Carbon Dioxide Emissions of New Road Cars in the Czech Republic in the Context of Sustainable Transport

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Abstract

Transport has an important role in human evolution. In modern society is the driving force of economic growth and allow people to commute to work and travel. Transport is also a major source and an important tool for continued European integration. More than ever, organizations and individuals in the European Union to reap the benefits offered by the extension and integration of the common market. This leads to an increase in volume and complexity of the traffic and therefore there is not sufficiently sustainable transport system in the European Union. This article aims to analyse the current development of the carbon dioxide emissions of new road cars in the Czech Republic in the context of sustainable transport. The article will present in great detail the relationship between road passenger transport and the production of carbon dioxide.
KEY WORDS: *road cars, carbon dioxide, road transport park, sustainable transport*

1. Introduction

Sustainable development requires global thinking and such that those who are richer, adopt lifestyles within the ecological possibilities of the planet (efficient use of energy). Sustainable development is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, direction of investments, the orientation of technological development and institutional changes are in line with the future. Sustainable development is also, in principle, must be based on political will [1].

World Commission on Environment and Development [1] generally defines sustainable development as follows: "Sustainable development is development that meets the needs of current generations without compromising meet the needs of future generations, and without it happening at the expense of other nations."

There is currently no precise and unambiguous, whether political or scientific definition of sustainable transport [2, 3, 4, 5, 6]. Using the concept of sustainable transport must increasingly reflect socially desirable attributes of local problems, while ignoring the global challenges that the concept of sustainable transport should address. The diversity of definitions and interpretations of the concept of sustainable transport can cause increased risk that this important concept ends up as a mere rhetoric and politicians will have scientific value.

Growth in transport activity increases pressure on natural resources and human society. Emissions of greenhouse gases, air pollutants and traffic noise affects climate, the environment and human health [7]. In addition, the increase in energy consumption in the transport sector requires the use of multiple sources. Increased transport activities and a greater incidence of accidents with fatal consequences generates social costs and delays due to congestion [8].

2. Theoretical Background and Methods

Many studies have analysed the relationship between the growth of carbon dioxide (CO2) emissions, energy intensity of transport, the share of fossil fuels in total energy consumption and economic growth using the method of decomposition. Analysis of decomposition is one of the most effective tools in place to investigate the factors influencing energy consumption and thus CO2 emissions [9, 10]. These studies were carried out mainly in the 80s of the 20th century and were used mainly in industrial contexts [11, 12]. However, in the 90s and after 2000 this technique was generalized and began to be used in other sectors (especially in transport) and began thoroughly to analyse the relationship between greenhouse gas emissions and energy consumption because of growing concerns about climate change [13, 14].

Transport accounts for about 23% of CO2 emissions related to energy [15, 16], which is approximately 15% of global greenhouse gas emissions [17, 18, 19]. Within the European Union (hereafter EU) are the cars for about 12% of CO2 emissions. In 1995, the European Commission launched a strategy to reduce the intensity of carbon dioxide emissions per kilometre of new road cars sold in the EU. Since then, the emission intensity of sold new road cars fell sharply, especially since 2007. In 2011, the strategy was updated with a proposal to reduce greenhouse gas emissions from transport by 60% by 2050 compared to 1990 levels [20].

The strategy is based on three pillars. The first pillar focuses on car manufacturers, from which it is required to reduce average emissions from new road cars. Associated directive established in 2009 aims to reduce average emissions of new road cars sold to 130 g CO2/km by 2015 and 95g CO2/km by 2021 [21]. The second pillar aims at ensuring that information on motor efficiency of new passenger road cars offered for sale or lease in the EU were available to consumers. The third pillar aims to influence the choice of consumers purchasing vehicles selected by increasing taxes, particularly taxes on fuels. All three pillars interact with each other and work together as a synergistic effect. In 2005, the European Commission proposed to harmonize the national vehicle registration and annual circulation taxes [22], but the proposal was ultimately rejected. Yet over the years, many European countries have established a third pillar of the strategy, and it greener car taxes, either revision of excise duties and value added tax or annual road tax.

Post cars in total CO2 emissions in the EU is approximately 12% [23]. CO2 emissions of passenger road cars depends on the annual mileage of each vehicle, however, several parameters affecting CO2 emissions (per kilometre a passenger vehicle). The first parameter is the type of fuel consumed. Passenger road car, which uses petrol, diesel or other fuels (liquefied petroleum gas, electricity), has different emissions of CO2 [24]. Another parameter can be vehicle weight, because the greater weight of the vehicle causes the car engine must work harder, and thus also increases fuel consumption for the same driving distance [25, 26, 27]. Furthermore, the engine displacement generally increases emissions of CO2 [24, 25, 28, 29]. Friction engine and vehicle aerodynamics also affects the emission of CO2. Among other parameters can include engine design and combustion [23], the vehicle speed and driving conditions [24, 30].

EU Sustainable Development Strategy devotes one of its seven key challenges for sustainable transport, with the overall objective: "To ensure that transport systems meet the economic, social and environmental needs of society while minimizing adverse impacts on the economy, society and the environment [23]." Among operational goals and objectives of EU sustainable development strategy include [22, 23]:

1. Decoupling economic growth and the demand for transport with the aim of reducing environmental impacts.
2. Achieving sustainable levels of transport energy use and reducing greenhouse gas emissions from transport.
3. Reducing pollutant emissions from transport to levels that minimize effects on human health and the environment.
4. Achieving a balanced ecological system toward the frugal use of different modes, with an emphasis on sustainable transport and mobility system.
5. The reduction in transport noise both at source and through mitigation measures to ensure that the overall noise level will minimize the impact on human health.
6. In accordance with the EU strategy on CO2 emissions from light commercial vehicles should average new car fleet achieve CO2 emissions of 140g/km (2009) and 120 g/km (2012).

Analysis of the transport sector in the context of sustainable development reveals a compromise between the advantages, such as allowing the creation of jobs, and its negative impacts, such as dependence on oil, environmental pressures or traffic fatalities. Since the goods transported more and more people are traveling, they need increasing amounts of energy transport uses. This linkage between transport and economic changes are monitored using an indicator of energy consumption to GDP. This indicator reveals the most important compromise, which must transport system to solve. Potential solutions to this conflict are modern technologies in manufacturing engines for more efficient operation of automobiles (reducing fuel consumption, reducing engine noise, alternative fuels, reducing automobile weight) [23, 31, 32, 33].

3. Research Results and Discussion

Article aims to analyse the current development of the carbon dioxide emissions of new road cars in the Czech Republic. Based on information from the Central Vehicle Register [34] the number of motor vehicles registered in the Czech Republic has increased in the year 2015 by 5.8%. In the January 2015 were registered 5,819,599 vehicles (Fig. 1), the total number of registered vehicles, including trailers of all types and categories were then on this date nearly 7 million units [35, 36, 37, 38].

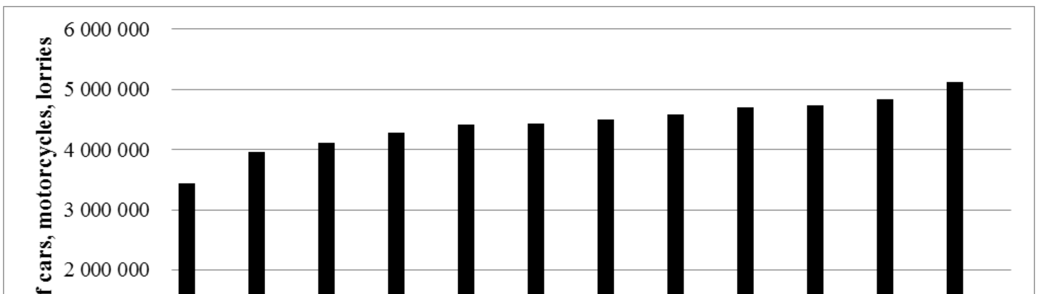

Fig. 1 Overview of road cars, motorcycles and lorries registered in the Czech Republic [34, 35, 37]

The number of registered road cars in 2015, continuing its trend of continuous growth (Table 1). In absolute terms this represents an increase of more than 280,000 vehicles, which represents an annual increase of 6%. The total number of road cars has already exceeded 1. 1. 2012 4.5 million line and currently with the number 5.1 million constitute more than 88% of the total number of vehicles registered in the Central Vehicle Register.

Table 1

Number of the road vehicles registered in the Czech Republic [34, 35, 37]

	2000	2005	2006	2007	2008	2009
Road cars	3 438 870	3 958 708	4 108 610	4 280 081	4 423 370	4 435 052
Motorcycles	748 140	794 000	822 703	860 131	892 796	903 346
Minibuses, buses and coaches	18 259	20 134	20 331	20 416	20 375	19 943
Lorries	275 617	415 101	468 282	533 916	589 598	587 032
Road tractors	22 669	24 060	22 622	20 915	17 814	14 735
Semi-trailers	22 780	29 087	44 974	50 480	53 623	52 415
Trailers	104 073	170 111	189 786	212 429	238 712	258 891
Special purpose road vehicles	78 497	54 620	48 777	46 672	43 609	39 300
	2010	**2011**	**2012**	**2013**	**2014**	**2015**
Road cars	4 496 232	4 581 642	4 706 325	4 729 185	4 833 386	5 115 316
Motorcycles	924 291	944 171	976 911	977 197	998 816	1 046 467
Minibuses, buses and coaches	19 653	19 674	19 882	19 619	19 808	19 950
Lorries	584 921	585 729	595 438	593 439	608 711	646 792
Road tractors	13 045	11 503	8 717	7 626	6 621	5 283
Semi-trailers	53 637	56 184	50 129	49 752	52 183	53 815
Trailers	278 137	299 546	336 914	345 742	374 050	405 908
Special purpose road vehicles	36 660	34 797	33 641	32 447	32 034	32 258

In 2015, there was also a slight increase in the number of minibuses and buses by less than 1% increase in the number of semi-trailers by about 3% and increased the number of trailers by about 8%. Number of trucks for long-term decline, according to information from the Central Vehicle Register decreased their number over the past 10 years to less than a quarter. In 2015, he formed the annual decrease in the number of trucks 20%. In the same year, a very slight increase in the number of special vehicles, the increase did not exceed 1% and the number of motorcycles has grown by almost 5%.

Regarding the age of road cars, nearly 60% are older than 10 years and about 80% are older than 5 years (Fig. 2).

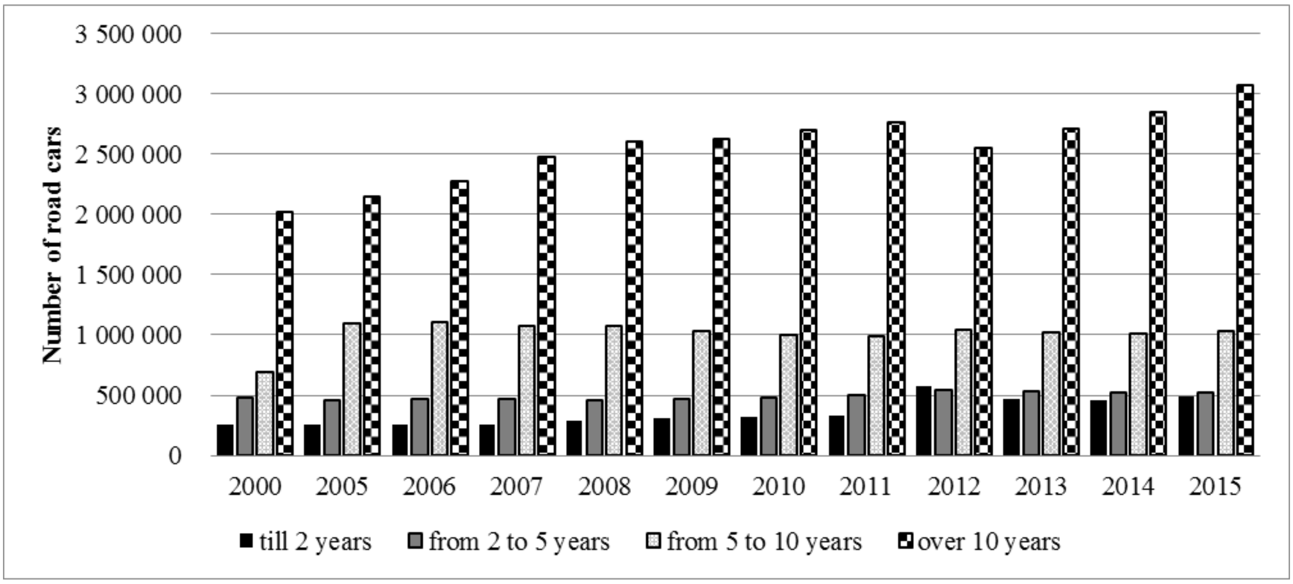

Fig. 2 Road cars registered in the Czech Republic by age category [34, 35, 37]

The number of registered trucks also rose, namely by more than 6%. Increased also the number of vehicles less than two years, namely by 15%, while there was an increase of almost 17% in the number of these vehicles older than

10 years. The percentage of trucks older than 10 years is significantly lower than for cars, because they form less than 42%. However, this percentage has slightly increased, namely by about 2%.

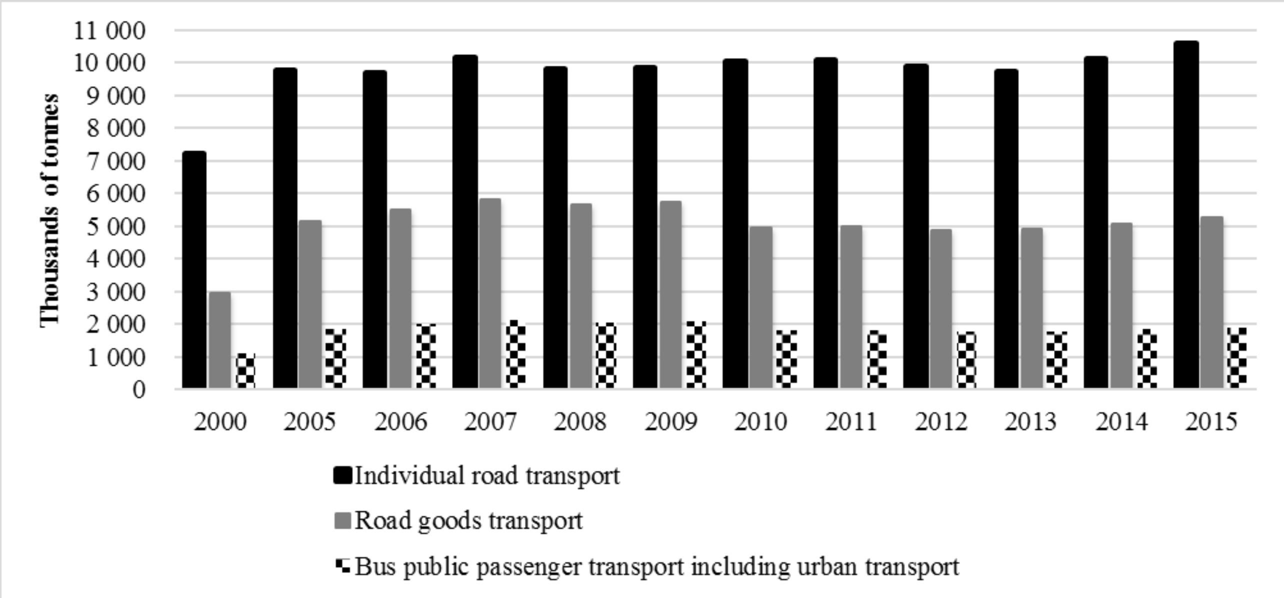

Fig. 3 Carbon dioxide emissions by mode of road transport [36, 38]

Among various transport modes, road cars and buses use more energy and produce more carbon dioxide emission [39]. Fig. 3 presents the carbon dioxide emissions by mode road of transport. It is evident that the largest share of CO2 emissions has individual road transport followed by the road goods transport. The smallest share of CO2 emissions in the Czech Republic has a bus public passenger transport including urban transport.

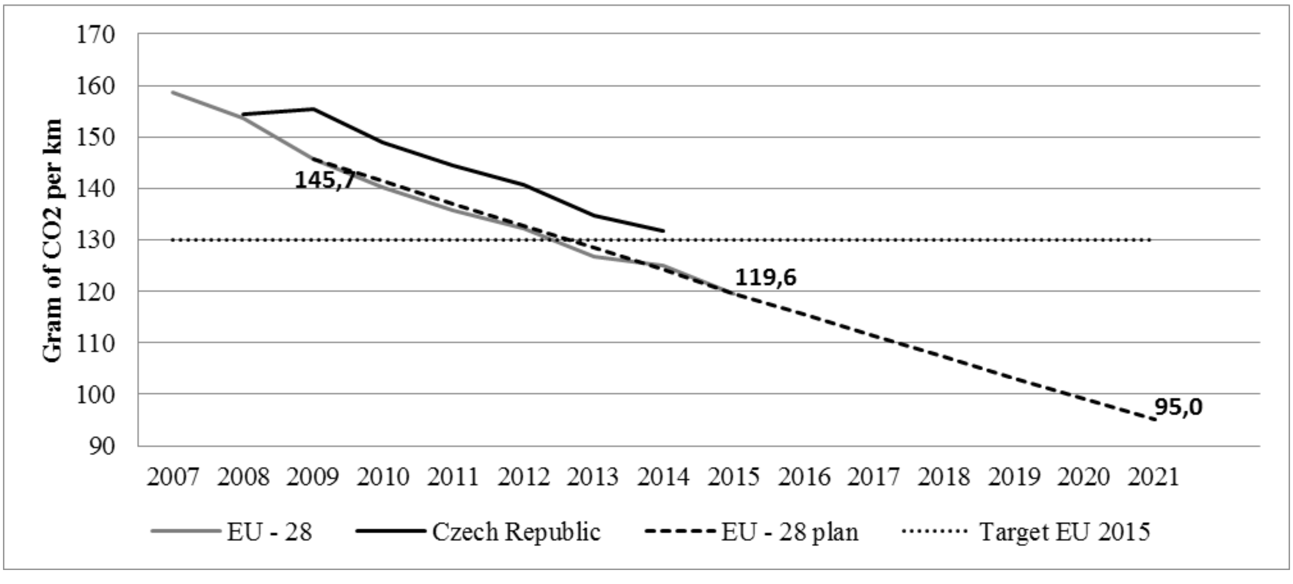

Fig. 4 Carbon dioxide emissions of new passenger road cars [20, 21, 23]

EU law lays down mandatory emissions reductions. These targets relate to the overall portfolio carmaker. Heavier cars with CO2 emissions above the limit values are still allowed, but should be offset by lighter vehicles fleet manufacturers. Limit values for passenger cars have been identified as follows [23]:

1. 130 grams of CO2 per kilometre in 2015.
2. 95 grams of CO2 per kilometre in the 2021.

Newly registered passenger road cars emit an average of 14% less CO2 emissions in 2014 and even 18% less CO2 emissions in 2015 compared to 2009 (Fig. 4). The decline in this brief period was largely the result of EU regulations. In the EU-28 average, newly registered road cars emit 125 grams of CO2 per kilometre in 2014 and 119.6 grams of CO2 per kilometre in 2015 (Fig. 4). Grams of CO2 per kilometre were 8% lower than the EU set a target. This value as a short-term trend is far below the EU has set targets. Since 2009, this figure declined by an average of 3% per annum.

Regulation is one of the reasons to reduce CO2 emissions to be effective. New road cars are becoming more and more efficient, even though their average weight is still relatively high and does not decrease at a rapid pace [23]. Member states have also managed to accelerate the reduction of CO2 emissions of the new car demand-oriented incentives, such as "scrapping bonus", a special tax on cars with high CO2 emissions or buying supported by grants for low-emission vehicles, such as hybrid-drive vehicles.

4. Conclusions

Transport is one of the key factors in the development of any modern society, while not a goal but a means of economic development and a prerequisite for achieving social and regional cohesion.

The issue of transport and mobility applies to traffic and performance modes. Different modes have different impacts on the environment and the entire ecosystem functioning. Transport activities have impacts on the environment and society, both locally and globally. Greenhouse gas emissions from transport, the impact of global climate change and noise have negative impacts on human society. Rising volumes of traffic can cause more congestion, bodily injury or even death. Monitoring of these links are also important, and answers the question of whether it can be achieved corresponding targets in the EU strategy for sustainable development.

The article was dedicated to one of the three pillars of sustainable development – environmental. Among the most discussed issues that fall into this pillar is the production of greenhouse gases, especially carbon dioxide. Road cars have a significant impact on climate change. Road transport currently accounts for approximately 23% of all carbon dioxide emissions in the EU, of which about 2/3 come from passenger road cars.

The EU has set binding targets for reducing emissions of new passenger road cars and improve fuel consumption of newly sold cars. This indicator is defined as the average CO2 emissions per kilometre of new passenger road cars registered in each year [23]. From the article suggests that the European Union and the Czech Republic are successful in achieving goals and reduce emissions of newly registered passenger road cars.

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