Indicator fact sheet

TERM 2006 01 — Transport final energy consumption by mode

Indicator code / ID	
Analysis made on (Assessment date)	01 September 2006
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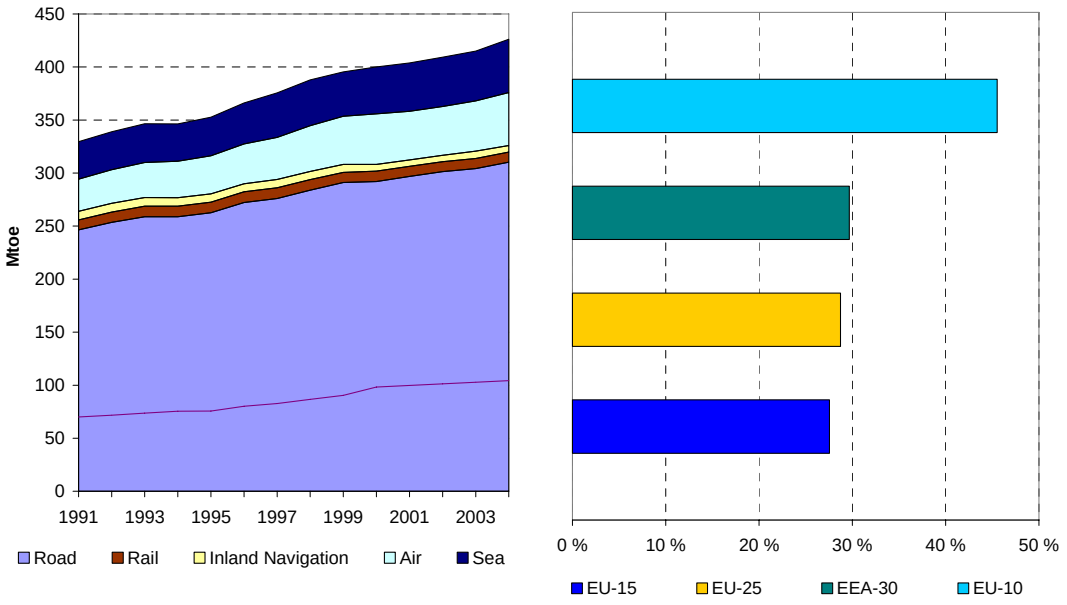
☹ Transport energy consumption increased by 29 % between 1991 and 2004. It is one of the major energy consuming sectors, being responsible for about 34% of total energy consumption (all sectors) in 2004. Aviation is the fastest growing energy consumer, and road transport is the largest, consuming around 73% of transport energy consumption. The continued growth in energy consumption threatens compliance with the Kyoto targets.

Figure 1: (a) Total energy consumption in transport (EEA-30), 1991–2004 (Mtoe) and (b) growth in transport energy consumption by region between 1991–2004

(a) **(b)**



Note: Inland navigation includes transport on inland waterways and coastal transport. The line dividing road transport distinguishes the share of freight (*lower part*) from passenger (*upper* part) transport. .Modelled data on the breakdown of road passenger and road freight is not be available from JRC for years 2001 through 2004.These data points were therefore estimated. This estimation was based on JRC's projections from the POLES model, .and Eurostat data. Data points for year 2001 and onwards are therefore to be treated as indicative figures.

The division is based on information from the 25 EU countries. Box 1 further elaborates on this. Transport by pipelines is not specified in the chart, however, is included in total transport data, as its contribution is far less than 1 % of total energy consumption by transport. EU-25 refers to the 25 EU member states as of May 2004. EEA-30 refers to EU-25 plus Norway, Iceland, Bulgaria, Romania, and Turkey. No data are available for EEA member countries Liechtenstein and Switzerland. The modes included in figure 1a are also included in figure 1b. Detailed data can be found in Table 1 and 2.

Source: Eurostat, 2006.

Results and assessment

Policy relevance

Transport is one of the largest energy-consuming sectors, accounting for 34% of final energy consumption (EEA 2006 assessment) and transport energy consumption still rises year-by-year. Transport relies almost exclusively on fossil fuels (98%) so greenhouse gas emissions grow roughly parallel to energy consumption.

Policy context

Reduction of fuel consumption by transport or of its impacts may be achieved by reducing transport demand, by a shift to more fuel efficient transport modes, by improving transport management, by increasing energy efficiency of vehicles and by using renewable fuels (e.g. biofuels, or fuel cell or electric vehicles powered by renewable fuels).

Although climate policy and the Kyoto protocol, as well as - to a lesser extent - air quality policy, are important drivers in reducing fossil fuel consumption, this fact sheet focuses mainly on energy policy. Other issues are addressed in TERM 02 and TERM 03.

The Green Paper on Energy Efficiency (COM(2005)265 "*Doing more with less"*) also outlines a number of options for transport :

1. organizing air-traffic management; the SESAME initiative could theoretically give rise to kerosene savings of 6% to 12% by reducing congestion around airports
2. optimising traffic management; (satellite) navigation systems, and cooperative driver assistance are mentioned as options to increase energy efficiency, along with safety
3. developing a market for clean vehicles; many of the clean technologies (electric, natural gas, hydrogen) also lead to more energy-efficient transport
4. infrastructure charging; the congestion charge in London e.g. has lead to a decrease in fuel consumption by 20%. To some extend, these savings are expected to be counterbalanced by increased transport outside the congestion charging zones, e.g. due to increased P+R from outside charging zones and in the long run due to companies moving away from the charging area.
5. tyres; introducing properly performing tyres as well as optimizing pressure may lead to reduction of energy consumption by 5% to 9%.

Next to the technologies mentioned in the Green Paper (item 3), the promotion of biofuels plays an important role in traffic energy policy (Directive 2003/30/EC). The indicative target set for 2010 is 5.75% substitution of traditional transport fuels. See TERM 31 and chapter 7 of TERM 2005 report[1].

In the Sustainable Development Strategy, the European Commission (2001) made sustainable transport one of its priorities. The following measures at the EU level were envisaged to achieve energy savings in transport:

1. *Energy taxation*: the Commission's proposal for a framework Directive to restructure and harmonise the Member States´ national systems of energy taxation was adopted by the Council in October 2003. The new Directive leads to an increase in minimum tax rates on mineral oil products and a widening of the scope of the EU system of excise taxation beyond mineral oils to include competing sources of energy. It will thus help reduce emissions, prevent distortions of competition in the internal market and contribute to the internalisation of external costs of energy use.
2. *CO_2 emission reduction measures*: The Community's strategy to reduce CO_2 emissions from passenger cars and improve fuel economy was endorsed by the Council in 1996 (European *Commission*, 2000b). It aims at achieving an average CO_2 emission figure for new passenger cars of 140 g CO_2/km by 2008/09 by covenants with the car manufacturers' associations ACEA, JAMA and KAMA. This year a review is to be held on the potential for further cuts in average new car CO_2 emissions between 2008 and 2012, aiming towards the

[1] Both available at the www.eea.europa.eu

EU's overall target of 120 g/km. According to the latest progress report, considering all measures at EU and national level, the average specific CO_2 emission from new passenger cars in the EU decreased in the period 1995 to 2002 from 186 g CO_2/km to 166 g CO_2/km, corresponding to a decrease of about 1.5 % per year. However, significantly stronger reductions of 3.5 % per year will have to be achieved to reach the 140 g CO_2/km by 2008/09 (European Commission, 2004). In a recent resolution, the European parliament urgently asks the Commission for additional measures to reach the Community goals. With passenger car taxation changes that favour low carbon emitting cars (European Parliament, 2004).[2] This resolution seems to fit with the DG ENV strategy to achieve fuel efficiency objectives consists by means of three steps: (1) covenant with car manufacturers, (2) consumer information (labelling) and (3) tax incentives (especially CO2-related vehicle taxes).

3. *Introduction of alternative fuels*: in order to promote the use of biofuels in transport and pave the way for gradually increasing the capacity of biofuel production, while securing the energy supply and rural employment, Directive 2003/30/EC has been adopted that aims at a biofuel penetration of 2 % in 2005 and 5.75 % in 2010. Member States are not subjected to any binding target, however, their progress has to be reported annually with respect to the projected goals. Member States are generally allowed to reduce excise duties for biofuels by up to 100 % (Directive 2003/96/EC) in order to stimulate their use.

4. *Improve energy efficiency*: The long-term EU target as expressed in the 5th Framework Programme is a 50 % reduction in CO_2 emissions per passenger-kilometre and per payload-kilometre. In the shorter term the aim is 5 to 10 % energy savings in order to achieve aggregate reductions in CO_2 emissions (European Commission, 2000c). In 2003, the European Commission came with a proposal for a Directive on the improvement of energy efficiency. The Directive sets indicative targets for Member States to achieve 1 % annual savings in energy efficiency. Each country would then decide how to distribute this target among their different sectors. The Commission envisages covering also all distribution sectors, from electricity and gas to district heating and transport fuels[3]. As to not put a disadvantage on countries that already have undertaken measures in energy saving, countries may take into account their efficiency gains as from 1991 (European Commission, 2003a).

5. *Research, development and promotion*: The European Commission is working on the following “clean transport” fields with respect to energy and transport:

– Promoting and developing clean urban transport (e.g. CUTE and CIVITAS[4]);

– Hydrogen application; “European Hydrogen and Fuel Cell Technology" Platform. The new platform is to promote and smoothen the EU's transitions from a fossil fuel based economy to a 'hydrogen economy' while gaining worldwide leadership in this new technology.

– The ‘Intelligent energy for Europe’ multi-annual research programme 2003–2006 (European Commission, 2002). This programme – with a total budget of € 215 million for the four-year period – is structured around specific fields: this includes the STEER programme, which concerns research on alternative vehicle propulsion, support for initiatives relating to the energy aspects of transport, the diversification of fuels and the promotion of renewable fuels. It also includes the preparation of legislative measures and their application.

The legislation and decisions outlined in this section should in principle apply to the ten countries joining the EU in 2004. However, in some cases they have negotiated so-called transition periods, giving them more time for implementation of specific provisions of EU environmental Directives.

[2] It should be stated here that the CO_2-emission factors reported by ACEA/JAMA/KAMA are based on the standard ECE-testing procedure and the EUDC (Extra Urban Driving Cycle). During this test all electronic devices and air-conditioning are turned off. It is therefore likely that real-world CO_2-emission factors are higher than presented by ACEA/JAMA/KAMA.

[3] Energy intensive industries falling under the Emissions Trading Directive or IPPC Directive are excluded from the scope of the Directive.

[4] CUTE stands for Clean Urban Transport for Europe and CIVITAS for CIty VITAlity Sustainability.

The Strategy was reviewed in early 2005 (COM(2005)37) followed by a draft declaration (COM(2005)218) on sustainability that includes the striving for decoupling and the "polluter pays principle", but without specific focus on traffic and transport.

Environmental context

Transport is nearly fully dependent on fossil fuels (98 % of transport consumption, representing 67 % of final oil consumption in the EU-15, for EU-25 the case is more or less the same) and thereby contributes heavily to the emission of CO_2 and other air pollutants (European Commission, 2000a). Additionally it contributes to the depletion of oil sources.

Assessment

Transport energy consumption in EEA-30 area has grown by 2.3 % per year during the 1991 – 2004 period, and equalled 428 Mtoe (million tonnes oil equivalents) in 2004 (34 % of all energy use).

As for growth in energy consumption differentiated to region, all regions show an increase in growth for the 1991-2004 period compared to the 1990-2003 period. For the EU-15, EU-25 and EEA-30 the increase in growth varies between 1 and 3 %. For the 10 new member states the increase is far more significant, being 10%. This might be explained by a stronger economic growth in the 10 member states, increasing transport demand.

There have been improvements in energy efficiency, such as for passenger cars, where new vehicles have increased energy efficiency by 1.5 % per year since 1995, but they have fallen far short of offsetting the growth in transport demand. Moreover, the continuing shift of transport demand towards the more energy intensive road and air modes have also contributed to the increase. All in all, the growth in energy consumption in the transport sector is projected to continue at an average 1 % a year in the EU-25 from 2000-2030 if no further policy measures are taken.[5] However, transport demand is projected to grow faster. The energy intensity of transport is thus expected to decrease (European Commission, 2003a).

While the growth figures for the regions listed in figure 1b are roughly equal, it covers some heterogeneity. While in the EU-15 the transport energy consumption has been steadily growing since 1990 (despite collapse of economy), in many of the ten new members there has been an absolute decline during some years. Countries like Lithuania and Estonia have lower transport energy consumption today than in 1990, but it has nevertheless grown or remained stable since about 1992. Indeed, many of the new member states saw a decline in the early nineties reflecting the economic difficulties experienced in the transition to market economies, this effect being enlarged by the general economic depression at that time. However, since the middle of the nineties, the 10 new countries have showed strong growth of more than 3 % per year.

Additional policies that reduce the (need for) demand for transport, foster modal shift, improve transport management and enhance vehicle's energy efficiency are needed to comply with the Kyoto protocol. Policies that focus only on the efficiency of vehicles will not be sufficient to overcome the dependency on road transport, as they may reduce the cost of transport movements ,hence causing increased demand, via the so-called rebound effect.

Fair transport charging is also an effective policy to reduce the negative effects (e.g. fuel consumption) of transport and improve overall transport efficiency of society as a whole.

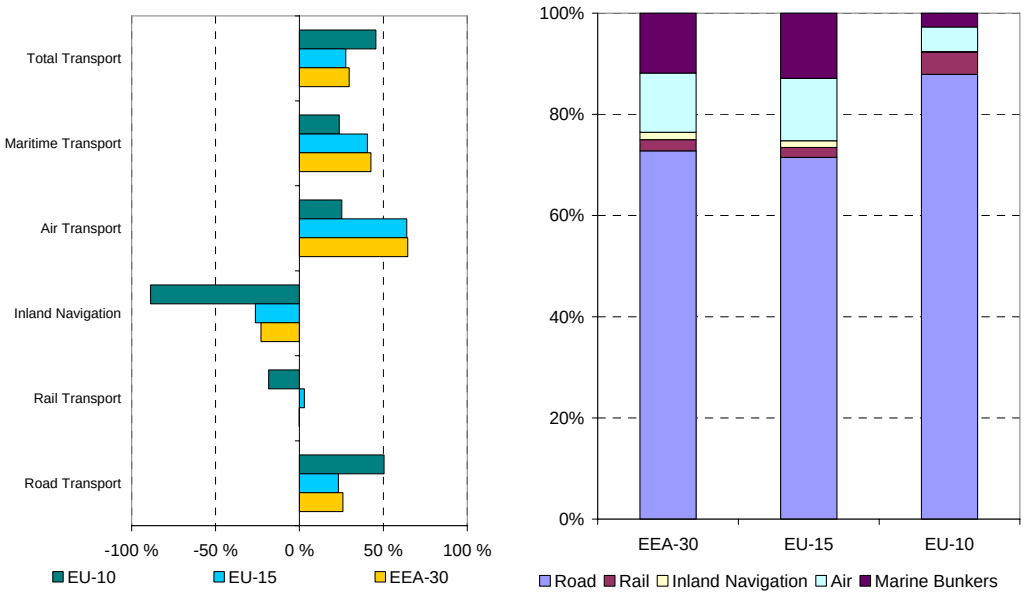
Sub-indicator: Energy consumption by mode

☹ **Road and air transport consume most transport energy in all Member States. These modes account for 84 % of total transport energy consumption in the EEA-30. Air transport shows the highest growth in energy consumption of all modes.**

[5] This is a baseline projection based on the PRIMES model that assumes business as usual. It does not include the effect of any new policies (the energy services directive, emissions trading, alternative fuels policy (in the projection biofuels reach only 3 % in 2020), post-Kyoto, etc. The projections were made as a framework for future policy making.

Figure 2: a) Change in final energy consumption from 1991 to 2004 by transport mode and b) distribution of final energy consumption over transport modes in 2004

a) **b)**



Notes: EU-25 is not included in the charts as it differs minimally with the EEA-30 bars. The energy consumption is allocated based on amount of fuel (energy) tanked in a specific country - this does in some cases not accurately reflect how much is *used* in or by that country or region. See text for discussion. The share of pipelines is very low (0.34 % for the EEA-30) and is therefore not visible on the chart. However the growth was threefold during the nineties in the EEA-30 area, mainly due to growth in Austria.

Source: Eurostat, 2006

Assessment

The total transport energy consumption in the EU-10 is still lower than for the EU-15.

Road transport energy consumption has increased in both the old and new member states. This is partly (at least EU-15 states) because real consumer fuel prices have remained more or less on the level of 1990 through the 1990's (see TERM 2005 21 EU – Fuel prices), while incomes have increased in the same period. As a result of this, car driving has become more affordable. Substantial increases in fuel prices since 1999 have slowed, but not reversed the growth in recent years. In the new member states, west-European transport patterns have been adapted, increasing the demand for road fuel. Reasons for this are:

- The economy-driven growth in demand for passenger transport affected by factors like development of housing, quality of public transport, changes in social behaviour.
- The growth in trade combined with a reconfiguration of trading patterns from eastward oriented (Russia) to westward oriented (Europe) and from bulk materials to manufactured goods. This increased the importance of road transport, because road transport is flexible and the easiest mode to access European markets. In turn, rail transport could not keep pace and lost its formerly high share.

The share of road transport is higher in the 10 new member states, as a result of the small share of air and sea shipping in transport energy consumption. Aviation generally is an expensive option for freight transport, and passenger aviation is not (yet) so much developed as in the EU-15 due to the less disposable income in the new member states. The low share of sea shipping for this region is geographically determined by general lack of coastal line.

Air transport shows the strongest growth in energy consumption of all modes over the last decade (56 % in EEA-30), linked to the strong increase in demand. However, energy

consumption declined in 2001 and 2002, likely a consequence of the terrorist attack on World Trade Centre in New York City and the SARS epidemic. EU projections from 2003, however, foresee an average 1.6 % annual growth in aviation energy demand from 2000-2030. However, this is without calculating the effect of possible future measures, e.g. emissions trading, en-route charging or fuel taxes (European Commission, 2003a).

The low share of rail is partly due to a relatively small share in demand, but also because rail transport in most situations is less energy-intensive than the main competitors. The large absolute decline in the ten new member states follow a decline in demand. As for freight transport, an important cause is the economical change (away from bulk industries). As for passenger transport, the decline can be explained by a.o. an increase in car ownership of 58 % in the ten new member states since 1990, poor rail service quality, reduced public funding, changes in social behaviour and reconfiguration of trading patterns.

Maritime transport covers fuels delivered to sea-going ships, except those navigating in coastal and inland waters. This category includes mainly international freight transport. Much of this fuel is tanked in countries such as the Netherlands (Rotterdam) that serve as international hubs. The energy consumption is allocated to countries based on amount of fuel (energy) tanked in a specific country (Table 1). This is not the most appropriate way of allocating consumption, because it does not reflect how much is *used* in, or *by* shippers from that country. The question of how to allocate consumption is a very difficult one when taking into account international transport. Each method has flaws. This is a difficulty in reducing emissions from the modes serving international transport, since discussions about allocation may continue. For reasons of simplicity and readily available data, allocation to countries is based on the amount of fuel tanked in a specific country in this factsheet.

Inland navigation includes water transport in coastal waters and on inland waterways and is only significant in countries with these geographical features. The energy consumption by inland navigation remained more or less constant during the 1990s followed by a decline that is now reversing. Energy consumption is nevertheless still 15 % below the 1990 level in the EEA-30, mainly due to reduced importance of bulk industries, which dominates demand for inland shipping.

Besides this overall common development, there is considerable variation among countries, although road in nearly all cases dominates energy consumption. Differences are mainly due to geographical and topographical constraints such as settlement and transport pattern, and to a limited extent by political choices.

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Data

Table 1: Energy consumption for the main modes in 2004 in the EEA-30

Unit: 1 000 tonnes of oil equivalents (ktoe)

	Road	Rail	Inland navigation	Air	Sea	Pipelines
Austria	6779	313	9	598		277
Belgium	8488	170	116	1427	7706	1
Bulgaria	2128	65	0	173	116	138
Cyprus	553	3		303	56	
Czech Republic	5520	277	6	334		27
Denmark	4027	101	121	888	791	
Estonia	382	48	8	30	149	0
Finland	3936	98	153	554	506	21
France	42273	1299	308	6256	2982	0
Germany (including ex-GDR	53187	1877	234	7312	2629	

from 1991)						
Greece	6022	61	669	1208	3212	1
Hungary	3484	162	1	221		
Iceland	213		6	125	71	3
Ireland	3811	51	18	727	149	
Italy	39094	900	248	3707	3343	42
Latvia	818	93	0	48	200	2
Lithuania	1197	77	5	40	109	11
Luxembourg (Grand-Duché)	2205	10		425		
Malta	166			101	23	
Netherlands	11004	188	283	3563	14589	
Norway	3285	163	810	603	509	
Poland	10503	528	1	285	250	212
Portugal	6343	67	25	842	650	
Romania	4664	333	41	140		28
Slovakia	1497	61		27		595
Slovenia	1330	28		21		
Spain	30817	1040	1534	5006	7136	
Sweden	6950	278	147	847	1875	
Turkey	10338	230	381	1861	1332	102
United Kingdom	39304	863	1107	12198	2051	0
EU-10	25448	1277	21	1408	787	847
EU-15	264240	7314	4972	45558	47618	341
EU-25	289688	8591	4994	46966	48404	1188
EEA-30	310318	9384	6231	49870	50434	1460

Note: For comparison, the total energy consumption for all sectors was 12.6 billion toe for the EEA-30. No data are available for EEA member countries Liechtenstein and Switzerland.

Source: Eurostat, 2006

Table 2 Trends in total transport energy consumption by country and region

Unit: 1 000 tonnes of oil equivalents (ktoe)

	1992	1994	1996	1998	2000	2002	2004
Austria	5145	5195	5760	6119	6276	7183	7976
Belgium	12434	12580	13401	14976	15013	16419	17908
Bulgaria	2165	2213	2059	2076	2053	2270	2620
Cyprus	743	759	843	906	1040	1032	915
Czech Republic	3074	3261	3747	3859	4749	5173	6164
Denmark	5043	5891	6035	6051	6041	5642	5928
Estonia	522	617	622	681	682	796	616
Finland	4761	4571	4416	4829	5067	5154	5268
France	45107	45715	48775	52495	54575	54333	53118
Germany (including ex-GDR from 1991)	63026	64044	64643	66895	68155	66545	65239
Greece	8815	9732	9672	10757	10761	10573	11173
Hungary	2602	2593	2658	3069	3251	3579	3867
Iceland	301	321	355	375	415	386	419
Ireland	2156	2340	2799	3452	4156	4532	4756
Italy	38311	39109	40329	43583	44006	45404	47333
Latvia	1041	949	806	713	694	1076	1161
Lithuania	1696	999	1257	1362	1141	1296	1439
Luxembourg (Grand-Duché)	1277	1341	1356	1553	1877	2126	2640
Malta	304	308	299	318	279	292	290
Netherlands	22387	22883	24523	25802	27114	28989	29627
Norway	4499	4772	5277	5619	5294	5266	5370
Poland	8008	8065	9485	9787	9555	9362	11778
Portugal	4914	5169	5607	6084	7174	7604	7927
Romania	3913	3243	4056	3918	3406	4373	5206
Slovakia	1382	1375	1381	1594	1549	2245	2180

Slovenia	885	1191	1496	1377	1313	1390	1379
Spain	28749	28739	32351	36425	38787	41676	45534
Sweden	8346	8615	8715	9336	9471	9161	10098
Turkey	9339	10751	12718	11265	12601	13122	14244
United Kingdom	48286	49204	51347	53064	54115	53504	55522
EU-10	20255	20117	22596	23666	24253	26240	29789
EU-15	298756	305127	319733	341422	352585	358847	370044
EU-25	319011	325245	342329	365088	376839	385087	399831
EEA-30	339231	346545	366788	388340	400610	410503	427695

Note: no data are available for EEA member countries Liechtenstein and Switzerland.

Source: Eurostat, 2006

Metadata

Web presentation information

1. Abstract / description / teaser:

   Transport energy consumption is ever growing, with aviation the fastest growing sector over-all. In the EU-10, however, the share of road is relatively large and growing faster than the other modes.

2. Policy issue / question:

3. Energy consumption is an important driver of environmental pressure, most notably climate change. The growth of energy consumption in the transport sector is hampering efforts to reduce total greenhouse gas emissions and thus far measures to reduce transport energy consumption have not had the desired effect, for emission reduction measures keep being outbalanced by the increased transport growth. Other aspects are energy security and pollution. Additional policy, combining different measures, with a strong focus on reducing energy consumption is essential. EEA dissemination themes: Transport

4. DPSIR: D

Technical information

1. Data source: Eurostat, 2006, Main data set *es_100a,* (downloaded June 2006) available from the website of Eurostat via following path or direct link.

   Path:

   urostat\Data\Environment and Energy\Energy\Energy Statistics – quantities\Energy Statistics – supply, transformation, consumption\.Supply, transformation, consumption – all products – annual data

   Link:
   http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/nrg/nrg_quant/nrg_10&language=en&product=EU_MASTER_energy&root=EU_MASTER_energy&scrollto=0

2. Description of data: Data concerns the energy finally consumed in transport.
   Original measure units: 1000 tonnes of oil equivalent, an energy unit equivalent to 4.19 TJ

   File: TERM 2006 01 Energy Consumption by Mode (second draft).xls

3. Geographical coverage: EEA-30 (EEA-32 excluding Liechtenstein and Switzerland)

   EU-25 may be divided into EU-15 (Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Austria, Portugal, Finland, Sweden, United Kingdom) and EU-10 (Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia) .

   EEA-30 is EU-25 plus Norway, Iceland, Bulgaria, Romania, Turkey

4. Temporal coverage: 1991–2004.

5. Methodology and frequency of data collection: Frequency: Annually. Energy consumption is based on fuel sales, reported through a common questionnaire. In the field of energy statistics no specific data collection technique is imposed by Eurostat. It is the responsibility of National Authorities to collect the relevant basic energy data required for filling-in the questionnaires and report them to Eurostat following the prescribed methodology. National data collection methods vary significantly from Country to Country and depending on the fuel type and production/consumption sector. Energy consumed by electric trains is included too, as is energy consumption from diesel trains. Last update 24.07.2006, most recent data 2004.

Quality information

1. Strength and weakness (at data level): Trends in individual countries are difficult to ascertain. Energy consumption data often show unexpected volatility from year to year.
2. Reliability, accuracy, robustness, uncertainty (at data level): The data for the EU-15 can be qualified as reliable, except data for pipelines, for which data lacks for many countries. Occasionally, data for older time series may change due to occasional revisions of methodology. These have previously resulted in changes of a few percent. For the ten new members and the three candidate countries the data are generally much less reliable. Gaps are frequent, as are conspicuous jumps in consumption (e.g. by a doubling or more). The most troublesome data are from the early nineties and data from the three Baltic States.
3. Overall scoring (give 1 to 3 points: 1 = no major problems, 3 = major reservations): 2

   Relevancy: 1
   Accuracy: 2 (Allocation of international consumption may be contentious)
   Comparability over time: 2 (good for groups of countries, but problematic for many individual countries where particularly data from the early nineties are less reliable)
   Comparability over space: 2 (the ten new member states have less systematic data, but group comparisons are quite safe)

Further work required

Allocation of international transport to individual countries may be contentious. This is particularly relevant for aviation and sea shipping. Data for inland navigation include not only river navigation, but also coastal shipping which would be useful to distinguish. Efforts are needed to improve methodologies and data to improve the statistics in this respect.

Box 1: Energy consumption in road transport by passenger and freight vehicles

The available European statistics does not distinguish between energy consumption in road transport by passenger and freight vehicles, since passenger and freight vehicles are both fuelled by diesel. However, road transport consumes the major portion of total transport energy demand, as is depicted in figure 1. Therefore, it is illustrative to divide road energy consumption into freight and passenger transport, on the basis of bottom-up calculation. Such a division also gives information about the shares of passenger and freight transport in total transport CO_2 emission, since carbon content of the various fuels is roughly the same.

Figure 3 presents the energy consumption of passenger and freight transport on roads in comparison with the other modes. Figure 4 zooms in at the distribution of energy consumption within transport on roads.

Private cars consume most energy in transport in the EU-25. These vehicles consume about half of the total transport energy demand. However, its share is declining, mainly because freight transport grew stronger than passenger transport during the last decade. For the future, energy consumption in freight transport is expected to remain growing stronger than in passenger transport. This is because people are supposed to travel no longer than 1.5 hours a day on average, independent of the mode used (horse and carriage or by car or high-speed train). Passenger transport may therefore reach a level of saturation, while freight transport is expected to continue growing since it is -to some extent- linked to economic growth.

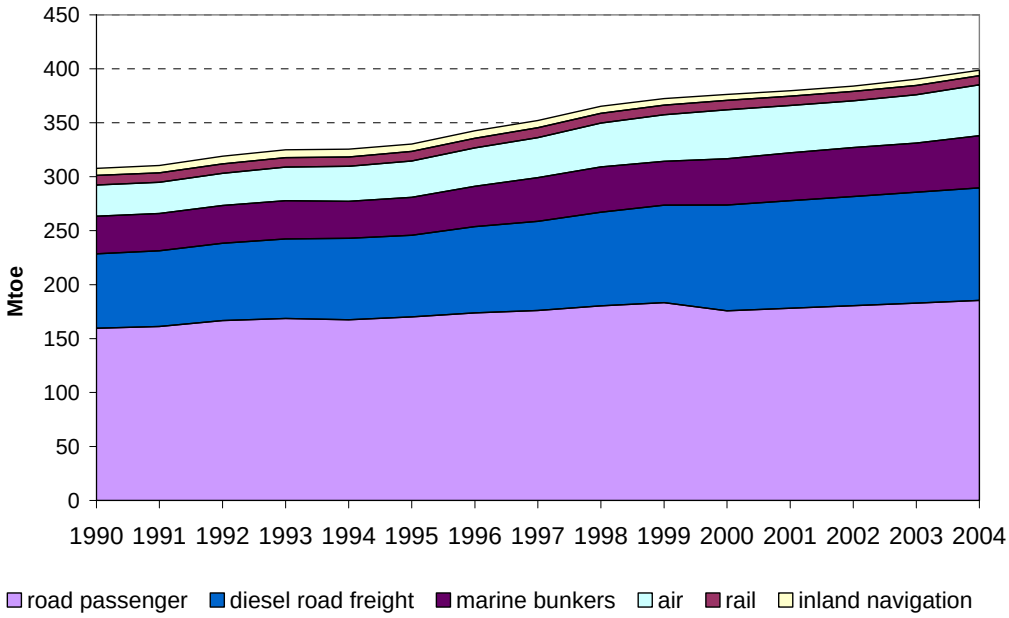
Private passenger vehicles are mostly fuelled by petrol. However, the share of diesel has grown during the nineties, reflecting the increased popularity of diesel cars. This is at least partly because of the improved driving properties of these vehicles, and the availibility of more models. For reference, see TERM Fact Sheet 21 external and internal cost issues on diesel cars. Since modern diesel vehicles have higher emissions of NO_X and PM_{10} than gasoline vehicles, the increased sale of diesel fuel creates problems with respect to human health and European air quality legislation at main transport routes and in cities. Since year 2000, the growth in diesel share for passenger cars seems to have stabelised.

Private vehicle fuel consumption -both gasoline and diesel- shows a downward trend in 2000. An explanation for this may be the high increased fuel prices at that time. Despite the decrease in passenger transport energy consumption, road freight energy consumption continued growing during this year, even at the strongest pace between 1994 and 2000.

LPG has a small market share but its share has remained more or less constant from the early nineties through 2004. This may be caused by the limited availability of refuelling points, higher maintenance costs and sensitivity to interruptions.

Note: Modelled data data on (1) the breakdown of road passenger and road freight and (2) the breakdown of fuel type,is not be available from JRC for years 2001 through 2004.These data points were therefore estimated. This estimation was based on JRC's projections from the POLES model, .and Eurostat data. Data points for year 2001 and onwards are therefore to be treated only as highly indicative figures. All other data of figure 3 and figure 4 are, although to a lesser extend, also indicative values.

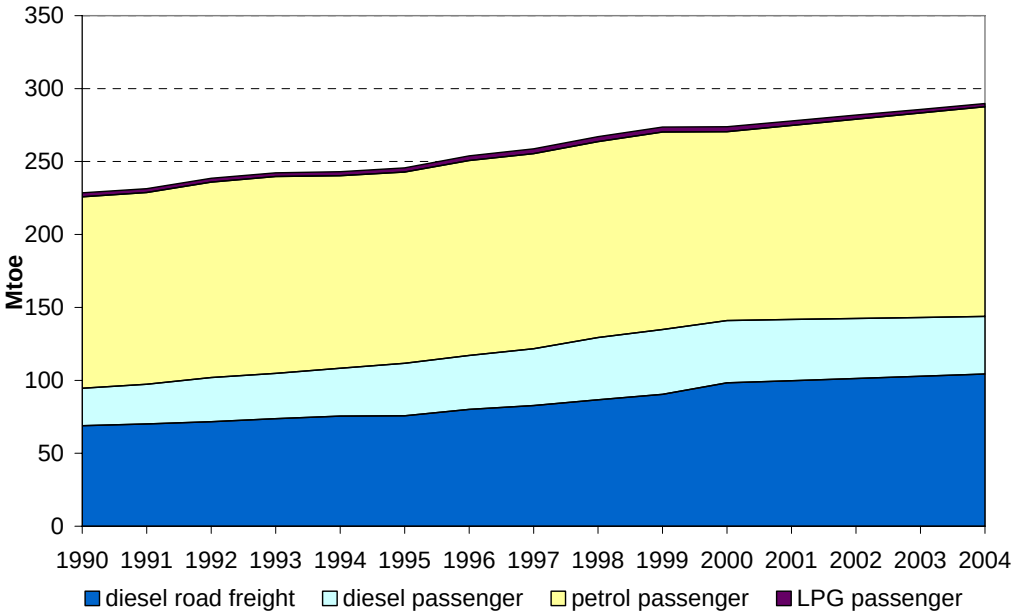
Figure 3: Distribution of EU-25 transport energy consumption over modes



Note : Road freight energy consumption (both in fig.3 and fig.4) represents heavy duty energy consumption, which includes bus energy consumption.

Source: Eurostat, 2004; JRC,2004

Figure 4: Distribution of EU-25 road transport energy consumption over passenger and freight transport.



Source: Eurostat, 2004; JRC,2004

Box 2 Energy use from other life cycle aspects than fuel use

The energy content of the fuel consumed does not reveal all the energy consumed during the entire life cycle of transport vehicles. Not only is energy consumption involved in the production chain of the fuel itself (processing, refining, pre-combustion, power generation) but also in the production and maintenance of vehicles and infrastructure.

Life cycle inventory databases provide general insight in the contributions of the various links in the chain. In the table below, the contributions to the total life cycle energy consumption per tonne-km or person-km are given for a number of transport modes. All data reflect the average situation in Europe; none of the figures is probably quite applicable in any particular case.

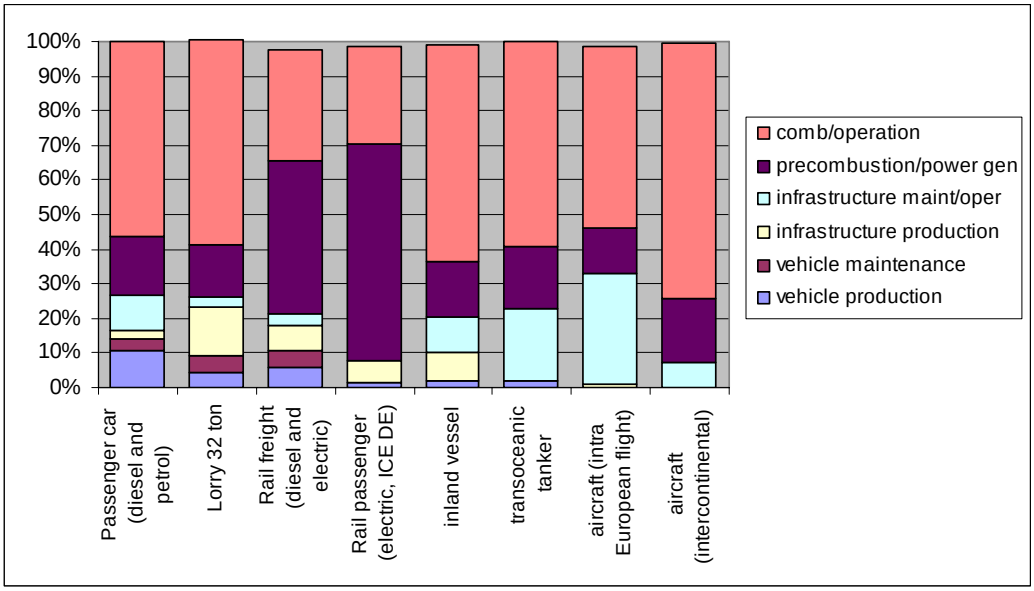
Table 3 Life cycle contributions to gross energy demand

Average European, per tkm/pkm	Vehicle		Infrastructure		Precomb/ power	Combustion/ operation	total covered
	prod.	maint.	constr.	maint/oper			
Passenger car (diesel and petrol)	11%	3%	2%	11%	17%	56%	100%
Lorry 32 ton	4%	5%	14%	3%	15%	59%	100%
Rail freight (diesel and electric)	6%	5%	7%	3%	44%	32%	98%
Rail passenger (electric, ICE DE)	1%	0%	6%	0%	63%	28%	98%
inland vessel	2%	0%	8%	10%	16%	62%	99%
transoceanic tanker	2%	0%	0%	21%	18%	59%	100%
aircraft (intra European flight)	0%	0%	1%	32%	13%	52%	99%
aircraft (intercontinental)	0%	0%	0%	7%	19%	74%	100%

Sources: EcoInvent 1.2 (update 13-02-2006)

The major contributions are, clearly, the combustion phase and pre-combustion or power generation in the case of electric rail (traction). However, the contribution of port and airport maintenance and operation is considerable for oceanic transport and intra-European air travel. For passenger cars, both infrastructure maintenance and vehicle production contribute on average 11% each, which is non-negligible with respect to the combustion phase.

Figure 5 Graphical representation of table 3



Source: EcoInvent 1.2 (update 13-02-2006)