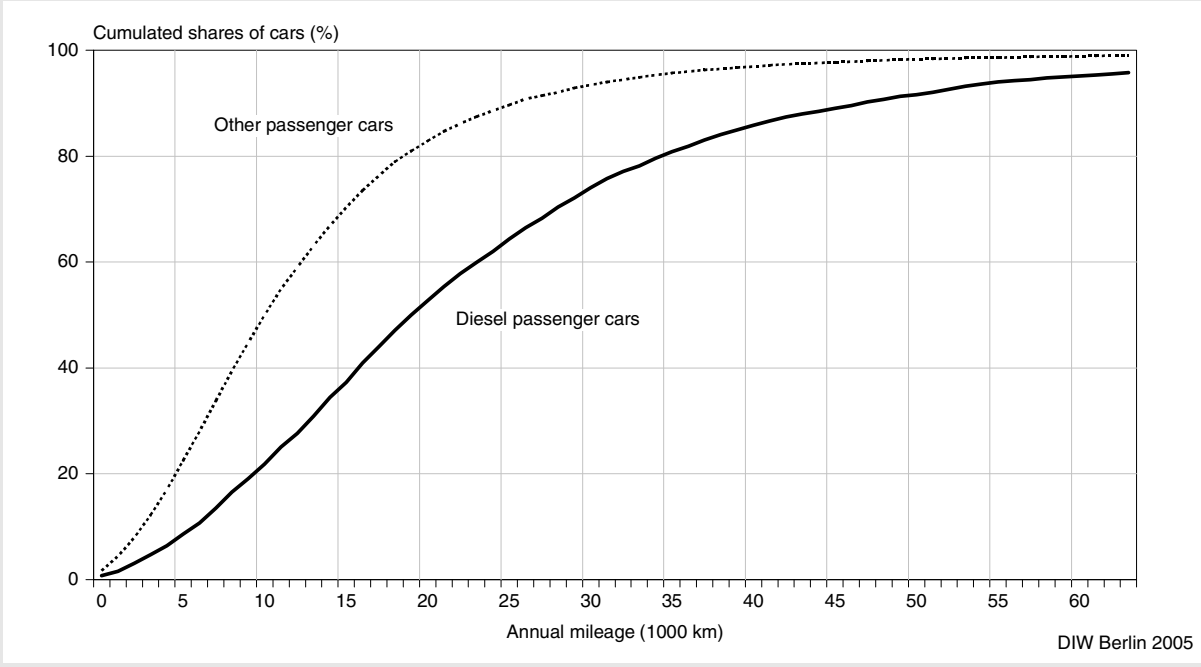
Share of Diesel-cars in New Registrations in European Countries



Sources: ACEA; DIW Berlin calculations.

Figure 2

Passenger Cars – Distribution of Annual Mileage



Sources: Mileage records 2002; DIW Berlin calculations.

Table 2

New Registrations of Passenger Cars in Germany in 2004 according to Segments[1] and Fuel Types

Segment[1]	Registrations in 1000				Standard Consumption Values					
					Liter per 100 km			g CO_2 per km		
	CF[2]	DF[3]	Total	Share (%) DF	CF[2]	DF[3]	Total	CF[2]	DF[3]	Total
Mini	122	13	135	9.7	6.0	4.2	5.8	141	111	138
Compact	512	109	620	17.6	6.2	4.8	6.0	146	127	142
Lower medium-sized class	513	353	865	40.7	7.0	5.4	6.3	164	142	155
Medium-sized class	280	362	642	56.4	8.1	5.9	6.9	190	156	171
Upper medium-sized class	104	162	266	61.0	9.8	7.5	8.4	230	198	211
Luxury class	57	14	71	19.5	10.1	8.5	9.8	237	224	235
SUVs	59	121	180	67.2	11.0	9.9	10.4	258	261	260
Vans	171	216	387	55.8	7.9	6.2	6.8	186	164	171
Utilities	6	86	92	93.8	8.2	6.3	6.4	193	166	168
Other	8	.	.	.	5.8	.	.	136	.	.
Total	1831	1436	3267	43.9	7.6	6.5	7.1	178	171	175

1 As per the classification of the models by the Kraftfahrt-Bundesamt; cf. http://www.kba.de/. The convertibles categorized as the tenth segment by the KBA are allocated to the respectively corresponding segment here. — 2 Carburetor fuel and passenger cars with other drive types. — 3 Diesel fuels.
Source: Kraftfahrt-Bundesamt (KBA, German Federal Bureau of Motor Vehicles and Drivers); DIW Berlin calculations.

35.8 billion liters results, 2.1% less than the previous year. This calculation confirms the consumption quantities determined from disaggregated vehicle data which result in a comparable figure given the decrease of gasoline engine passenger cars by a total of 1.4 % and a decrease of the average consumption of these passenger cars by 0.6%.

Contribution to climate protection unsatisfactory in the past decade

From 1994 to 2004 the number of passenger cars on the road in Germany rose by 14 %, the number of freight vehicles by 30%. Alongside the number of motor vehicles, the mileage also continued to increase: overall it increased by 14%, the mileage of passenger cars by 12%, that of freight vehicles by 23%. Additionally, there have been no signs of a saturation of passenger car numbers[10] thus far, nor has the average use of the passenger car – the median mileage – decreased drastically, as was anticipated by the rising multi-car status of private households. Apparently the opposing tendencies – such as the greater degree of urban sprawl and the concentration of trade on centers – are so powerful that overall, the average annual mileage per passenger car has remained the same – a good 13 000 km during this time period. This development must be seen against the background of an average increase of fuel prices by a nominal 50% from 1994 to 2004. Thus analyses are confirmed in which only a marginal price elasticity of fuel and traffic demand was determined.[11]

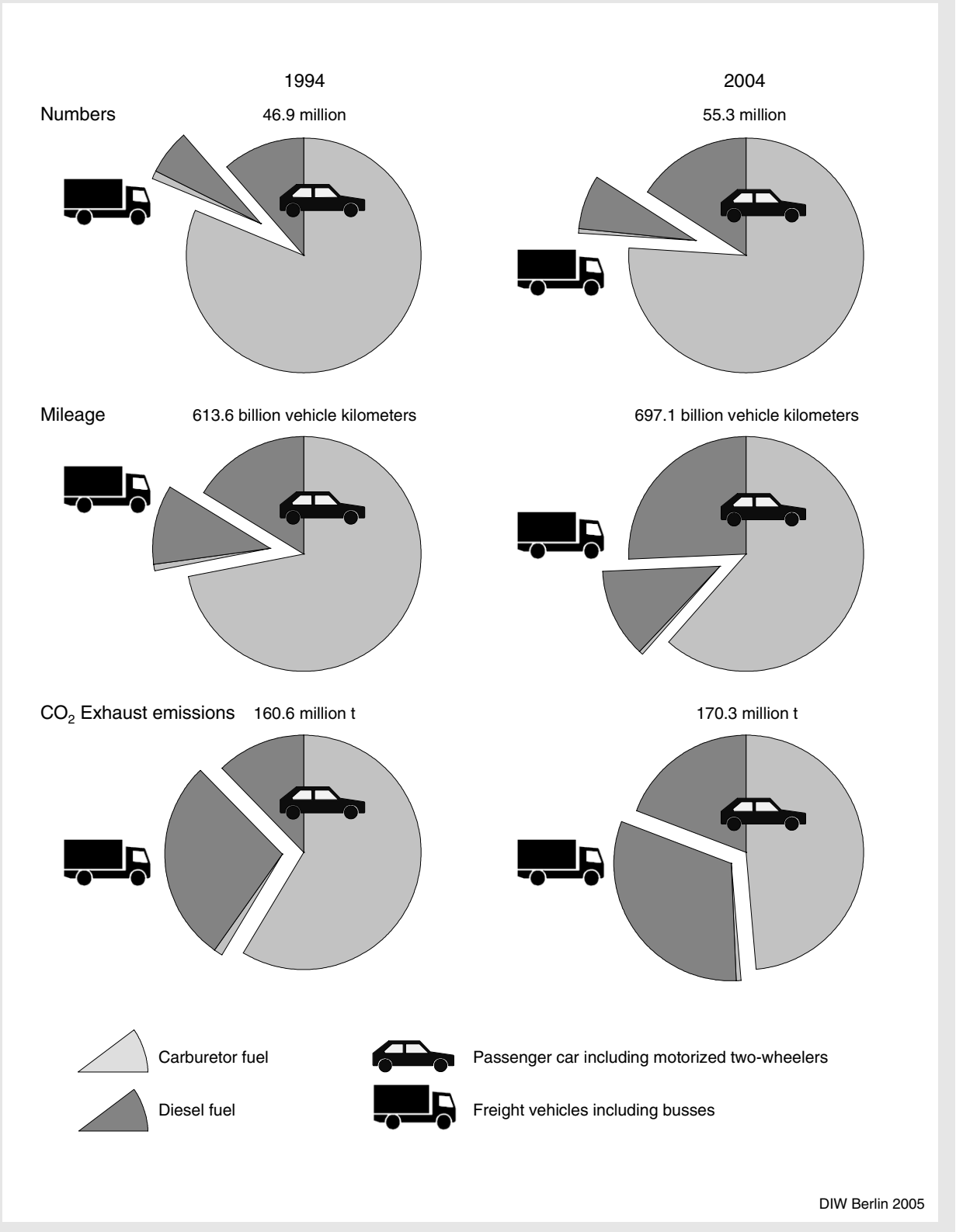
Technical advancement in engine and vehicle development has improved the utilization of energy contained

[10] In the first half of 2005, around 2.5% more vehicles were newly registered, at 1.7 million passenger cars, than in the corresponding period of the previous year.

[11] International literature states the short-term elasticity of the passenger car mileage in relation to the fuel price as approximately −0.15 and long-term as approximately −0.30. The price elasticity of fuel demand is approximately twice as high. Current meta studies on the elasticity of fuel and transportation demand are offered by Daniel Graham and Stephen Glaister: 'Road Traffic Demand Elasticity Estimates: A Review'. In: *Transport Reviews,* vol. 24, May 2004, pp. 261-274; Phil Goodwin, Joyce Dargay and Mark Hanly: 'Elasticities of Road Traffic and Fuel Consumption with Respect to Price and Income: A Review'. In: *Transport Reviews,* vol. 24, May 2004, pp. 275-292; Rainer Hopf and Ulrich Voigt: 'Verkehr, Energieverbrauch, Nachhaltigkeit' (Traffic, Energy Consumption, Sustainability). Heidelberg among others, 2004, p. 52 et seq. For Germany, a current empirical study determined a value of −0.30 for the fuel price elasticity; cf. Institut für angewandte Verkehrs- und Tourismusforschung (IVT, Institute for Applied Transport and Tourism Research), ProgTrans AG and STASA (Steinbeis Transferzentrum Angewandte Systemanalyse): 'Analyse von Änderungen des Mobilitätsverhaltens – insbesondere der Pkw-Fahrleistung – als Reaktion auf geänderte Kraftstoffpreise' (Analysis of Changes in Mobility Behavior – Especially Passenger Car Mileage – as Reaction to Altered Fuel Prices). Final report to research project no. 96.0756/2002 of the Bundesministerium für Verkehr, Bau- und Wohnungswesen (Federal Ministry for Traffic, Construction and Housing). Heilbronn 2004.

Figure 3

Vehicle Numbers, Mileage and CO_2 Exhaust Emissions 1994 and 2004



Sources: German Federal Bureau of Motor Vehicles and Drivers; Federal Office for Goods Traffic; DIW Berlin calculations.

in fuel and consequently lowered specific consumption. But only a fraction of these innovations actually also decrease consumption since, simultaneously, more and more heavy and high-performance cars are sold.[12] Additional vehicle features (comfort, safety) increase consumption – without this fully affecting the standard consumption values. The effective average consumption of passenger cars sunk in the 10 years analyzed by 11% – from 8.9 l to 7.9 l per 100 km. Since freight vehicles have fewer options of providing for fuel economization, specific consumption – as relates to all motor vehicles – has sunk by 8% during the time period covered by the study.

Overall, however, with almost 70 billion liters, fuel consumption of the domestic vehicle fleet in 2004 was just under 5% higher than in 1994. Seen from an environmental perspective, this development cannot be viewed as satisfactory, especially since it is sugarcoated by the reference parameter of 'fuel volume in liters.'

The success in reducing average consumption can be primarily traced back to the increase in diesel passenger cars. With the growing significance of diesel fuel in the traffic area and its higher carbon density per liter, the CO_2 discharge has climbed more sharply than the fuel consumption measured in liters.[13] The CO_2 emissions were 6% higher in 1999 than in 1994, since then they have stagnated, hovering at approximately 170 million tonnes annually.[14] In the meantime more than half of the CO_2 emissions of domestic vehicles come from the exhaust of diesel engines.[15]

The European automobile association, ACEA, submitted a voluntary commitment to the EU Commission to reduce CO_2 discharge of new vehicles to 140 grams of CO_2 per kilometer by 2008. This binding commitment of the automobile industry to reduce fuel consumption is one of the three core areas of the community strategy to reduce CO_2 emissions in passenger cars.[16]

From 1995 to 2003 a reduction by almost 12% from 186 to 164 grams of specific CO_2 emissions in new passenger vehicles was achieved in the EU15 countries (171 grams for gasoline and 157 for diesel passenger cars, respectively).[17] In their review of the effectiveness of the strategy, the Commission reached the conclusion that further efforts were required in order to increase the average reduction rate and achieve the objective set.

The comparative value for passenger cars registered in Germany in 2004 amounts to 174.8 grams; in this context gasoline engine and diesel engine passenger cars are only marginally discrepant in their climate relevance with an average of 178.4 grams and 170.5 grams of CO_2 discharge respectively per km.[18]

Thus, to achieve the objectives in terms of climate policy, it does not suffice to count too much on the contribution of the diesel components. It appears to be crucial that incentives to reduce fuel consumption in wider market segments are insufficient. In the mid-term, alternative drive systems with a substantial lower emission value must play a role in any strategy targeted towards reducing emissions.[19] Only when further technical innovations and modified buyer behavior – both, for example, bolstered by appropriate tax measures[20] – more powerfully advocate vehicles with a lower rate of consumption will Germany be able to appropriately contribute to the reduction objectives created at the European level.

[12] In the number of passenger cars on the road, the average engine performance of 61 kW in 1993 has taken a clear leap, reaching 73 kW in 2004.

[13] In 2004 diesel passenger cars consumed around 18% less, at 6.9 l per 100 km, than the average passenger car with carburetor engine at 8.4 l per 100 km. More than half of this low consumption rate can be traced back to the higher energy density per liter of diesel fuel as compared to gasoline. At combustion, diesel fuel emits 12% more CO_2 per liter than carburetor fuel.

[14] This does not contradict other statements made about the reduction of CO_2 emissions of traffic after 1999. As a result of the differentiation according to energy balances and the definitions relevant according to the obligations stipulated in the Kyoto Protocol, only the fuel sold domestically is considered. Cf. Hans-Joachim Ziesing: 'Carbon Dioxide Emissions in Germany – Stagnating in 2004'. In: *DIW Berlin Weekly Report,* no. 9/2005.

[15] The voluntary commitment concerning environment policy made by the German Verband der Automobilindustrie (VDA, association of the automobile industry) to the federal government in 1995 to lower, by 2005, the average standard fuel consumption of passenger cars sold in Germany by 25% as compared to 1990 is stipulated in more specific consumption quantities. According to the VDA, by 2004 a reduction of the standard consumption of close to 23% was realized. Cf. VDA Annual Report for passenger vehicles 2005, p. 127 f.

[16] Cf.: A community strategy to reduce CO_2 emissions from passenger cars and improve fuel economy In: Communication from the Commission COM (95) 689 final, Brussels and Bulletin EU 12-1995, Clause 1.3.146, Brussels. Similar commitments were made by the Korean and Japanese associations with the target year being 2009.

[17] Cf. Implementing the Community's Strategy to Reduce CO_2 Emissions from Cars: Fifth Annual Communication on the Effectiveness of the Strategy. In: Communication from the Commission, COM (2005) 269 final, Brussels.

[18] Cf. Kraftfahrt-Bundesamt (KBA): *Statistische Mitteilungen* (Statistical notes), series 1, Flensburg, 2005, p. 66. In this context the emission values for new diesel cars fell to 170 grams by 2001 and starting in 2002 exhibited a slightly rising tendency.

[19] The share of alternative drive technologies is still at 0.25% for passenger car new registrations; cf. Kraftfahrt-Bundesamt (KBA), loc. cit.

[20] For example, the most recent initiative of the European Commission could be taken up which, by means of a draft directive, strives for the complete or partial orientation of the measurement basis of registration and annual vehicle taxes in Europe with CO_2 emissions, cf. Proposal for a Council Directive on Passenger Car Related Taxes, COM (2005) 261 final, Brussels, 29 March 2005.