

CARBON FOOTPRINT FROM TRANSPORT

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Abstract

In this paper will be analyzed method of the carbon footprint with a special analysis of carbon footprint for the transport sector. Carbon footprint refers to the amount of greenhouse gasses produced due to human activities, measured in units of carbon dioxide equivalents. It is used as an indicator for understanding the negative impact on the environment and representing amounts of harmful gasses which are emitted into the atmosphere. Each sector emits a certain amount of harmful gasses. In the first place according to these emissions is the energy sector followed immediately by sector of transport. The transport sector is the fastest developing and growing sector. That is why this paper presents the comparative analysis of the carbon footprint of vehicles that are using diesel or petrol.

Keywords: carbon footprint, transport, emissions, environmental aspects.

1 INTRODUCTION

A sudden increase interest in the problem of environmental protection began in the early '70s of the twentieth century, initially only among scientists, and later in public and politics in general.

Since 1990, the key problems in the field of environmental protection are the greenhouse effect and global warming, ozone hole, acid rain and the destruction of tropical forests. Although these problems have a large scale, causes and solutions to these problems lie in the attitudes of people and the expectations of humanity in relation to the environment.

One of the most significant problems in terms of environmental protection air pollution.

Furthermore, according to the National Academy of Sciences, the expected doubling of atmospheric carbon dioxide and other greenhouse gasses could raise the earth's average surface temperature 1.5-4.5 °C in the next century, [1].

Air pollution is defined as the presence of one or more contaminants in the external environment that have an adverse effect on humans, plants or animals, or in any way adversely affect mood, ability to work. All pollutants in the air, on the basis of their physical characteristics, can be divided into particles and gasses.

To reduce the negative environmental impact, it is necessary to take a series of measures. During the last twenty years, there were intensively developed a software package that allows the estimation of emissions per kilometer [2]. Carbon footprint is one of the many models that can be used to calculate and analyze emissions of CO₂ into the atmosphere. Estimation of approximate values of CO₂ emissions, together with a few large greenhouse gasses is called carbon footprint [3].

2 CARBON FOOTPRINT

Carbon footprint has become a widespread concept in estimates of carbon dioxide emissions. Since its inception carbon footprint did not have a clear definition. Therefore, there is a lot of definitions of this model, because every scientist has given his views on the definition and use. Carbon footprint has emerged from the ecological footprint which was developed in 1996 by Wackernagel and Rees [4]. The standard unit of measurement for carbon footprints is carbon dioxide equivalents (CO₂e) [5]. CO₂e combines the measurement of six types of greenhouse gasses by weighing them each for their global warming potential relative to carbon dioxide over a period of time, generally 100 years. The gasses included are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), perfluorocarbons (PFC), hydrofluorocarbons (HFC) and sulphur hexafluoride (SF₆). These gasses are translated into the amount of CO₂ (this is called the equivalent amount of CO₂). The Carbon footprint is increasingly used to measure the volume of GHG emissions related to specific activities or products.

Today it describes the narrowest to the widest interpretation of GHG emission measurement.

In response to the increasing concern about climate change, governments, businesses and consumers are considering ways to decrease the carbon footprint of activities and products. The two main response strategies are:

1. Reduction
2. Offsetting.

When you define the reduction meant that certain activities are performed to less carbon-intensive way. This is achieved in a manner that applies modern technologies that help to reduce emissions of greenhouse gasses. Nowadays it is more and more talk about zero-emission technology.

Offsetting refers to taking external actions to compensate for a certain carbon footprint by means of some form of carbon capture or reduction elsewhere by others. If the carbon footprint of a certain activity is offset 100%, it is sometimes claimed that the activity is 'carbon neutral'.

The reduction of the greenhouse effect, in addition to a variety of technologies that can be applied, is required to man himself takes care that during their activities do not harm the environment that surrounds him.

In this paper will be explained footprint from transport and will be and give recommendations on how to reduce this footprint.

3 TRANSPORT AS A SOURCE OF GREENHOUSE GASES

Transport represents a great emitter of greenhouse gas emissions and is the main cause of air pollution in cities. Combustion is the main process during which the chemical energy of the fuel is converted into heat and then into mechanical work in IC engines. Of the total energy that is released during the burning process, about 42% is used to start the vehicle, while the remaining 58% is loss [6]. Basically, when the engine has higher efficiency, there are also smaller amounts of harmful exhaust gasses. The development and use of new technologies in order to reduce emissions have led to such advanced solutions that are harmful gas emissions fell by more than 95%.

In the case of perfect combustion the fuel reacts with the air and products of this combustion are carbon dioxide, water and nitrogen molecules. In practice, perfect combustion is not possible. Apart from the basic products of perfect combustion, there is formed and oxides of nitrogen, incombustible hydrocarbons, and carbon monoxide. Emissions of pollutants from transport in Europe have tended to decrease, however, in spite of such trends, predictions are that the concentration of gas which is the most usual in the group of greenhouse gasses, CO₂, will stay high in most urban areas [7].

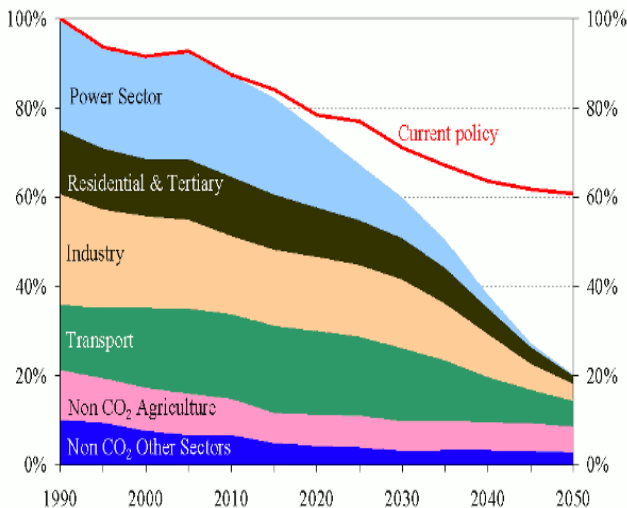


Fig. 1 Emission of CO₂ by sectors [8]

As can be observed in Figure 1 all sectors to 2050 should have been decreasing CO₂ emissions. But as for the transport of the declining trend is quite small when compared with the energy sector or industry. We see that in these sectors have an important reduction while this is not the case with transport. When we talk about transportation should be noted that road transport is the biggest polluter of the atmosphere.

In Figure 2 greenhouse gas emissions from transport, in percentage, is presented. One of the factors why road traffic represents the greatest polluters for years when it comes to the transport sector is the fact that every day the number of vehicles increases drastically. In the present day in a small extent use public transportation (bus, tram, trolley bus, train) and more and more used individual vehicles.

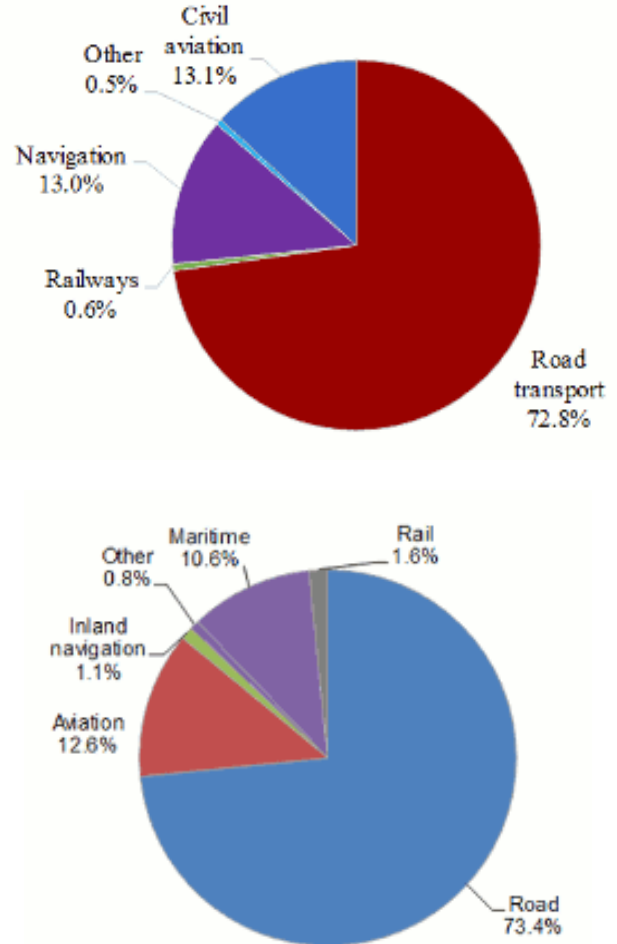


Fig. 2. Greenhouse gas emissions from transport by mode in 2014 [8]

In addition to the emissions that have immediate effect and intensified at the local level, some programs have delayed / long-term adverse effects in the form of global warming and climate change. Transport contributes significantly to global climate change. Concentrations of carbon dioxide, methane and nitrous oxide generated by burning fuel in vehicles cause greenhouse gasses. Emissions of greenhouse gasses (GHG) retained electromagnetic radiation and thus lead to global warming of the earth's surface. Further some of these gasses destroying the ozone layer which protects the earth's surface from ultraviolet radiation.

Emissions of CO₂ occur in other sectors such as industry, household, power plant but in transport is a significant issue with 27% [9]. Taking into account all the sectors of transport in road transport is the highest CO₂ emissions with 72%.

Air pollution as a negative external effect of traffic is a big problem today because it affects many fields of human life. Emissions do not directly affect human health but indirectly through the greenhouse effect and global warming affect.

4 MODEL OF CARBON FOOTPRINT FOR ROAD TRANSPORT

In order to analyze the carbon footprint of transport, it must be first define the so-called Scop [10]. Using Scope define whether it is of direct GHG emission or indirect emission. There are 3 Scopa:

Scope 1 is for direct greenhouse gasses emissions (GHG) occur from sources that are owned or controlled by the company.

Scope 2 accounts for GHG emissions from the generation of purchased electricity consumed by the company.

Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions.

In the transport sector does not fall only scope 2. Scope 1 emissions and represents directly related to the road transport. Scope 3 emissions or indirectly represents the transport of passengers and goods by public transport or air traffic. Figure 3. explains scopes.

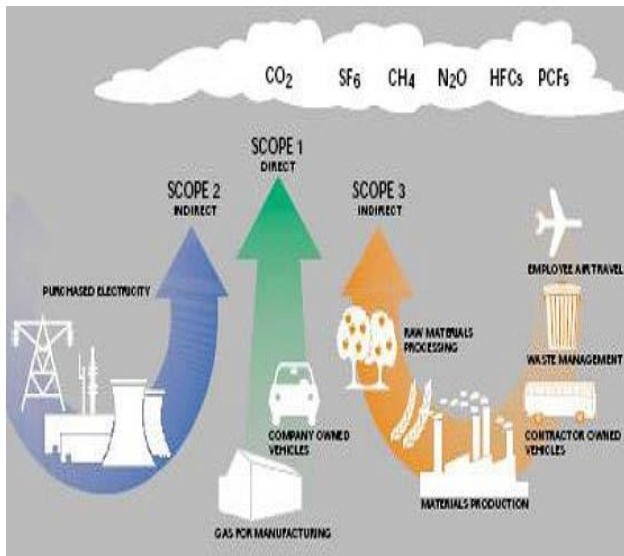


Fig. 3. Classification of Scope [11]

The equation for calculation carbon footprint in transport is:

$$\text{Distance (km/year)} \times \text{Emission factor (kg CO}_2\text{e/km)} = \text{Emissions (kgCO}_2\text{e/year)} \quad (1)$$

From the equation, can be seen that the reduction of carbon footprint and therefore in a to decrease the GHG from transport can also influence what we use fuel with less emission factor. The following table shows the values o emission factors for two different types of fuel.

Table 1. Emission factor for petrol and diesel [12]

Fuel	CO ₂ e g/l
Petrol	2,3
Diesel	2.69

Next in this paper, will be present how Carbon footprint is modified depending on the type of fuel that is used. Also, is considered as CO₂e emissions decreased with years. When calculating carbon footprint we need to take into account the average fuel consumption. So from literature [13] is the average value of consumption of vehicles to petrol and diesel engines. Average annual kilometers are adopted 20000km a year.

5 RESULTS AND DISCUSSION

In this part of the paper analysis of the carbon footprint for motor vehicles which are using diesel and petrol engines is done. The results are shown in Table 2. and Figure 4 What can be immediately seen from the Table 2. is that fuel consumption is constantly decreasing. This indicates on daily work on perfecting engines to diesel and petrol engines. For 2003 and 2008 are presented in the real situation but 2020 is presented how it is planned to this spending

Table 2 . Carbon footprint for different fuel

Year	Fuel consumption		Carbon footprint[kgCO ₂ e/year]	
	Petrol	Diesel	Petrol	Diesel
2003	7	6	3220	3240
2008	5.8	5.3	2668	2862
2020	4.9	4.5	2254	2430

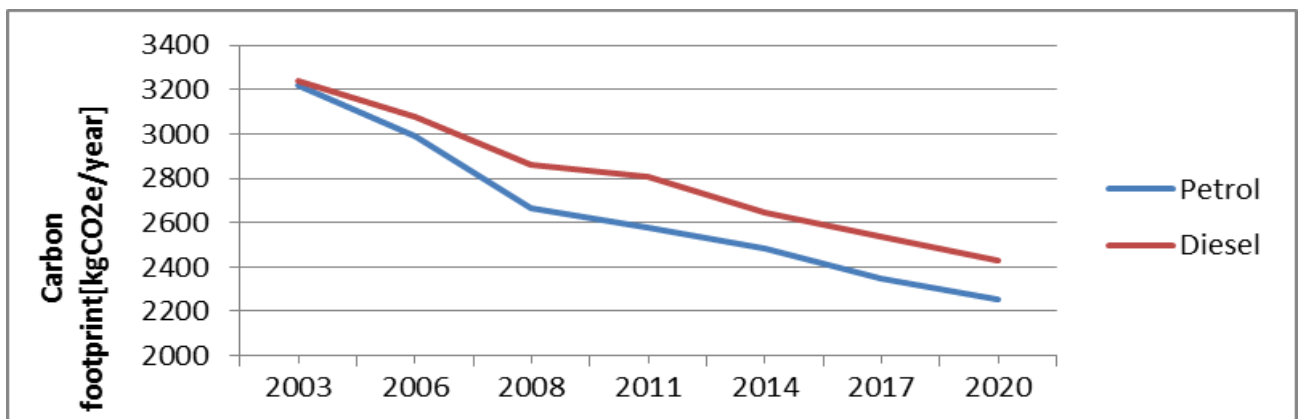


Fig. 4. Changes in carbon footprint for various types of fuel

From Figure 4 it can be concluded that with years carbon footprint will decrease. Also, vehicles using petrol have a lower carbon footprint than their diesel-powered. This indicates that in the future should improve over the diesel-powered vehicles so that their emissions were lower. It is estimated that by 2020, all vehicles have a significantly lower emission of CO₂e.

Active promotion of eco-driving and use the in-car information to realize cost-effective emissions savings. There is a downward trend in the carbon footprint of road transport. With such a trend should continue in order to meet the requirements laid down by the Kyoto Protocol. In this paper, is shown carbon footprint is for one vehicle. However, if we have already mentioned, there is a trend of an increasing number of vehicles used. Which means that we come to the conclusion that we do not have much reduce the carbon footprint of road transport. Because investing constantly in new technology and the use of renewable fuels for engines but how does increase the number of vehicles in use also increases the negative impact of greenhouse gasses. Use of a car on LPG is also an option for the protection of the environment. The coefficient of CO₂e emissions for LPG is only 1.6 g / l [12]. When this value is compared with diesel or petrol we notice a significant difference. But the use of biofuels such as biodiesel, ethanol should be our future. In the longer term electric cars charged by wind turbines, for instance, seem to be a fine solution for the global energy system. In the long term, cars powered by fuel cells and hydrogen can supplement electric cars. Road charges can also help reduce CO₂ emissions, regulate traffic and reduce local pollution. There should be an emphasis on more kinds of alternative fuels so that vital transport activities are not affected by supply failures.

6 CONCLUSAN

This paper analyzes the gasses of greenhouse originating from road traffic. They were analyzed and considered as CO₂e or carbon footprint model. With this model can be shown which fuel combustion exempt most greenhouse gasses. The analysis determined that vehicles using diesel engines harmful impact on the environment than petrol engines. Using Carbon footprint explained that greatly affects the environment has the number of kilometers that passes a motor vehicle.

From the above, it can be concluded that it is necessary to reduce the use of individual motor vehicles. People should use public transport at least when it comes to daily commuting. Going to work or school should be carried out by public transport and in this way, each one can help to environmental conservation.

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