Ways to Decrease CO_2 emissions from Passenger's Cars

N. Matsouki, E. Konstantinidis, Ch. Tsipa, Z. Gareiou,
E. Zervas*
Hellenic Open University – Patras (Greece)
*zervas@eap.gr

Introduction

Carbon dioxide (CO_2), as one of the main greenhouse gases (GHGs), has a significant impact on global climate change. The transport sector consists one of the dominant anthropogenic sources of CO_2 [1,2]. Thus, this sector is considered responsible for more than 20% of the production of GHGs (2019), while around 50% of them is caused by passenger's cars (PCs) [3]. Especially in the EU, it is estimated that PCs produce in some countries up to 75% of CO_2 emissions of the transport sector [4]. Pcs emit also other compounds, that deteriorate the air quality. The decreasing of CO_2 and other pollutant emissions from PCs is more than obvious and it would be beneficial both for human heath and natural environment [5]. In order to move with actions promoting emissions reduction, a comprehensive list of way key parameters affecting the generation of CO_2 and of other pollutants is presentet.

Parameters affecting CO_2 emissions

- Number of new PCs registrations [2,6-8, 9]. Emissions increase from higher PCs sales.
- Type of fuel used [13]. Decrease in CO_2 emissions from the use of diesel compared to gasoline PC has already been showed. Diesel cars have been estimated to produce 21-35% less CO_2 compared to gasoline cars [14,15].
- PCs weight [9,16]. Lighter PCs consume less fuel so weight limit of PCs would be beneficial for CO_2 emissions [7].
- Engine capacity. Average CO_2 emissions increase with engine capacity [6,16].
- Driving conditions. PCs emissions are higher 30-40% in real –world driving conditions compared to lab testing conditions. Factors that influence the emissions are vehicle characteristics and sub-systems, environmental and traffic conditions, etc. [4].
- Engine design and combustion [17]. Increased combustion efficiency results to lower emissions [2,18].
- Emission control and after-treatment devices. Pollutants emissions can be reduced through after process treatment of the gases produced [2].
- Fuel consumption due to altitude changes. Higher altitude increase deceleration time, leading to decrease on fuel consumption and thus emissions production [19].

Conclusions

Several parameters contribute to reduced CO_2 emissions from PCs use. These parameters are related with both the vehicles design characteristics, such as vehicles weight, type of fuel used, engine characteristics, etc. and to in addition to driving and market conditions. An holistic approach is necessary to effectively decrease these emissions.

Bibliography

1. Bampatsou C, Zervas E. Critique of the regulatory limitations of exhaust CO2 emissions from passenger cars in European union. Energy Policy. 2011 Dec;39(12):7794–802
2. Zervas E. Analysis of the CO2 emissions and of the other characteristics of the European market of new passenger cars. 1. Analysis of general data and analysis per country. Energy Policy. 2010 Oct;38(10):5413–25.
3. Sacchi R, Bauer C, Cox B, Mutel C. When, where and how can the electrification of passenger cars reduce greenhouse gas emissions? Renewable and Sustainable Energy Reviews. 2022 Jul;162:112475.
4. Fontaras G, Zacharof NG, Ciuffo B. Fuel consumption and CO 2 emissions from passenger cars in Europe – Laboratory versus real-world emissions. Progress in Energy and Combustion Science. 2017 May;60:97–131.
5. Zervas E. Emissions of Non-regulated Pollutants from European Passenger Cars of Different Technology. In 2010 [cited 2022 Oct 3]. p. 2010-01–2226. Available from: https://www.sae.org/content/2010-01-2226/
6. Zervas E. Analysis of the CO2 emissions and of the other characteristics of the European market of new passenger cars. 2. Segment analysis. Energy Policy. 2010 Oct;38(10):5426–41
7. Zervas E, Lazarou C. Influence of European passenger cars weight to exhaust CO2 emissions. Energy Policy. 2008 Jan;36(1):248–57.
8. Babatsou C, Zervas E. Eu Socioeconomic Indicators And Car Market. 2011 Nov 27 [cited 2022 Oct 3]; Available from: https://zenodo.org/record/1329404
9. Zervas E. Analysis of CO $_2$ Emissions and Other Characteristics of New German Passenger Cars. Energy Fuels. 2009 Jan 22;23(1):244–52.
10. Zervas E. Analysis of CO2 emissions and of the other characteristics of the European market of new passenger cars. 3. Brands analysis. Energy Policy. 2010 Oct;38(10):5442–56.
11. Zervas E, Kastelis N. Analysis of New Passenger Cars Market of UK and of Their Co2 Emissions. SAE International Journal of Fuels and Lubricants. 2009;1(1):1345–61
12. Zervas E, Panousi E. Exhaust Methane Emissions from Passenger Cars. In 2010 [cited 2022 Oct 3]. p. 2010-01–2224. Available from: https://www.sae.org/content/2010-01-2224/
13. Zervas E, Poulopoulos S, Philippopoulos C. CO2 emissions change from the introduction of diesel passenger cars: Case of Greece. Energy. 2006 Nov;31(14):2915–25.
14. Sullivan JL, Baker RE, Boyer BA, Hammerle RH, Kenney TE, Muniz L, et al. CO $_2$ Emission Benefit of Diesel (versus Gasoline) Powered Vehicles. Environ Sci Technol. 2004 Jun 1;38(12):3217–23.
15. Zervas E, Lazarou C. CO2 benefit from the increasing percentage of diesel passenger cars in Sweden. Int J Energy Res. 2007 Feb;31(2):192–203.
16. Zervas E, Diamantopoulos E. Relationships Between CO $_2$ Emitted from New Passenger Cars in European Union and Their Engine and Vehicle Characteristics. In 2009 [cited 2022 Oct 3]. p. 2009-01–1825. Available from: https://www.sae.org/content/2009-01-1825/
17. Zervas E. Comparative study of some experimental methods to characterize the combustion process in a SI engine. Energy. 2005 Jul;30(10):1803–16.
18. Bebkiewicz K, Chłopek Z, Sar H, Szczepański K. Comparison of pollutant emission associated with the operation of passenger cars with internal combustion engines and passenger cars with electric motors. Int J Energy Environ Eng. 2021 Jun;12(2):215–28.
19. Zervas E. Impact of altitude on fuel consumption of a gasoline passenger car. Fuel. 2011 Jun;90(6):2340–2.