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REDUCING FUEL CONSUMPTION AND CO_2 EMISSION IN MOTOR CARS

Valentinas Mickūnaitis, Alvydas Pikūnas, Igor Mackoit

Dept of Automobile Transport, Vilnius Gediminas Technical University
J. Basanavičiaus g. 28, LT-03224 Vilnius, Lithuania. E-mail: tiauto@ti.vgtu.lt

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Abstract. The paper considers the problem associated with the dependence of fuel consumption and CO_2 emission by automobiles on their characteristics such as mass, class, engine displacement, transmission and type of fuel used. Automobiles of various classes offered in Lithuanian market were investigated from the above perspective. The main factors determining different average fuel consumption and CO_2 emission by these motor cars were identified. Some measures of reducing automobile fuel consumption and CO_2 emission are offered.

Keywords: fuel consumption, CO_2 emission, greenhouse gas.

1. Introduction

Global warming caused by carbon dioxide emission in the atmosphere made scientists start searching for the ways of reducing it.

Lithuania signed the Kyoto protocol requiring to reduce CO_2 emissions by 8 % by 2012, compared to the level of 1990 [1, 2]. For this purpose, various methods are used in automobile transport: new technologies and transport facilities are developed, the design of internal combustion engine is improved, power losses caused by transmission from the engine, mass and tractive resistance of the vehicle are reduced and more efficient equipment for on-board diagnostics and traffic control systems are developed. In addition, some alternative fuels are tested, more effective fuel consumption standards are established, maintenance and repair of vehicles, the structure of the car park and drivers' skills are improved, etc. [3–5].

The main problems investigated in Lithuania include the use of the alternative fuel, the improvement of the car park structure and performance of vehicles, and the reduction of fuel consumption [6, 7].

The present paper is aimed at determining the effect of the fuel used by a motor car, as well as its mass, type, engine displacement and transmission on fuel consumption and CO_2 emissions.

2. The analysis of fuel consumption and CO_2 emission

Fuel consumption and CO_2 emission by new automobiles (786 units) sold in Lithuania were determined according to the requirements raised by the Directive 1999/100/EB.

The effect of the type of fuel used on fuel consumption and CO_2 emission is shown in Fig 1.

The data obtained show that average fuel consumption and CO_2 emission of the automobiles using diesel oil are lower than these characteristics of motor cars with petrol engines. However, the latter have some advantages over the automobiles with diesel engines as far as the amount of CO_2 emission per one litre of burnt fuel is concerned (e. g. petrol – 2 387.5 g CO_2/litre, diesel oil – 2 694.9 g CO_2/litre).

As shown in Fig 2, there is linear dependence between fuel consumption and CO_2 emission of motor cars.

The average values of fuel consumption and CO_2 emission, depending on the automobile engine displacement (capacity), are graphically represented in Fig 3.

The data presented in Fig 3 show that the larger the engine displacement, the higher the average fuel consumption and CO_2 emission of both types of motor cars having petrol and diesel engines. This is also shown in Fig 4 as linear dependence between motor car's fuel consumption and CO_2 emission, on the one hand, and engine displacement, on the other.

The relationship between fuel consumption and CO_2 emission of an automobile and its mass is presented in Fig 5.

The results obtained show that, when the automobile mass increases, average fuel consumption and CO_2 emission of both types of cars, having petrol and diesel engines, increases, consequently.

As shown in Fig 6, there is a linear relationship between average fuel consumption and CO_2 emission of an automobile and its mass.

The relationship between fuel consumption and CO_2 emission of an automobile and its class is given in Fig 6.

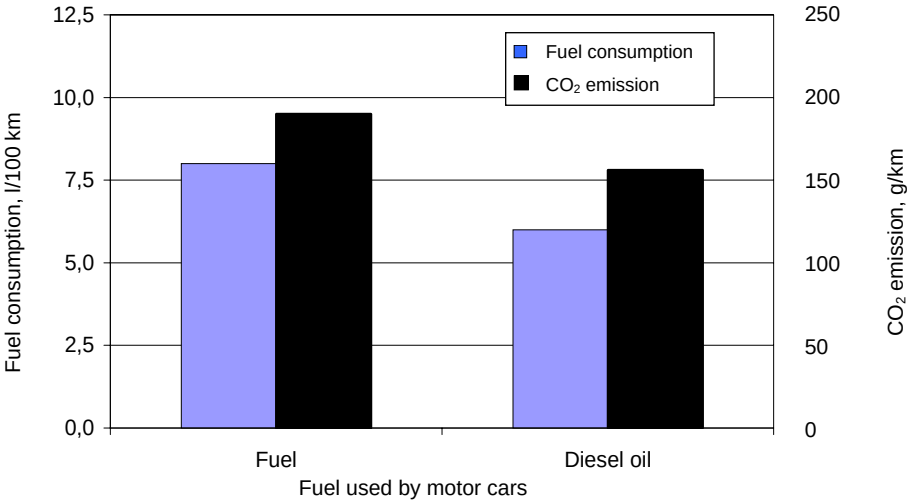

Fig 1. Average fuel consumption and CO_2 emission by motor cars depending on the fuel used

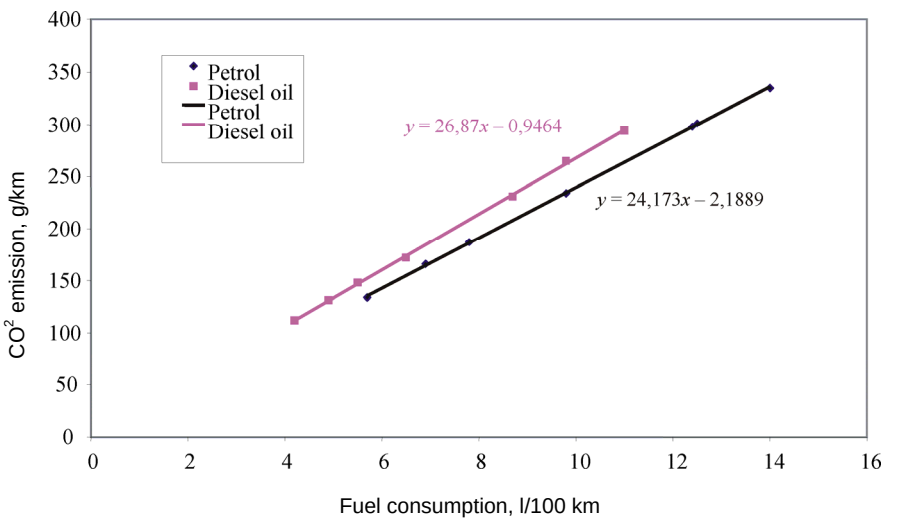

Fig 2. The relationship between CO_2 emission and fuel consumption of a motor car

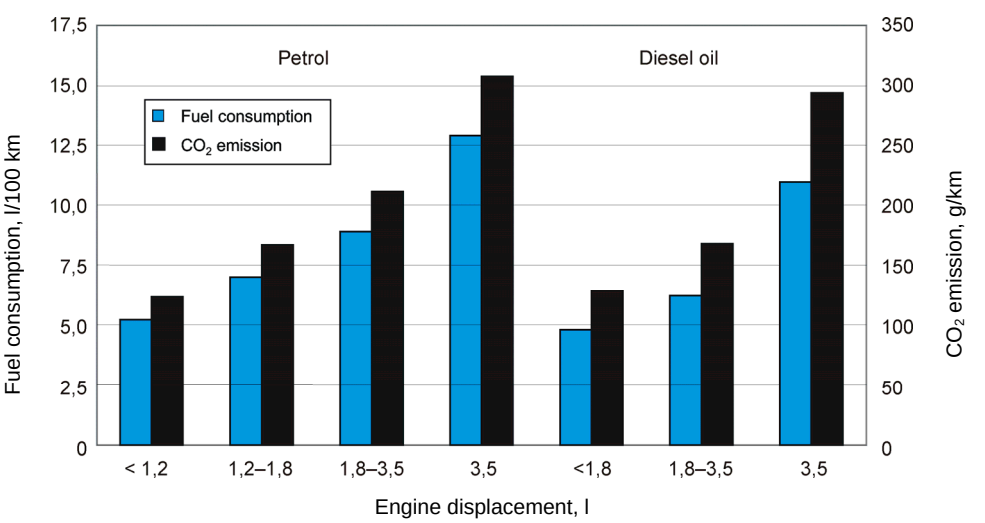

Fig 3. Average fuel consumption and CO_2 emission by a motor car depending on its engine displacement

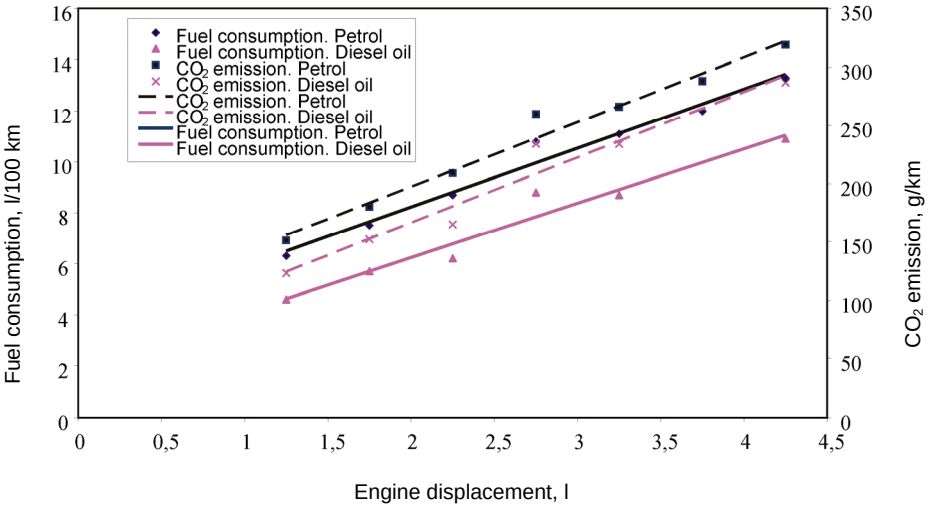

Fig 4. The relationship between fuel consumption and CO_2 emission of an automobile and its engine displacement

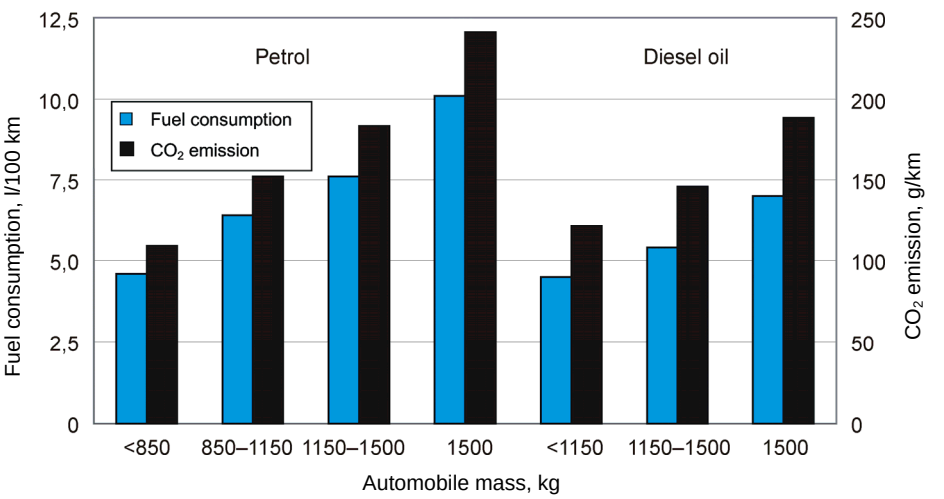

Fig 5. The relationship between average fuel consumption and CO_2 emission of an automobile and its mass

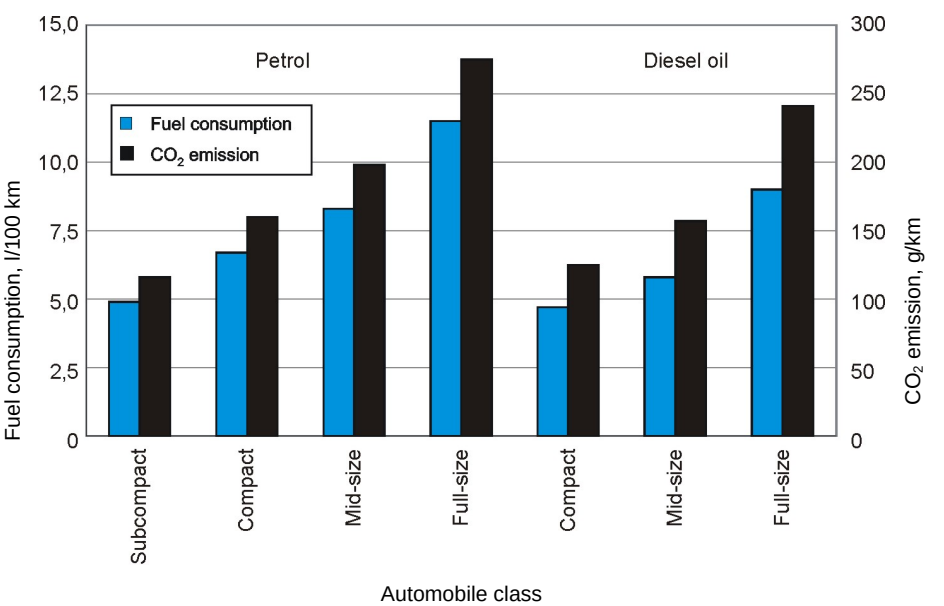

Fig 6. The relationship between average fuel consumption and CO_2 emission of an automobile and its class

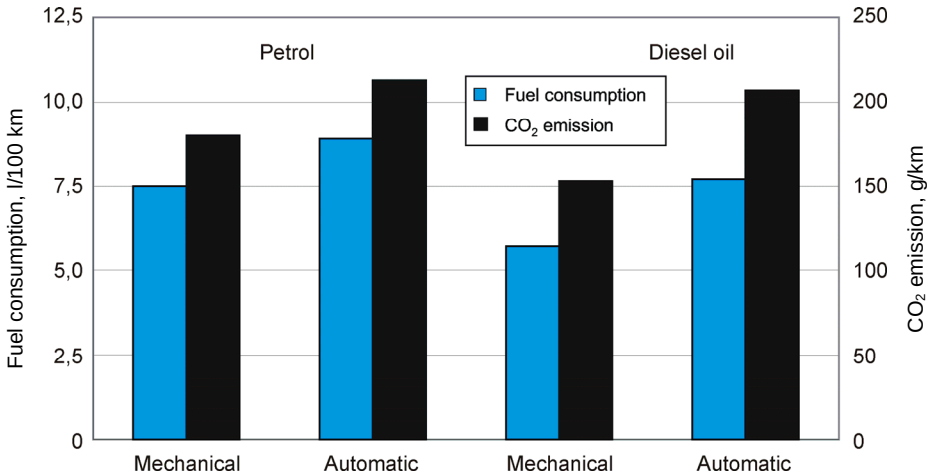

Fig 7. The relationship between average fuel consumption and CO_2 emission of an automobile and type of transmission used

The data presented show that fuel consumption and CO_2 emission of full-size automobiles (using petrol or diesel oil) is twice as much as that of compact automobiles.

To determine the impact of the type of transmission on fuel consumption and CO_2 emission of an automobile, 595 mid-size motor vehicles with mechanical transmission and 191 cars with automatic transmission were investigated.

The data presented in Fig 7 show that automobiles with mechanical transmission consume less fuel and release smaller amounts of CO_2 than those using automatic transmission.

3. Conclusions

1. There is linear dependence between the emission of carbon dioxide (CO_2) and fuel consumption.
2. Average fuel consumption and CO_2 emission of automobiles using diesel oil is lower than these characteristics of cars using petrol – by 26 and 17 %, respectively, but, when burnt, one litre of diesel oil releases 2.7 kg of CO_2, while one litre of petrol produces 2.4 kg of this gas.
3. The larger the engine displacement of an automobile, the higher its fuel consumption and CO_2 emission.
4. The larger the automobile mass, the higher the fuel consumption and CO_2 emission. When mass is increased by 100 kg, fuel consumption and CO_2 emission grow by about 6.5 % for petrol engines and by 7.1 % for diesel engines.
5. Fuel consumption and CO_2 emission of automobiles with automatic transmission using petrol increase by about 19 %, compared to 35 % for such automobiles using diesel oil.

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