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EVALUATION OF THE ENVIRONMENTAL INFLUENCE OF TRANSPORT

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Abstract

The sustainable development of transport is among the priorities of the general EC transport policy. The transport sector generates a considerable part of the negative effects. The unveiling of opportunities for decreasing the negative external effects of the transport sector requires evaluation and comparative analysis. The paper presents quantitative and cost evaluation of the noxious emissions of transport, as well as a comparative analysis of the environmental influence of road and railway transport. The evaluation is based on official statistical information sources for energy consumption, ozone precursors' emissions, fine dust particles, and the emissions of greenhouse gasses. The comparative analysis enhances the main streams and directions of road and railway carriages in the Republic of Bulgaria by indicators of the harmful influence. The evaluation and analysis results prove that the development of railway transport should take a priority place and should be a strategic goal of the national transport policy for the next program period 2014-2020.

Keywords: *Transport, transport policy, sustainable development, environment, external effects.*

1 OBJECTIVES

The climate change, air and water pollution, energy consumption, destruction of the ozone layer and ecosystems are among the most significant environmental problematic issues (Dadalos, n.d.). Undoubtedly, transport has a significant negative impact and contribution to these problematic issues.

Quantitative and comparative evaluation of the negative impact of transport on the environment are a solid platform for the creation of opportunities for its reduction. That tendency provides the possibility to outline the strategic objectives for sustainable development and achievement of economic efficiency in the transport sector, as well as to measure the results from their efficiency in the sector.

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The harmful substances emissions value assessment is necessary to determine the economic costs and benefits to society and to evaluate and compare projects and strategies in the transport sector.

The specific objectives of the analysis are, as follows:

– to determine the relative level and dynamics of the environmental impact in the transport sector of Bulgaria;

– to determine the proportion of the transport sector for each of the major environmental issues;

– to make a comparative assessment of significant and global effects, such as the particulate matter emissions, and thegreenhouse gases with the EU average values.

– to compare in terms of quantity and value the environmental impact of the passenger rail and passenger cars transport on the main directions in Bulgaria.

Table 1. Assessment indicators

1.Energy consumption	
Impact	Description
Impact on the environment and human health through the emission of harmful substances and greenhouse gases	Fuel and energy consumption in transport, calculated as thousands of tons of oil equivalent (thousand t, 1000 toe)
2. Emissions of ozone precursors	
Impact	Description
A strong oxidant, adverse effects of ground-level ozone on human health (respiratory system, pulmonary diseases, asthma) and ecosystems.	Precursors of ozone, nitrogen dioxide, carbon monoxide and non-methane volatile organic compounds. The potential for the formation of tropospheric ozone using NMVOC equivalents: NMVOC = 1; NOx = 1.22; CO = 0.11 and CH_4 = 0,014.
3. Precursor emissions of PM10	
Impact	Description
Impact on human health (respiratory diseases, respiratory infections of the upper respiratory tract, bronchitis). The harmful effect is more pronounced at the same time the presence of sulphur dioxide in ambient air.	The dust is a major atmospheric pollutant of the air. Dust particles are emitted directly into the atmosphere (primary emission) or form of the gas into the atmosphere-precursors of those particles (secondary emissions). Sulphur dioxide, nitrogen oxides and ammonia are inorganic gaseous substances, the precursors to fine particulate matter. The potential for formation of aerosols of the main atmospheric pollutants is as follows: NOx = 0,88; SO_2 = 0.54 and NH_3 = 0,64.
4. Greenhouse gases	
Impact	Description
Impact on the climate change (global warming)	According to the UN Framework Convention on climate change the main greenhouse gases are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hidrofluorokarboni (HFCs), perfluorokarboni (PFCs) and sulphur hexafluoride (SF_6). Different greenhouse gases have different global warming potential (GWP). The impact is compared with the impact of CO_2 (GWP = 1) and identified as CO_2 equivalent.

2 METHODOLOGY

The methodology includes:

- selection of evaluation indicators for the impact of the economic sectors on the environment;
- quantitative assessment of the environmental impact of selected indicators;
- a comparative assessment of the transport sector impact in relation to the impact of other sectors;
- a comparative assessment of the impact on the transport modes;
- determination of the strategies of change of the indicators values and their structure in the sectors of transport.

2.1 Indicators

The main emissions of harmful substances from the transport sector are: sulphur oxides (SO_x), nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC), ammonia (NH_3), carbon monoxide (CO), heavy metals (mercury-Hg, cadmium-Cd, lead-Pb) polycyclic aromatic hydrocarbons (PAHs), dioxins and furans (DIOX) particulate matter (PM). Their negative impact on the environment and human health is measured by four major assessmen indicators which are specified in the Table 1 (Ifeu, 2010). Four key indicators are used for comparative evaluation between rail and road transport, taking into account the emissions from the transport sector with the most significant negative effect on the environment:

- CO_2 Emission of carbon dioxide
- NOx Emission of nitrogen oxides
- NMHC Emission of hydrocarbons
- PM Emission of particulate matter

These indicators take into account the most significant negative effects on the environment - the greenhouse effect, soil and water acidification, eutrophication and eco-toxicity, human toxicity and smog formation.

2.2 Impact assessment

The evaluation of energy consumption includes the level, dynamics and structure of the final energy consumption per sector and transport mode. The final energy consumption in transport includes the consumption by rail, road (incl. households), air and inland waterway transport. Quantification is in thousands of tonnes of oil equivalent (thousand tones)

Examinations of the emission of greenhouse gases, the ozone precursor and the PM10 are done in three aspects - emissions from the transpot sector, share of the transport sector emissions in the national emissions and share of the road transport emissions in the emissions from the transport sector.

The potential of tropospheric ozone formation using NMVOC equivalents:

- NMVOC = 1;
- NOx = 1.22;
- CO = 0.11, and
- CH4 = 0,014. (Ministerstvo na okolnata sreda i vodite, 2013, p. 5)

The potential of aerosols formation of the main atmospheric pollutants is as follows:

- NOx = 0,88;
- SO2 = 0.54, and
- NH3 = 0,64. (Ministerstvo na okolnata sreda i vodite, 2013, p. 8)

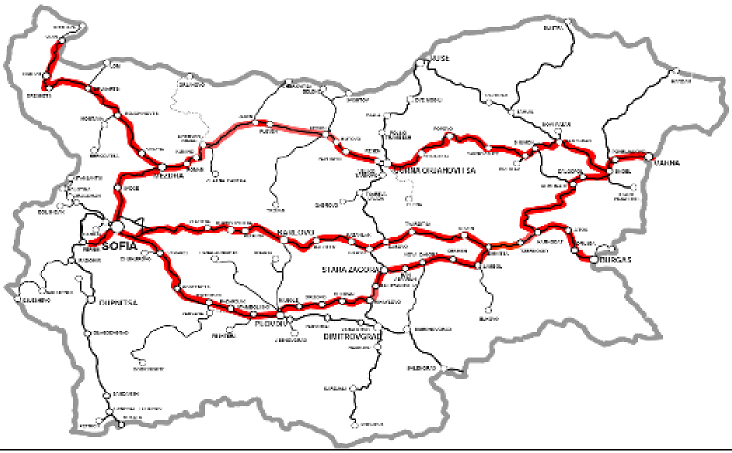
The impact is compared with the CO_2 (GWP = 1) impact and is identified as CO_2 equivalent (CO_2-eq).

Comparative analysis between rail and road transport covers five main areas (Figure 1) and 11 points of origin and destination of passenger flows or a total of 121 relationships from the transport network of Bulgaria.

Detailed origin/destination matrices have been developed for the included in the study relations with quantitative and value estimates of the emissions. The model "EcoPassanger" (Ifeu, 2010) is used for quantitative assessments of the harmful substances emissions. Official data sources for 2011 and personal calculations of authors on rail and road tripss have been used for the model. The calculations for road transport are made for vehicles with diesel engine, mid-range (1,4-2,0 l.), emission standard Euro 3 and 1.5 passenger load per car.

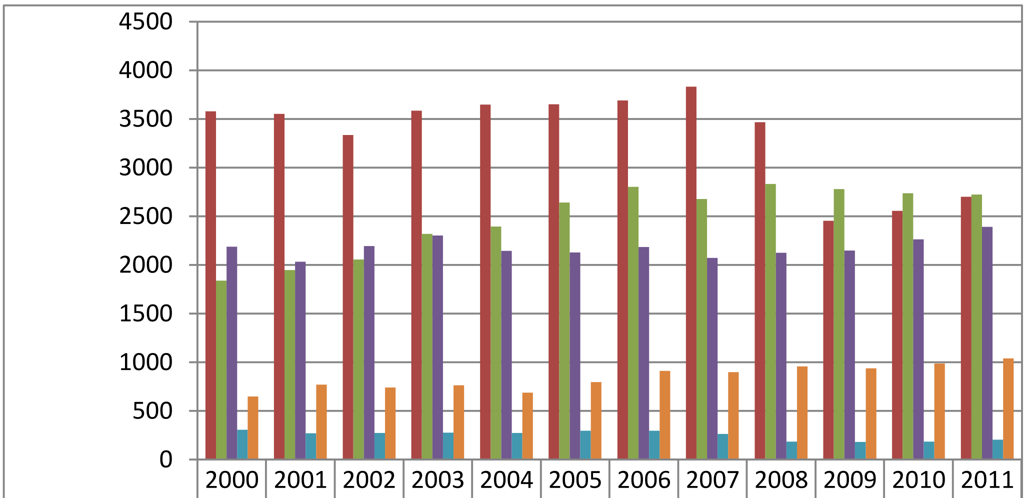
The energy consumption for 1 passenger-kilometer in the model is defined on the basis of average weighted values for the specific energy consumption and the average for the country specific load factors per categories of trains.

The value assessments are made on the basis of reference unit prices for these indicators recommended in the Requirements for preparation of CBA (Cost benefit analysis) in Transport sector (CBA Guidelines, 2008) which have been brought to 2011 by indices of GDP (gross domestic product) and PPP (purchasing power parity) for Bulgaria and the data on the number of trips by personal vehicles and train.



Sofia – Karlovo – Burgas
Sofia – Plovdiv – Stara Zagora – Burgas
Sofia – Svoge – Mezdra – Gorna Orjahovitsa – Varna
Sofia – Pernik
Sofia – Svoge – Mezdra – Vidin

Fig. 1 Main areas and points of origin and destination of passenger flows



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
industry	3579	3553	3336	3584	3648	3651	3689	3831	3467	2454	2557	2701
transport	1839	1948	2055	2319	2396	2642	2801	2678	2832	2778	2738	2722
households	2189	2033	2193	2304	2146	2127	2183	2073	2125	2149	2262	2391
agriculture	307	271	273	277	273	297	295	265	186	183	184	206
services	650	770	742	763	687	795	911	899	958	939	987	1039

Fig. 2 Energy consumption by sectors (1000 toe) (data source (NSI, 2013)*)*

The model takes into account the main externalities (impact over the environment) associated with the use of the means of transportation and the production of fuels and electricity. The model does not include the effects of the production and maintenance of vehicles and the construction and maintenance of transport infrastructure. Also, the model does not include the additional resource consumption (heating, lighting, etc.) and the effects on land use, noise and depletion of the ozone layer. The greenhouse gas methane is not included also because emissions of carbon dioxide and nitrous oxide are dominant in the transport sector (Ifeu, 2010).

3 RESULTS AND AND FINDINGS

The study and conclusions contained in it are for the period 2000-2011, based on official statistics.

3.1 Energy consumption

Data on energy consumption by sector is shown in Figures 2 and 3.

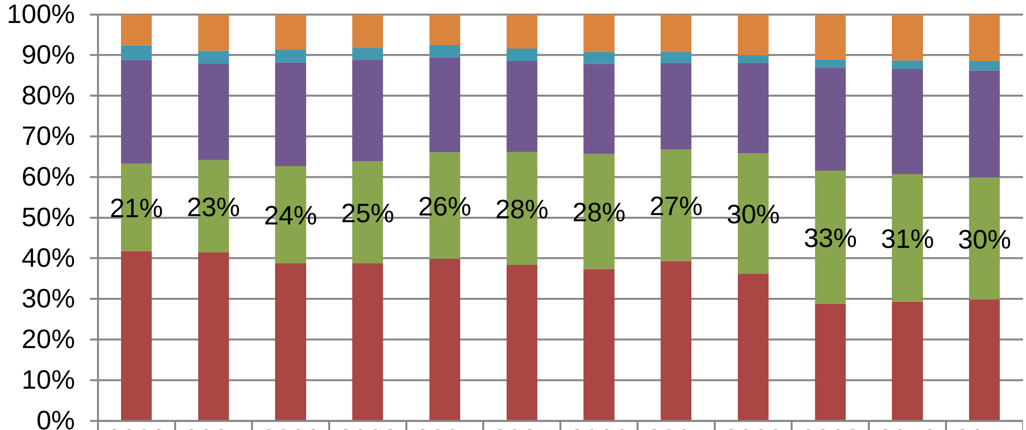
Conclusions on energy consumption by sector:

- The final energy consumption in 2011, as compared to 2000, increased by 5.8%, while the increase in transport was 48,0% and in services - 59.8%.
- The consumption of energy in transport (24,59%) accounts for the largest share, followed by that in industry (24.40%) and households (21.60%) in the structure of final energy consumption for 2011
- A temporary period of decrease of energy consumption was observed in 2007, probably due to the increase of the excise tax in the price of petroleum products.
- The relative share of transport and energy consumption increased from 17.41% to 24,59% for the period 2000-2011.
- The transport share in the final energy consumption of the country was 24,59% during 2011.

The level, dynamics and structure of energy consumption in transport per transport modes are presented in Figures 4 and 5.

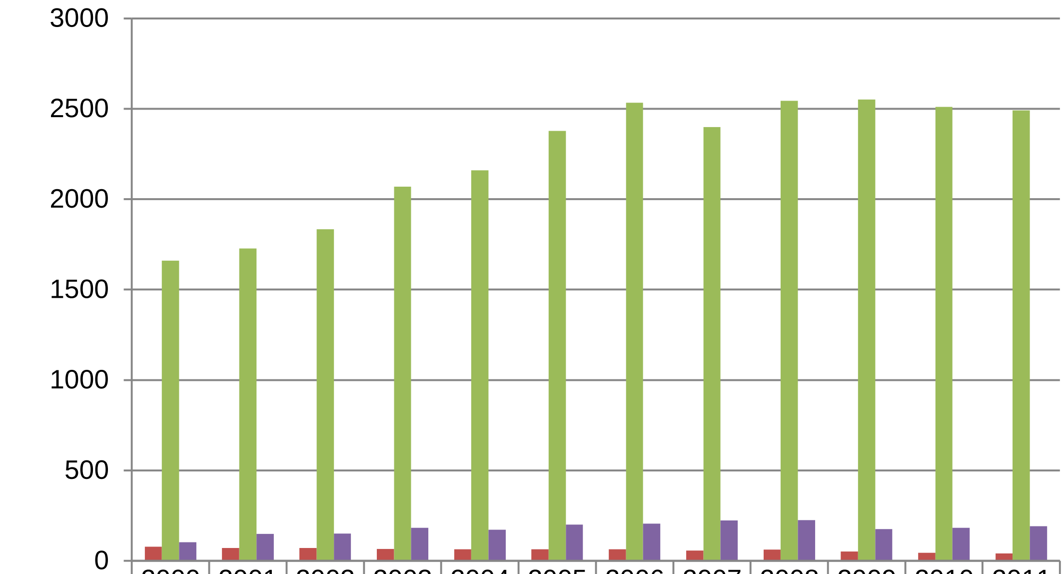
Conclusions on energy consumption by transport mode:

- There is a tendency of decrease of the total energy consumption of the sector and the levels go slowly down after 2006.
- The road transport has the largest share in the energy consumption of the sector for the entire period from 2000 to 2011 and it varies between 88.7% to 91.8%. At the same time. there is an increase of the use of the energy from road transport.
- The relative share of rail transport for the same period is within the range from 4.19% in 2000 upto 1.47 % in 2011 with a pronounced downtrend, as the main reason to that could be attributed to exist the reduction of rail traffic.



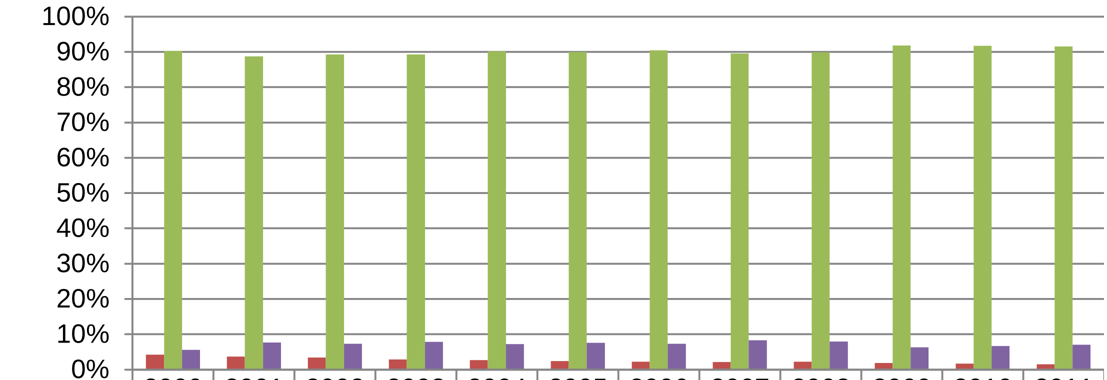
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
services	8%	9%	9%	8%	8%	8%	9%	9%	10%	11%	11%	11%
agriculture	4%	3%	3%	3%	3%	3%	3%	3%	2%	2%	2%	2%
households	26%	24%	26%	25%	23%	22%	22%	21%	22%	25%	26%	26%
transport	21%	23%	24%	25%	26%	28%	28%	27%	30%	33%	31%	30%
industry	42%	41%	39%	39%	40%	38%	37%	39%	36%	29%	29%	30%

Fig. 3 Share of energy consumption by sectors (%)(data source: (NSI, 2013))



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Railway	77	71	70	66	64	64	63	57	62	51	45	40
Road	1660	1728	1834	2070	2160	2377	2533	2399	2545	2551	2510	2491
Air	102	149	151	183	172	200	205	223	225	176	183	191

Fig. 4 Energy consumption by transport modes (1000 toe)
(data source: (NSI, 2013))



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Railway	4%	4%	3%	3%	3%	2%	2%	2%	2%	2%	2%	1%
Road	90%	89%	89%	89%	90%	90%	90%	90%	90%	92%	92%	92%
Air	6%	8%	7%	8%	7%	8%	7%	8%	8%	6%	7%	7%

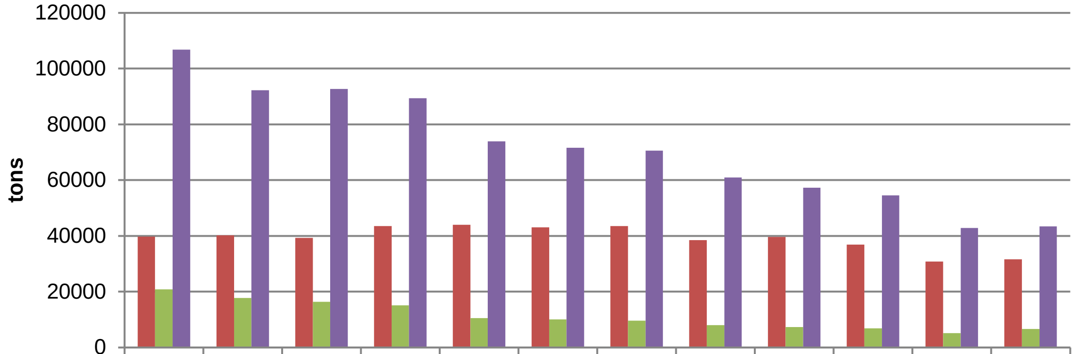
Fig. 5 Share of energy consumption by transport modes (%)
(data source: NSI,2013)

3.2 Emissions of ozone precursors

The main ozone precursors in the transport sector are nitrogen oxides (NOx), carbon monoxide (CO) and non-methane volatile organic compounds (NMVOC).

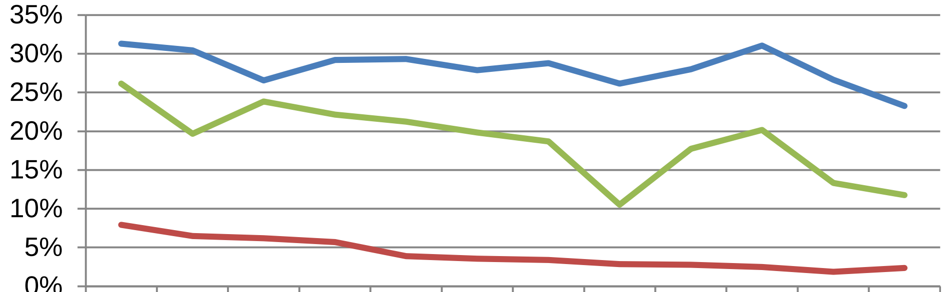
Agregate evaluation of the total emissions of ozone precursors is done by reducing the values of emissions of the different pollutants to the equivalent of NMVOC, which value is assumed to be unit.

Data regarding emissions are presented in figures 6, 7 and 8.



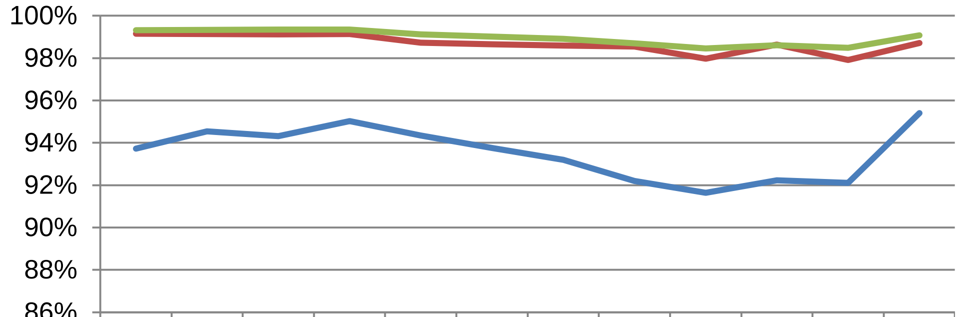
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Nitrogen oxides	39725	40199	39331	43588	43998	43026	43517	38505	39639	36874	30834	31665
Non methane volatile organic compounds	20812	17786	16394	15102	10547	10046	9592	8045	7364	6846	5165	6594
Carbon monoxide	106789	92238	92702	89402	73939	71566	70615	61001	57291	54576	42860	43464

Fig. 6 Emissions of ozone precursors of transport (data source: (NSI, 2013))



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Nitrogen oxides	31%	30%	27%	29%	29%	28%	29%	26%	28%	31%	27%	23%
Non methane volatile organic compounds	8%	6%	6%	6%	4%	4%	3%	3%	3%	2%	2%	2%
Carbon monoxide	26%	20%	24%	22%	21%	20%	19%	11%	18%	20%	13%	12%

Fig. 7 Share of emissions of ozone precursors of transport by nacional emissions (data source: (NSI, 2013))

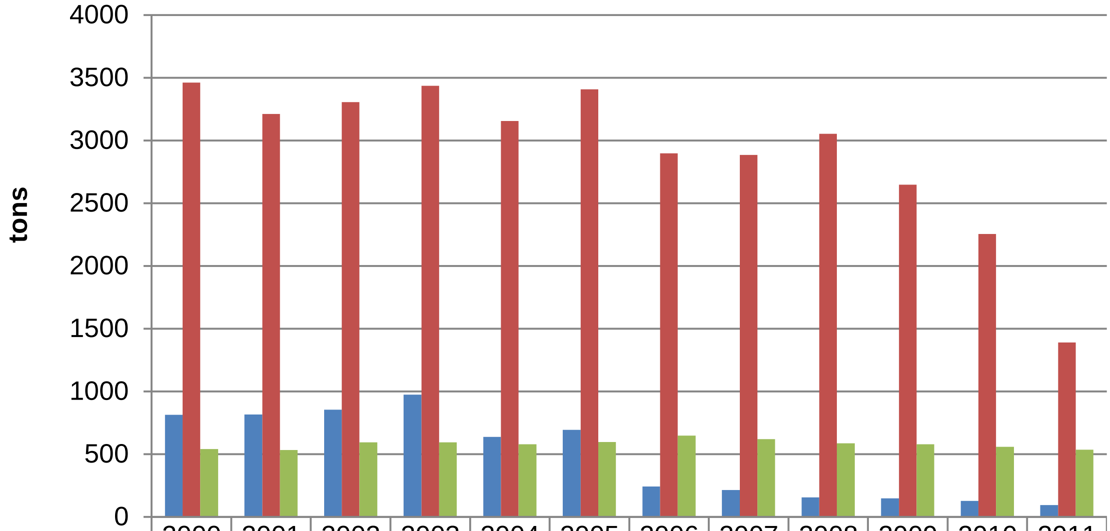


	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Nitrogen oxides	94%	95%	94%	95%	94%	94%	93%	92%	92%	92%	92%	95%
Non methane volatile organic compounds	99%	99%	99%	99%	99%	99%	99%	99%	98%	99%	98%	99%
Carbon monoxide	99%	99%	99%	99%	99%	99%	99%	99%	98%	99%	98%	99%

Fig. 8 Share of emissions of ozone precursors of road transport by transport modes (data source: (NSI, 2013))

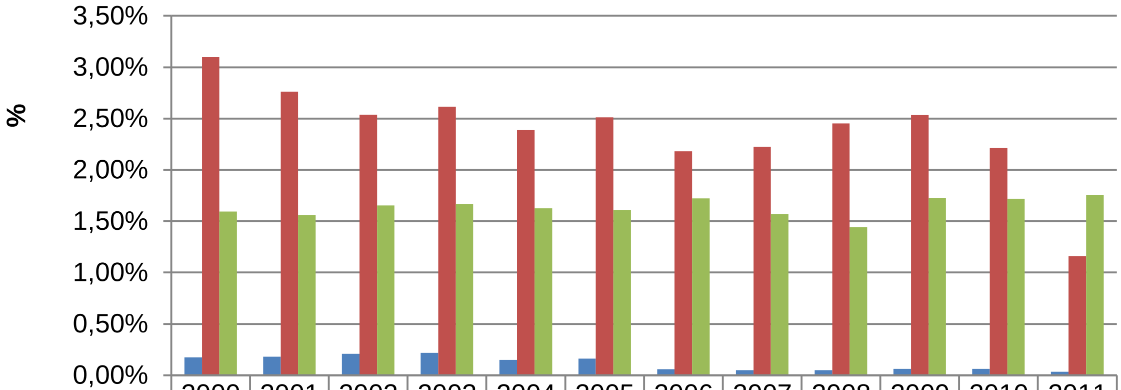
Conclusions on emissions:

- There is a tendency of reducing emissions of ozone precursors from the transport sector.
- The quantities of emissions of carbon monoxide (CO) are the highest in the sector.
- The transport sector has the largest share in the national emissions of nitrogen oxides.
- The road transport is the source of over 95% of the nitrogen oxides, over 98% of non-methane organic compounds and over 99% of the carbon monoxide emitted from transportation.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
sulfur oxides	812	815	855	973	636	694	241	214	154	148	126	93
nitrogen oxides	3460	3210	3306	3435	3154	3408	2898	2884	3053	2647	2254	1390
ammonium	541	534	594	594	578	597	648	620	586	577	557	535

Fig. 9 Precursor emissions of PM10 in the transport sector (data source: (NSI, 2013))



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
sulfur oxides	0,17%	0,18%	0,21%	0,22%	0,15%	0,16%	0,06%	0,05%	0,05%	0,06%	0,06%	0,03%
nitrogen oxides	3,10%	2,76%	2,54%	2,62%	2,39%	2,51%	2,18%	2,23%	2,45%	2,53%	2,21%	1,16%
ammonium	1,59%	1,56%	1,65%	1,67%	1,62%	1,61%	1,72%	1,57%	1,44%	1,72%	1,72%	1,76%

Fig. 10 Share of emissions of PM10 from the transport of the national emissions (data source: (NSI, 2013))

3.3 Precursor emissions of PM10

Emissions of particulate matter (PM) in the atmosphere are primary or originate from precursor emissions (secondary emissions). According to Eurostat figures in 2010 Bulgaria takes first place in the group of relative levels of particulate matter (PM) (184.62%) and significantly exceeds the average rates of the EU (100%). One of the main sources of PM and its precursors is the transport sector. According to the National report on the status and protection of the environment in Bulgaria for 2013, the total quantity of particulate matter emitted from transportation is 1690 tons and 98% of it comes from road transport.

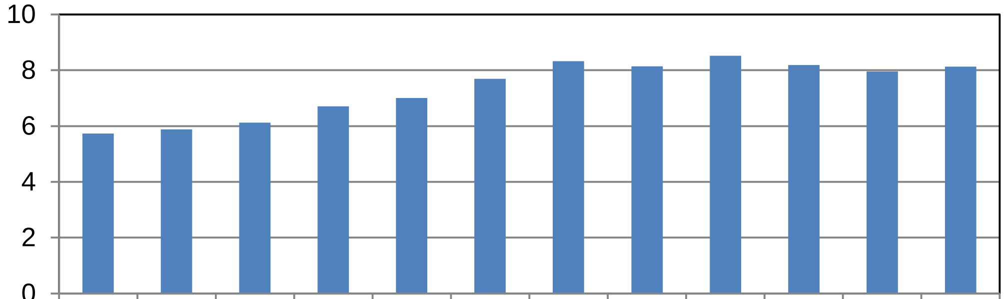
Data for the level and dynamics of precursor emissions of particulate matter in Bulgaria is shown in Figures 9 and 10. The values are determined on the basis of NOx, SO_2 and NH_3 emissions and the factors that influence their potential to form aerosols, indicating the maximum amount of a given pollutant which theoretically, in the presence of specific physical and chemical conditions, could turn into fine particles.

Conclusions:

- The share of the transport sector in national emissions of PM precursors is decreased from 0.79% in 2000 to 0.47% in 2011.
- There are tendencies for reducing emissions of sulphur and nitrogen oxides. For the period from 2000 to 2011, the emissions of sulphur oxides have decreased by ca. 89%, and those of nitrogen oxides by approximately 60%.
- The decrease of sulphur and nitrogen oxides is more significant for road transport (91.3%) for the same period.
- The emissions of ammonia, which come primarily from road transport, remain at the same level.

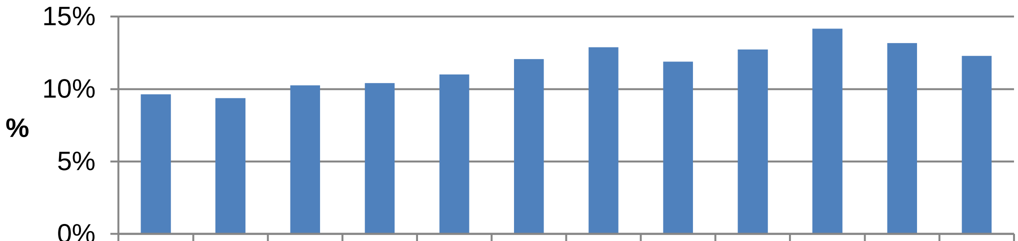
3.4 Emissions of greenhouse gases

The main greenhouse gases (GHG), which are included in the UN Framework Convention on climate change, are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hidrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).



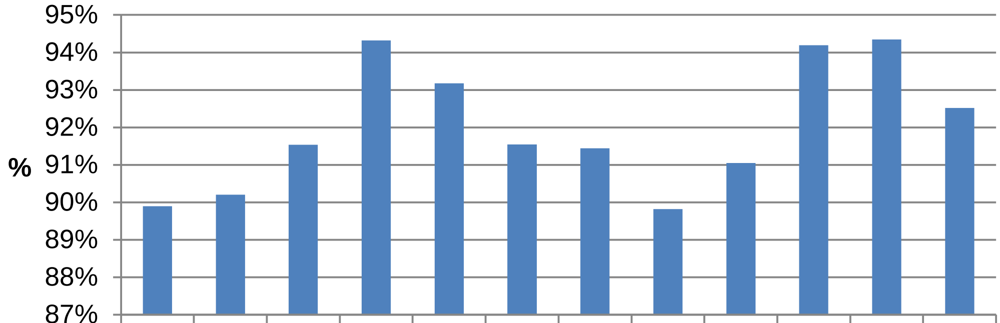
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
■	5,74	5,88	6,12	6,71	7,01	7,70	8,32	8,14	8,53	8,18	7,95	8,13

Fig. 11 Emissions of greenhouse gases from the transport (1000 t CO2 equivalent) (data source: (NSI, 2013))



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
■	9,65	9,38	10,26	10,41	11,01	12,07	12,89	11,89	12,73	14,16	13,18	12,29

Fig. 12 Share of the transport in the national greenhouse gas emissions (data source: (NSI, 2013))



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
■	89,8	90,2	91,5	94,3	93,1	91,5	91,4	89,8	91,0	94,2	94,3	92,5

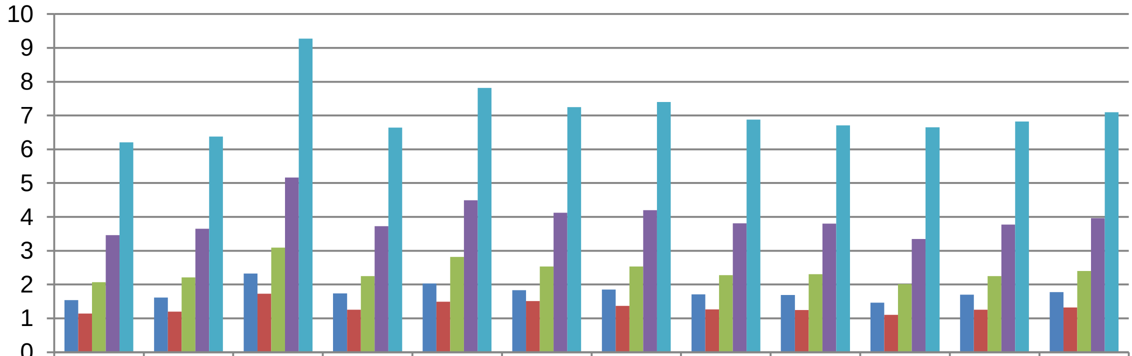
Fig. 13 Proportion of road transport in the greenhouse gas emissions in transport (data source: (NSI,2013))

Conclusions regarding emissions of GHG and data on Fig. 11 - 13 :

- Data illustrate that there is a tendency for reduction of the greenhouse gas emissions deriving from transport.
- There is a tendency towards increase of the share of greenhouse gases since 2000.
- In 2011, transport accounts for the emission of 8129 thousand tons CO2-EQ, representing 12.3% of the national emissions of greenhouse gases. In 2011, 92.5% of the greenhouse gas emissions come from the road transport.
- As per Eurostat data, the relative share of Bulgaria in CO2 emissions in the EU is negligible, only 0.85%. However, the level of emissions from newly registered vehicles is above the EU average of 18%.

3.5 Comparative evaluation

Quantification includes the relative emission levels definition for one passenger and of the overall emissions, the total quantities of emissions and the emission type and mode of transport structure. Upon application of that model, the received emission ratios for the transport of one passenger by car and train as per the included in the study relations are summarized per origination points in Figure 14.



	Karlo-vo	Plovdiv	Mez-dra	Pernik	Svoge	Burgas	Stara Zagora	Gorna Orjaho vitsa	Varna	Vidin	Sofia	Avg.
CO2	1,54	1,61	2,33	1,74	2,03	1,83	1,85	1,71	1,69	1,46	1,70	1,77
PEC	1,14	1,20	1,73	1,26	1,49	1,51	1,37	1,27	1,25	1,10	1,26	1,33
PM	2,07	2,21	3,09	2,25	2,82	2,53	2,53	2,28	2,30	2,02	2,25	2,40
NOX	3,46	3,65	5,17	3,72	4,50	4,13	4,20	3,82	3,80	3,35	3,77	3,96
NMHC	6,20	6,38	9,28	6,64	7,82	7,24	7,40	6,88	6,70	6,65	6,82	7,09

Fig. 14 Relative level of emmissions per passenger by car v.s per passenger by rail

Conclusions of comparative evaluation:

- The emissions for car carriage of one passenger are significantly higher than those in the rail transport. The relative level of emissions from road transport is with highest values for NMHC and on the average it is about 7 times higher than that in rail transport.
- The relative level of emissions of the road transport in relation to those of the rail transport is different for each of the examined relations, whereas, it has the highest values for journeys from Mezdra and Svoge.

Summarized data of the total quantities and the emission structure per type of transport are presented in Table 2.

Table 2. Emission quantities

Transport mode	Emissions (t/year)				
	CO_2	PM	NO_X	NMHC	Total
Railway	22306	5	49	3	22363
Road	1788125	584	8882	854	1798445
Total	1810430	589	8931	857	1820807
Transport mode	Emissions per passenger (kg/passenger)				
	CO_2	PM	NO_X	NMHC	Total
Railway	12.51	0	0.03	0	12.54
Road	21.5	0.01	0.11	0.01	21.63
Road/Railway	1.72	2.35	3.88	6.77	1.72
Transport mode	Share of emissions by transport modes				
	CO_2	PM	NO_X	NMHC	Total
Railway	1.23%	0.90%	0.55%	0.32%	1.23%
Road	98.77%	99.10%	99.45%	99.68%	98.77%

Conclusions on emission quantities:

- The substantial increase of the passenger flow (over 40 fold) and the relatively higher unit quantities of the emissions per passenger for car trips have led to an average of over 80 times larger quantities of emissions from road transport vs. those of trips by train.
- The relative share of road transport in the emissions of harmful substances is on the average over 98%.
- The CO_2 has the largest share in the quantity of emissions for one transported person (12.51 kg for rail and 21.5 kg. for road transport).

The value assessment indicates the price paid by society in connection with the consequences of harmful emissions. Table 3 illustrates the total value of the aggregated emissions of transports by the examined relations.

Table 3. Value of emissions

Transport mode	Total value of emissions (BGN*)				
	CO_2	PM	NO_X	NMHC	Total
Railway	1301902	304211	293577	1800	1901491
Road	104367136	33371978	53153859	568335	191461307
Total	105669038	33676189	53447436	570135	193362798
Transport mode	Share of transport modes in the emission value				
	CO_2	PM	NO_X	NMHC	Total
Railway	1.23%	0.90%	0.55%	0.32%	0.98%
Road	98.77%	99.10%	99.45%	99.68%	99.02%
Transport mode	Value per passenger (BGN/passenger)				
	CO_2	PM	NO_X	NMHC	Total
Railway	0.73	0.17	0.16	0.00	1.07
Road	1.26	0.40	0.64	0.01	2.30

**1 €=1.95583 BGN (Bulgarian Lev)*

Conclusions on the price paid by society in connection with the consequences of harmful emissions:

– The total amount of social expenditure in connection with harmful emissions deriving from the transportation of passengers as per the examined relations, which represents approximately 8% of the passenger flow of the country, is calculated to over 193 million BGN per year.
– 1.9 million BGN (or less than 1%) are the costs related to rail transport with a relative share of shipments of ca. 2.14%.
– A shift of 1% in the trips by car to that by rail will lead to a reduction in the costs by 0.53%.

4 FINAL CONCLUSIONS

In the first part of analysis the estimates for the level and dynamics of harmful for the environment emissions is shown that Bulgaria has reached a progress in relation to the main indicators for sustainable development of transport in terms of environmental impact. These results, however, to a great extent are due to the negative trends in the economic development, such as the overall reduction in transport traffic and the reduced market share of the rail transport.

The results of the comparative analysis between road and rail transport, despite the fact that it covers only part of the transport system of the country, demonstrate the need of pursual of a consistent and effective policy to increase the market share of passenger rail transport.

WORKS CITED

CBA Guidelines. (2008, 12). *Requirements for preparation of CBA in Transport sector.* Retrieved from DP Nacionalna kompanija Zheleznoptna infrastruktura: http://www.rail-infra.bg/

Dadalos. (n.d.). *Kurs 4: Kak mozhe da se opazva klimata?* Retrieved from International UNESCO Education Server for Democracy: Peace and Human Rights Education - D@dalos: http://www.dadalos-iizdvv.org/nachhaltigkeit_bg/grundkurs_4.htm

Ifeu. (2010, April). *EcoPassenger Environmental Methodology and Data.* Retrieved from EcoPassanger: http://ecopassenger.hafas.de/hafas-res/download/Ecopassenger_Methodology_Report.pdf

Ministerstvo na okolnata sreda i vodite. (2013). *Nacionalen doklad za sstojanieto i opazvaneto na okolnata sreda.* Sofia: Ministry of Environment and Water (MoEW), Executive Environment Agency (ExEA). Retrieved from http://eea.government.bg/bg/soer/2011/soer-bg-2011.pdf

NSI. (2013). Retrieved from Bulgarian National Statistical Institute (NSI): http://www.nsi.bg/en

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