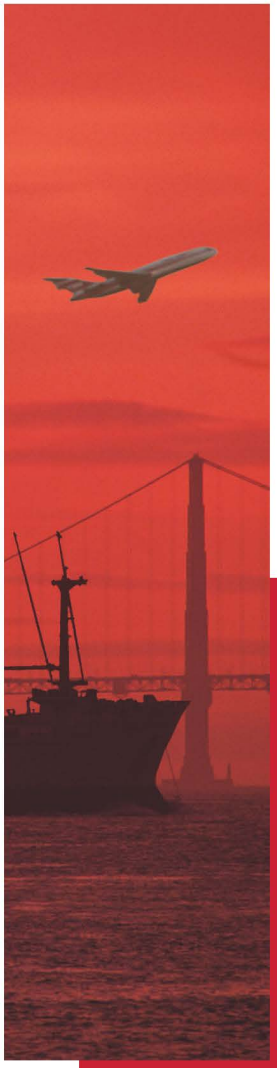
European Parliament

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT B
STRUCTURAL AND COHESION POLICIES



Agriculture and Rural Development

Culture and Education

Fisheries

Regional Development

Transport and Tourism

RESEARCH FOR TRAN COMMITTEE - GREENHOUSE GAS AND AIR POLLUTANT EMISSIONS FROM EU TRANSPORT

IN-DEPTH ANALYSIS

EN

2015

European Parliament

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

TRANSPORT AND TOURISM

RESEARCH FOR TRAN COMMITTEE - GREENHOUSE GAS AND AIR POLLUTANT EMISSIONS FROM EU TRANSPORT

IN-DEPTH ANALYSIS

This document was requested by the European Parliament's Committee on Transport and Tourism.

AUTHOR

Marc Thomas
Policy Department B: Structural and Cohesion Policies
European Parliament
B-1047 Brussels
E-mail: poldep-cohesion@europarl.europa.eu

EDITORIAL ASSISTANCE

Adrienn Borka

LINGUISTIC VERSIONS

Original: EN

ABOUT THE PUBLISHER

To contact the Policy Department or to subscribe to its monthly newsletter please write to: poldep-cohesion@europarl.europa.eu

Manuscript completed in November 2015.

Print	ISBN 978-92-823-8348-3	doi:10.2861/224	QA-04-15-820-EN-C
PDF	ISBN 978-92-823-8347-6	doi:10.2861/495781	QA-04-15-820-EN-N

This document is available on the Internet at:
http://www.europarl.europa.eu/studies

DISCLAIMER

European Parliament

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

TRANSPORT AND TOURISM

RESEARCH FOR TRAN COMMITTEE - GREENHOUSE GAS AND AIR POLLUTANT EMISSIONS FROM EU TRANSPORT

IN-DEPTH ANALYSIS

Abstract

Transport is the only EU sector where greenhouse gas emissions have risen since 1990. Conversely, transportation has significantly reduced its emissions of atmospheric pollutants in the past two decades - but it is still a major cause of air pollution, especially in urban areas. Besides, it is unclear whether the decline in transport demand/emissions observed since the 2008 economic downturn is only cyclical or is (at least partly) attributable to structural reasons.

IP/B/TRAN/INT/2015-06 2015

PE 563.409 EN

CONTENTS

LIST OF ABBREVIATIONS

C_6H_6	Benzene
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
EEA	European Environmental Agency
FEC	Final energy consumption
GHG	Greenhouse gas
GWP	Global warming potential
HDV	Heavy-duty vehicle
IPCC	Intergovernmental Panel on Climate Change
N_2O	Nitrous oxyde
NH_3	Ammonia
NMVOC	Non-methane volatile organic compound
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
O_3	Ozone
Pb	Lead
pkm	Passenger-kilometre(s)
$PM_{2.5}$	Particulate matter with a diametre of 2.5 micrometres or less
PM_{10}	Particulate matter with a diametre of 10 micrometres or less
SO_2	Sulphur dioxide
SO_X	Sulphur oxides
tCO_2-eq	Tonne CO2 equivalent
tkm	Tonne-kilometre(s)
toe	Tonne oil equivalent

1. OVERVIEW

Between 1990 and 2013 the EU-28 population grew by about 30 million[1]. During the same period the number of cars rose by around 84 million[2]. Transport demand (strongly) increased in parallel, and so did the related fuel consumption and greenhouse gas (GHGs) emissions: the significant progress made on fuel quality and vehicle efficiency were not sufficient to offset increasing traffic volumes. GHGs emissions from transport increased by 22% over the period. **Transport is the only sector in the EU where GHGs emissions have risen since 1990.**

Conversely, advances in technologies have significantly reduced emissions of air pollutants in spite of traffic growth. However, transportation remains one of the major sources of atmospheric pollution, notably in urban areas. The ever increasing number of diesel engines and booming air and maritime transport have a negative impact in this respect.

When considering the development of transport demand/emissions over the past quarter of a century, it is important to stress that the 2008 economic downturn marked a clear break. While there is a rising trend throughout the period, demand and emissions have being going down since the beginning of the economic crisis - with the notable exception of air transport.

The recent decline in transportation emissions is therefore (at least partly) cyclical and due to the poor economic situation. This should be kept in mind when assessing the capacity of the transport system to meet the relevant EU environmental goals.

The following should also be kept in mind when looking at the figures: the environmental performance of road vehicles is notoriously overestimated. The laboratory tests used to measure 'official' fuel consumption/emissions[3] underestimate consumption/emissions in real life[4]. This was true even without the frauds recently denounced by the United States Environmental Protection Agency[5]. It is in this context that the EU type-approval system is in the (much-debated) process of being (partly) reviewed[6].

---

1 From 475 to 505 million, i.e. a rise of 6.3%.

2 About 164 to about 246 million cars, i.e. a 50% increase.

3 Directive 2007/46/EC establishes the framework for the type-approval of motor vehicles. Regulation (EC) No 715/2007 deals with type-approval of passenger cars and light commercial vehicles with respect to their pollutant emissions (Euro 5 and Euro 6). Type-approval of heavy duty vehicles with respect to their pollutant emissions (Euro VI) is dealt with by Regulation (EC) No 595/2009.

4 See: European Commission, Joint Research Centre, Analyzing on-road emissions of light-duty vehicles with Portable Emission Measurement Systems (2011). According to the International Council on Clean Transportation, in 2014 there was a difference of 40% between official and real-world CO_2 emissions from cars in the EU (See: ICCT, From laboratory to road, September 2015). On the failure of the current EU type-approval process see, for instance: Transport and Environment, Mind the Gap! Why official car fuel economy figures don't match up to reality (2013).

5 'Contentious' diesel vehicles are alleged by the US Environmental Protection Agency and the California Air Resources Board to emit up to 40 times more nitrogen oxide (NO_x) than standards allow.

6 See COM(2014)0028 (amendments to Regulations (EC) No 715/2007 and (EC) No 595/2009) and the related report of the EP Committee on the Environment, Public Health and Food Safety (A8-0270/2015). See also the EP resolution of 27 October 2015 on emission measurements in the automotive sector (P8_TA(2015)0375). In view of the current scandal the European Commission should propose to also amend the 'framework directive' (i.e. Directive 2007/46/EC).

2. TRANSPORT DEMAND[7]

2.1 Change in volumes: the 2008 crisis reversed the trend but did not offset the growth in the previous years

Passenger and freight motorised transportation within the EU-28: change in volume between 2000 and 2013

Passengers in the EU	2000	*2009 (Peak)*	2013	Variation 2000/2013	*Variation 2009/2013*
Total pkm (billion)	**5 963**	***6 492***	**6 465**	**+ 8.4%**	*- 0.4%*

Freight in the EU	2000	*2007 (Peak)*	2013	Variation 2000/2013	*Variation 2007/2013*
Total tkm (billion)	**3 245**	***3 843***	**3 481**	**+ 7.3%**	*- 9.4%*

In 2013 over 3 480 billion tonne-kilometres[8] of goods and around 6 465 billion passenger-kilometres[9] were transported in motor vehicles within the EU. **Although these volumes have declined since the 2008 economic downturn (the demand for freight transport peaked in 2007, the demand for passenger transport in 2009), over the long run there is a rising trend.**

It is important to note that the current economic difficulties do not impact transport modes uniformly[10]. For instance pkm (all modes) decreased by 0.4% between 2009 and 2013 while over the same period pkm by car fell by 2% and pkm by air jumped by 11%. At the present time there is no clear correlation between changes in economic activity and transport demand at EU level. To what extent this 'decoupling' will continue in periods of economic growth is still unclear[11].

[7] Source: Eurostat, June 2015. Changes in transport demand and modal split between 2000 and 2013 are detailed in the Annex.

[8] A tonne-kilometre (tkm) is equivalent to the movement of one tonne of goods over one kilometre.

[9] A passenger-kilometre (pkm) is equivalent to the movement of one passenger over one kilometre.

[10]

	Yearly growth rate						
	2007	2008	2009	2010	2011	2012	2013
EU-28 Real GDP	+3.1%	+0.5%	-4.4%	+2.1%	+1.7%	-0.5%	+0.2%
tkm by road within the EU	+3.6%	-1.8%	-10.1%	+3.2%	-0.6%	-2.9%	+1.5%
pkm by car within the EU	+1.2%	+0.2%	+1.6%	-1.2%	-0.4%	-1.8%	+1.3%
pkm by air within the EU	+4.17%	-2.1%	-6.8%	+2.7%	+7.6%	-1%	+1.6%

[11] In this respect it should be noted that car mobility peaked in the EU 15 in 2004 i.e. well before the economic downturn.

2.2 Key features

Irrespective of economic fluctuations and of the many and diverse situations among the Member States, the main features of transport demand at EU level are: the large predominance of road in both passenger and freight transport; booming air transport which is the fastest growing mode; the increasing use of tram and metro in urban areas; and the continuous decline of rail in freight transport. These features reflect on the sector's emissions.

2.3 EU objectives

The 2011 White Paper on transport clearly states that '*Curbing mobility is not an option*'. EU objectives therefore do not aim at lowering the level of transport demand but rather at modifying the modal split.

Thus, the White Paper lays down that (1) by 2050 the majority of *medium-distance* (over 300 km) passenger transport should go by rail, and that (2) 30% of road freight over 300 km *should shift* to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050.

3. ENERGY CONSUMPTION[12]

3.1 Energy consumption goes with transport demand

Roughly, from 1990 to 2012 the share of transport in EU final energy consumption[13] jumped from one quarter to one third.

Actually, while the EU-28 FEC increased by circa 2.3% between 1990 and 2012, it jumped by 26% with respect to the transport sector. This increase, which took place in spite of improvements in fuel and engine efficiency, is directly attributable to demand growth. The trend was therefore reversed at the onset of the economic crisis and the related fall in the volume transported.

Transport final energy consumption: change between 1990 and 2012

Transport sector FEC	1990	*2007 (Peak)*	2012	Variation 1990/2012	*Variation 2007/2012*
In million toe	**332**	***457***	**419**	**+ 26%**	*- 8%*

Transport final energy consumption: change by mode between 1990 and 2012

Road	International waterborne[14]	International Air[14]	Rail	Domestic Air	Domestic waterborne
+ 24%	+ 28%	+ 80%	- 16%	+ 7%	- 21%

Transport final energy consumption: share by mode in 2012

Road	International waterborne	International Air	Rail	Domestic Air	Domestic waterborne
74%	11.2%	10.7%	1.7%	1.5%	1.4%

3.2 Fuels: 95% oil derived

In 2012, **around 95% of the energy consumed by the EU transport sector was oil derived**. This dependence on oil is rather stable. Conversely the share of diesel amongst the oil-based fuels is on an upward trend and reached 71 % in the same year.

In 2012, the share of 'sustainable biofuels'[15] in transport reached 5.1% (it was 3.4% in 2011).

[12] Source: European Environment Agency, 2015.

[13] The final energy consumption (FEC) is the total energy consumed by end users, excluding consumption by the energy sector itself.

[14] i.e. planes and vessels departing from the Member States.

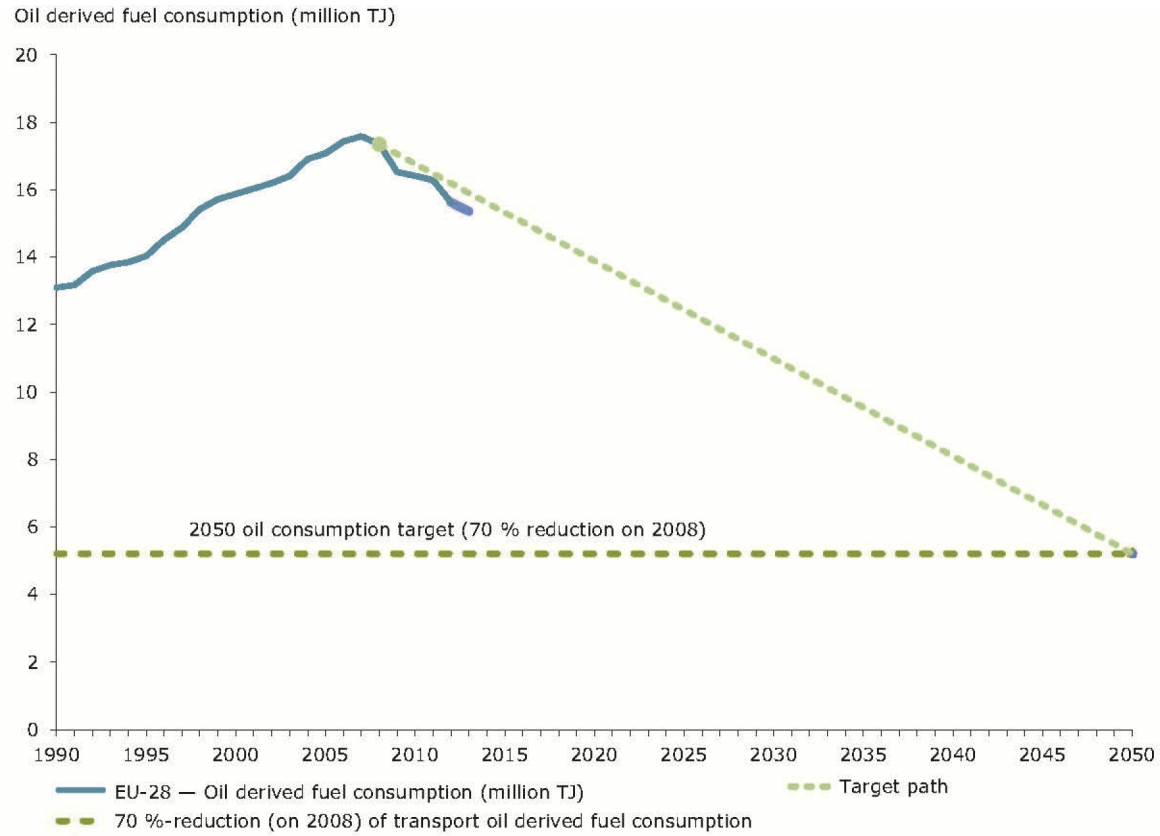
[15] i.e. biofuels meeting the sustainability criteria of Directive 2009/30/EC. Note that according to Eurostat the systems for certifying sustainable biofuels are still not fully operational in some Member States.

Furthemore, the share of electricity in (essentially road) transport is stable and insignificant (around 67 000 toe in 2012). About 20 % of this corresponds to renewable electricity[16].

3.3 EU objectives

- Directive 2009/28/EC lays down that in each Member State 10 % of the energy consumed in the transport sector must be renewable by 2020. Only biofuels complying with the sustainability criteria of Directive 2009/30/EC are to be taken into account. In addition, there is a 7% cap on biofuels made from food crops.
- The 2011 White Paper on transport stipulates that (1) there must be a 40% share of low-carbon sustainable fuels in aviation by 2050, and that (2) the use of conventionally fuelled cars in urban transport shall decrease by 50% before 2050 and by 100% by 2050.
- According to the Impact Assessment accompanying the 2011 White Paper, oil consumption in transport should reduce by 70% between 2008 and 2050.

Reduction in oil consumption in transport: EU target and current trend



Source: European Environment Agency, 2014.

[16] The impact of electric vehicles on the environment is not always lower than that of internal combustion vehicles when power generation and the manufacture of vehicles/batteries are considered. Electric vehicles 'have the edge' only if they travel a large number of kilometres. See: ADEME (2013).

4. GREENHOUSE GAS EMISSIONS[17] [18]

Between 1990 and 2012, the total man-made greenhouse gas (GHGs) emissions of the EU-28 decreased by 17%, from 5 806 to 4 824 million tonnes CO_2 equivalent (tCO_2-eq)[19]. Over the same period, GHGs emissions from transport increased by 22%.

4.1 In 2012 transport accounted for roughly a quarter of the total EU man-made greenhouse gas emissions

Because of the combustion of petroleum based products, transport is a source of greenhouse gas, mainly in the form of CO_2, CH_4 and N_2O[20]. **The sector currently contributes to roughly a quarter of the total EU man-made greenhouse gas emissions**[21]. **This share is growing since transport is the only EU sector where the GHGs emissions have risen since 1990** - despite the reduction trend observed since the 2008 economic downturn and the related decrease in transport demand.

Actually, GHGs emissions from transport peaked in 2007 and they have been decreasing since then (-10.5% from 2007 to 2012), like the sector's final energy consumption. However, this reversal in trend did not offset the growth over the previous year.

GHGs emissions per sector within the EU-28, shares in % in 1990 and 2012(*)

	ENERGY INDUSTRIES	TRANSPORT	*All modes within Member States*	*Air from Member States*	*Waterborne from Member States*	INDUSTRY	AGRICULTURE	HOUSEHOLDS	SERVICES	Wastes, Fugitives emissions, …
1990	28.9 %	16.6 %	*13.5 %*	*1.2 %*	*1.9 %*	22.8 %	12.3 %	9 %	3.4 %	7 %
2012	29.2 %	24.3 %	*18.5 %*	*2.8 %*	*3 %*	17.7 %	11.3 %	8.8 %	3.7 %	5 %

(*) LULUCF are not included

17 Source: European Environment Agency, 2014.

18 **Emissions from international aviation and international waterborne transport are excluded from the Kyoto targets. However, they are (1) not negligible (about one quarter of GHGs emissions from EU transport in 2012, and around 37% of NOx) and (2) included in the EU GHGs emissions reduction targets. GHGs and air pollutants emissions from planes and vessels departing from the Member States are therefore considered in this note. Non-exhaust emissions from road transport are also taken into account. However emissions from fishing vessels are not considered.**

19 Excluding emissions and removals from land-use, land-use change and forestry (LULUCF).

20 GHGs from transport are mainly carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The 'global warming potential' (GWP) of each gas is currently set as follows by the UN Intergovernmental Panel on Climate Change (IPCC): CO_2 = 1; CH_4 = 21; N_2O = 310. In other terms, the GWP of nitrous oxide is 310 times that of carbon dioxide.

21 That is 1.17 billion tonnes CO_2 equivalent. Transport is second only to Energy industries (29.2% and 1.41 billion tonnes CO_2 equivalent in 2012). However, GHGs emissions from Energy industry have being decreasing over the past quarter century (- 16% by volume from 1990 to 2012).

4.2 Road emits much more GHGs than other modes, but the share of long distance air and waterborne transport is growing

GHGs emissions from transport within the EU-28 per modes: volumes and shares in 1990 and 2012(*)

	Volume, in million tCO_2-eq			Share in GHGs emissions from transport	
	1990	2012	Change	1990	2012
ROAD	722.416	843.217	+ 16,72%	75 %	71.9 %
AIR	84.087	150.716	+ 79,24%	8.7 %	12.8 %
In MS	*14.196*	*16.128*	+ 13,61%	*1.5%*	*1.4%*
From MS	*69.892*	*134.588*	+ 92,57%	*7.3%*	*11.4%*
RAIL	13.45	7.15	- 46,84%	1.4 %	0.6 %
WATERBORNE	133.1	162.839	+ 22,34%	13.8 %	13.9 %
In MS	*22.935*	*17.213*	*- 24,95%*	*2.4%*	*1.5%*
From MS	*110.165*	*145.625*	*+ 32,19%*	*11.4%*	*12.4%*
OTHER(**)	9.583	9.351	- 2,42%	1 %	0.8 %
TOTAL	962.636	1173.273	**+ 21,88%**		

(*) LULUCF are not included.
(**) Other includes pipelines; ground activities at airports and harbours, and off-road activities.

4.3 EU objectives

- The 2011 White Paper on transport set the following objectives: (1) a reduction of transport (including international aviation, excluding international maritime transport) GHGs emissions by 20% between 2008 and 2030, and by at least 60% between 1990 and 2050; and (2) a reduction of international maritime transport emissions by 40 % from 2005 levels by 2050.
- Regulation 443/2009/EC set the following average emissions limits for new passenger cars: 130 g CO_2/km for the new fleet by 2015 (this target was met in 2013 - under the current UE type-approval framework) and 95 g CO_2/km from 2021 onwards.
- Regulation 510/2011/EC set the following average emissions limits for new light commercial vehicles (up to 3.5 t): 175 g CO_2/km by 2017 for the new fleet (this target was met in 2013 - under the current UE type-approval framework) and 147 g CO_2/km by 2020.

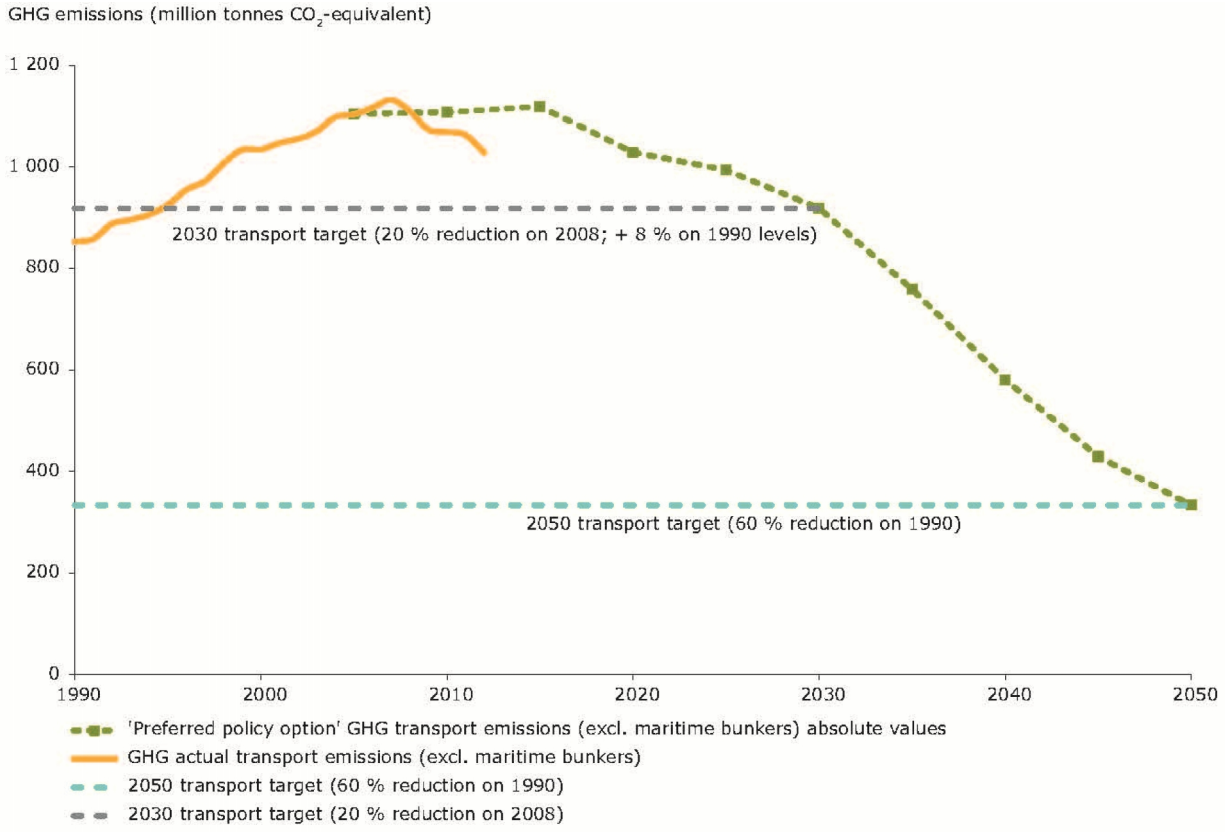
Heavy-duty vehicles (HDV) fuel consumption and CO_2 emissions are not regulated at EU level - while they currently produce around one quarter of road transport CO_2 emissions. This share is increasing together with road freight traffic. In 2014 the European Commission proposed 'a strategy' for reducing HDVs consumption/emissions[22].

- Directive 98/70 as amended by Directive 2009/30/EC lays down that life-cycle GHGs emissions of road transport fuel shall be reduced by at least 6% between 2010 and 2020. (A further 'non-binding' 4% reduction over the same period is also envisaged, through 'compensatory measures').

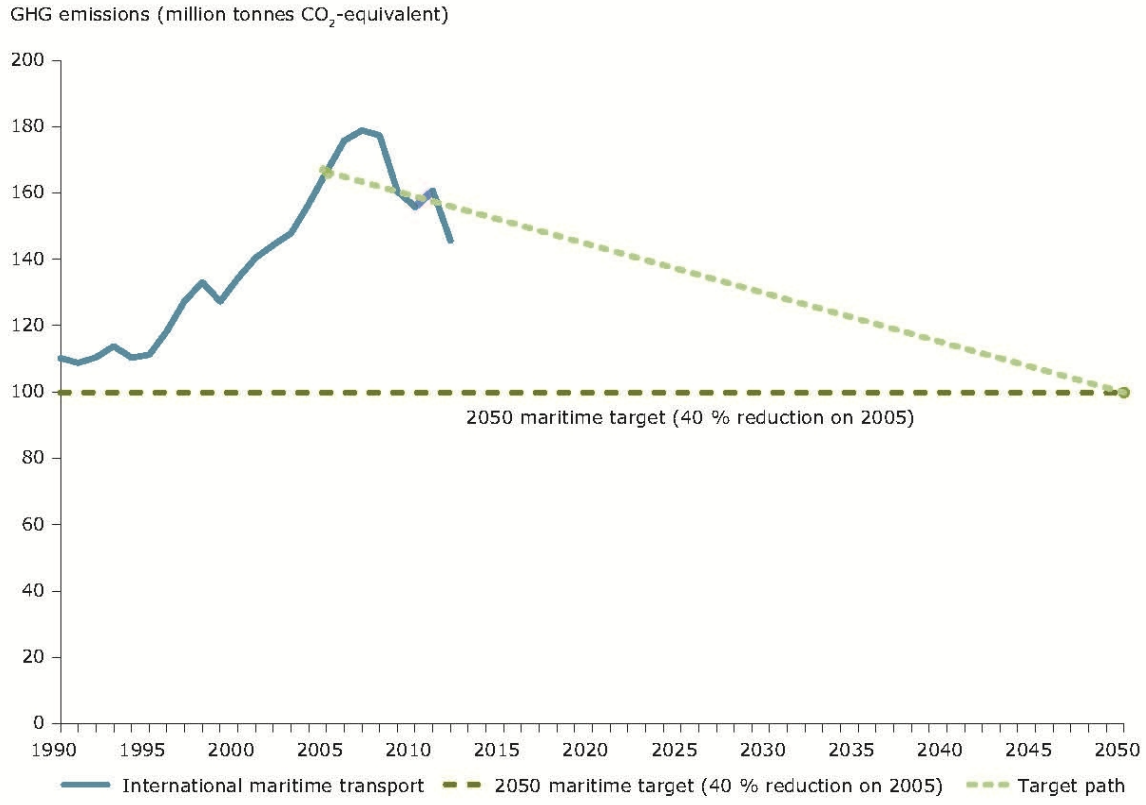
[22] COM(2014)285 final of 21.5.2014.

GHGs emissions from transport within the EU-28: targets and current trends

All modes but international maritime transport:



International maritime transport:



Source: European Environment Agency, 2014.

5. AIR POLLUTANT EMISSIONS[23]

5.1 Transport is a major source of air pollution

Transport is also a major cause of atmospheric pollution. This is mainly because of the combustion of petroleum based products[24].

In addition to the pollution emitted by combustion engines, the 'non-exhausted' pollutant emissions (which are not regulated) are generated by fuel evaporation and the deterioration of brakes, tyres and road surfaces, essentially in the form of particulate matter (and essentially by road transport). There is no standard technique to determine the share of non-exhausted PM emissions which, nevertheless, are significant: the European Environment Agency (EEA) evaluated that in 2013 non-exhaust emissions were almost half of exhaust emissions of primary PM_{10}, and about one-third of exhaust emissions of primary $PM_{2.5}$.[25]

Share of transport in total emissions of the main air pollutants in the EU-28, in 1990 and 2013 (exhausted and non-exhausted emissions)(*)

	CO	NMVOC[26]	NO_X	PM_{10}	$PM_{2.5}$	SO_X
1990	54 %	35 %	50 %	19 %	25 %	7 %
2013	25 %	15 %	57 %	20 %	24 %	27 %

(*) International air and waterborne transport are included

5.2 (Road) transport air pollutant emissions are going down...

Unlike the trend for GHGs, and despite the general increase in traffic over the period, **the volume of transport emissions of atmospheric pollutants has been decreasing significantly for the past two decades**[27]. This is due to the introduction of ever more strict technical standards for vehicles efficiency and fuel quality. In recent years this is also due to the economic downturn and the related fall in both passenger and freight traffic.

It is noteworthy that most of this overall reduction in air pollutant emissions is due to road transport.

---

[23] Source: European Environment Agency, 2015.

[24] This combustion emits primarily sulphur dioxide (SO_2), mono-nitrogen oxides (NO_X), suspended particulates (PM_{10}, $PM_{2.5}$), lead (Pb), carbon monoxide (CO), benzene (C_6H_6) and ozone (O_3). Some of these pollutants also indirectly impact climate change: CO and NO_X (as well as NMVOCs) induce ground-level ozone (NO_X also promote tropospheric O_3 formation); SO_2 induce aerosols. Some components of PM also have a global warming potential.

[25] Quantification of non-exhausted PM emissions is dealt with extensively in the 2013 "EMEP-EEA emission inventory guidebook", Part B, Chapter 1.A.3.b.vi and vii. Note that the relative importance of non-exhausted emissions increases since the efficiency of engines improves. Thus, according to the EEA non-exhaust emissions were 20% of exhaust emissions of primary PM_{10} in 1990 and 49% in 2013. As regards $PM_{2.5}$, the respective numbers were 11% and 33%.

[26] NMVOC: non-methane volatile organic compound.

[27] Only ammonia (NH_3) emissions are increasing (significantly: + 338% by volume from 1990 to 2013). But transport is responsible for less than 2 % of all emissions of this gas. This increase is due to road and air transport, NH_3 emissions of which have jumped over the last decades parallel with the booming traffic. It is noteworthy that road transport recently started reducing its ammonia emissions, not yet aviation. [The growth in NH_3 emissions from road transport from 1990 was attributable to the increasing use of three-way catalytic converters. Since 2000 a new generation of catalysts emit less NH_3].

Change in the volume of the main air pollutants emitted by transport in the EU-28 between 1990 and 2013 (exhausted and non-exhausted emissions)(*)

CO	NMVOC	NO_X	PM_{10}	$PM_{2.5}$	SO_X
- 84 %	- 83 %	- 39 %	- 30 %	- 35 %	- 34 %

(*) International air and waterborne transport are included

Change in the volume of the main air pollutants emitted by road transport in the EU-28 between 1990 and 2013 (exhausted and non-exhausted emissions)

CO	NMVOC	NO_X	PM_{10}	$PM_{2.5}$	SO_X	NH_3
- 86 %	- 86 %	- 56 %	- 41 %	- 50 %	- 99 %	+ 380 %

5.3 However aviation and waterborne transport air pollutant emissions are going up

As in the case of GHGs, **emissions from aviation and waterborne transport are showing a strong increase, in particular SO_X, NO_X and particulates. This is due to (1) the sharp increase in traffic - notably long distance traffic - and (2) rather slow progress on emissions standards[28].** Aviation (like road transport) also increased NH_3 emissions significantly.

The 2008 economic downturn and the related decline in freight traffic have erased (except for NO_x) the strong increase in air pollutant emissions from waterborne transport over the period 1990-2007[29]. Air transport did not experience such a reversal in trend:

Change in the volume of the main air pollutants emitted by aviation in the EU-28 between 1990 and 2013 (domestic and international flights)

CO	NMVOC	NO_X	PM_{10}	$PM_{2.5}$	SO_X	NH_3
- 29 %	- 36 %	+ 96 %	+ 4 %	+ 5%	+ 71 %	+ 94 %

As a result, international air and waterborne transport now account for a significant share in atmospheric pollutant emissions from the EU transportation sector:

Share of international air and waterborne transport in atmospheric pollutant emissions from the EU-28 transportation sector, in 2013

CO	NMVOC	NO_X	PM_{10}	$PM_{2.5}$	SO_X
3 %	8 %	37 %	38 %	44 %	93 %

[28] Standards are set by, respectively, the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO) - where progress can be slow. In addition, because of the lifetime of ships and planes it takes decades before new standards spread.

[29] From 1990 to 2013 pollutants emissions by waterborne transport developed as follows:

	CO	NH_3	NMVOC	NO_X	PM_{10}	$PM_{2.5}$	SO_x
1990-2007	+ 13%	- 7%	+ 6%	+ 37%	+ 31%	+ 34%	+ 43%
2007-2013	- 26%	- 22%	- 29%	- 23%	- 28%	- 28%	- 30%
1990-2013	- 16%	- 27%	- 25%	+ 6%	- 6%	- 4%	0

5.4 (Road) transport remains a major cause of air pollution

Despite the improvement in fuel quality and vehicle efficiency, transport remains a major cause of air pollution (see Table under 5.1). This is especially true **in urban areas where road transport is the most important source of nitrogen dioxide and benzene** (C_6H_6). Diesel vehicles make the situation worse since they emit more particulate matter and nitrogen oxides than petrol vehicles.

It appears moreover that particulate matter is one of the most harmful pollutants since it enters into sensitive regions of the respiratory system. Consequently, in 2012 the International Agency for Research on Cancer (a branch of the World Health Organization) concluded that diesel engine exhaust is carcinogenic to humans[30].

5.5 EU objectives

- The limit values for ambient air concentrations of major air pollutants [SO_2, NO_2, PM_{10}, $PM_{2.5}$, Pb, C_6H_6, CO and O_3] are set by Directive 2008/50/EC. The limit values for ambient air concentrations of arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons are set by Directive 2004/107/EC.

- In addition, Directive 2001/81/EC set national emission ceilings for the major atmospheric pollutants, including NH_3 which is not regulated by Directive 2008/50/EC and Directive 2004/107/EC. This text is currently under revision in order to (1) introduce stricter national emission ceilings and (2) limit emissions for two pollutants which are not covered by the current text (methane and $PM_{2.5}$).

[30] It should be borne in mind that diesel fuels are used in nearly all sectors (agriculture; mining; factories; heating and power generation; ...). Transport currently account for 20% of PM_{10} and 24% of $PM_{2.5}$.

6. REFERENCES

- European Commission, *EU transport in figures* (2015)
  http://ec.europa.eu/transport/facts-fundings/statistics/doc/2015/pocketbook2015.pdf

- European Environment Agency, Report No 10/2012: *The contribution of transport to air quality* (2012)
  http://www.eea.europa.eu/publications/transport-and-air-quality-term-2012

- European Environment Agency, Technical Report No 12/2013: EMEP/EEA air pollutant emission inventory guidebook (2013)
  http://www.eea.europa.eu//publications/emep-eea-guidebook-2013

- European Environment Agency, Report No 7/2014: *Focusing on environmental pressures from long-distance transport* (2014)
  http://www.eea.europa.eu/publications/term-report-2014

- European Environment Agency, *Why did greenhouse gas emissions decreased in the EU between 1990 and 2012?* (2014)
  http://www.eea.europa.eu/publications/why-are-greenhouse-gases-decreasing

- European Environment Agency, Technical Report No 9/2014: *Annual European Union greenhouse gas inventory 1990-2012 and inventory report 2014* (2014)
  http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2014
  Note: these are the data submitted by the EU to the UNFCCC Secretariat[31]

- European Environment Agency, *Total greenhouse gas emissions trends and projections* (2015)
  http://www.eea.europa.eu/data-and-maps/indicators/greenhouse-gas-emission-trends-5/assessment-1

- European Environment Agency, *Final energy consumption by transport modes* (2015)
  http://www.eea.europa.eu/data-and-maps/daviz/final-energy-consumption-by-transport-1#tab-chart_2

- European Parliament, *The impact of biofuels on transport and the environment, and their connection with agricultural development in Europe* (2015)
  http://www.europarl.europa.eu/RegData/etudes/STUD/2015/513991/IPOL_STU%282015%29513991_EN.pdf

- Transport & Environment, *Don't breathe here – Tackling air pollution from vehicles* (2015)
  http://www.transportenvironment.org/sites/te/files/publications/Dont_Breathe_Here_report_FINAL.pdf

[31] UNFCCC: United Nations Framework Convention on Climate Change.

ANNEX: PASSENGER AND FREIGHT TRANSPORT WITHIN THE EU-28: CHANGE IN VOLUME AND MODAL SPLIT, 2000-2013[32]

Change in volume of passengers transported within the EU, by mode, in billion pkm[33]

Passengers transported in the EU	2000	*2009 (Peak)*	2013	Variation 2000/2013
Total PKM (billion)	**5 963**	***6 492***	**6 465**	**+ 8.4%**
Of which by road	**5 011**	***5 430***	**5 323**	**+ 6.2%**
of which passenger cars	*4 355*	*4 774*	*4 672*	*+ 7.3%*
of which buses and coaches	*548*	*534*	*526*	*- 4%*
of which powered 2-wheelers	*108*	*122*	*125*	*+ 15.7%*
Of which by air	**460**	***525***	**583**	**+ 26.7%**
Of which by train	**372**	***404***	**424**	**+ 14%**
Of which by tram and metro	**78**	***91***	**95**	**+ 21.8%**
Of which by sea	**42**	***43***	**39**	**- 7.1%**

Change in the modal split of passenger transport in the EU, in % of the volume transported

Transport mode	Modal share		Variation 2000/2013
	2000	2013	
Road	**84%**	**82.3%**	**- 2%**
of which passenger cars	*73%*	*72.3%*	*- 1%*
of which buses and coaches	*9.2%*	*8.1%*	*- 12%*
of which powered 2-wheelers	*1.8%*	*1.9%*	*+ 5.6%*
Air	**7.7%**	**9%**	**+ 16.9%**
Rail	**6.2%**	**6.6%**	**+ 6.5%**
Tram and metro	**1.3%**	**1.5%**	**+ 15.4%**
Maritime	**0.7%**	**0.6%**	**- 14.3%**

[32] Calculations based on Eurostat (June 2015) and EC "EU transport in figures" (September 2015).

[33] A passenger-kilometre (pkm) is equivalent to the movement of one passenger over one kilometre.

Change in volume of freight transported within the EU, by mode, in billion tkm[34]

Freight transported in the EU	2000	*2007 (Peak)*	2013	Variation 2000/2013
Total TKM (billion)	**3 245**	***3 843***	**3 481**	**+ 7.3%**
Of which by road	**1 509**	***1 925***	**1 719**	**+ 13.9%**
Of which by sea	**1 067**	***1 190***	**1 089**	**+ 2.1%**
Of which by train	**405**	***452***	**407**	**+ 0.5%**
Of which inl. waterways	**134**	***145***	**153**	**+ 14.2%**
Of which by oil pipeline	**127**	***128***	**112**	**- 11.8%**
Of which by air	**2**	***2***	**2**	**0%**

Change in the modal split of freight transport in the EU, in % of the volume transported

Transport mode	Modal share		Variation 2000/2013
	2000	2013	
Road	**46.5%**	**49.4%**	**+ 6.2%**
Maritime	**32.9%**	**31.3%**	**- 4.9%**
Rail	**12.5%**	**11.7%**	**- 6.4%**
Inland Waterways	**4.1%**	**4.4%**	**+ 7.3%**
Oil pipeline	**3.9%**	**3.2%**	**- 18%**
Air	**0.1%**	**0.1%**	**0%**

[34] A tonne-kilometre (tkm) is equivalent to the movement of one tonne of goods over one kilometre.

CAT: QA-04-15-820-EN-C (paper)
CAT: QA-04-15-820-EN-N (pdf)

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT B
STRUCTURAL AND COHESION POLICIES

Role

The Policy Departments are research units that provide specialised advice to committees, inter-parliamentary delegations and other parliamentary bodies.

Policy Areas

- Agriculture and Rural Development
- Culture and Education
- Fisheries
- Regional Development
- Transport and Tourism

Documents

Visit the European Parliament website:
http://www.europarl.europa.eu/supporting-analyses

PHOTO CREDIT: iStock International Inc., Photodisk, Phovoir

ISBN 978-92-823-8348-3 (paper)
ISBN 978-92-823-8347-6 (pdf)

doi: 10.2861/224 (paper)
doi: 10.2861/495781 (pdf)

Publications Office