CO2 Reduction Methods from Vehicles

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***Abstract -* Various measurements and scientific researches indicate a significant increase of carbon dioxide concentration in the atmosphere (30-40%) since the beginning of industrial revolution which represent one of the biggest ecological and environmental problems of modern society. Scientists round the world warn that concentration of CO2 in the atmosphere has reached a record level, i.e. the highest concentration of CO2 in the last 650 thousand years. The level of CO2 is increasing faster than scientists predicted even a matter of opinion that the Earth has lost even the ability to absorb vast amounts of carbon. The effect of greenhouse and global warming of earth are terms often mentioned today in the world. A number of natural disasters, large temperature differences, health problems, are just some of the consequences of global warming which is one of the causes of rising concentrations of carbon dioxide in the atmosphere.**

**In the last twenty years is indicated a large increase consumption of fuels per year, which causes increased emission of carbon dioxide. Annual fuel consumption is growing for several reasons: increasing freight traffic flows in all segments, increasing global industrial production, higher traffic density in urban areas, the use of fuel for household and similar. For example, only the combustion of motor vehicles, each year the Earth's atmosphere drop to $ 8 billion in carbon dioxide. In order to achieve lower carbon dioxide emissions caused by higher fuel consumption, is to research in the areas of automotive and transportation infrastructure to reach satisfactory solutions. Consequently, the use of alternative fuels and eco-technical innovation are the main concept of the environmental policy of the European Union to limit CO2 emissions.**

**One of the strategy elements of environmental protection is to promote increase of dizel fuel vehicles, which comparatively with gasoline motor vehicle has a smaller specific fuel consumption. Use of bio-fuels in transport vehicles propulsion systems will have important part in reducing of CO2 emission in transformation period, while hydrogen (H2) will be used as a future fuel. Over past ten years a large influence has been made in progress of developing fuel cells, which is very important for CO2 emission reduction. In the debates on the quality of motor fuels due to CO2 emissions need to refer to the direct application of hydrogen combined with fuel cell propulsion system to transport vehicles, with the ultimate goal that in due course replace the internal combustion engine. Alternative fuels use in combination with hybrid technology vehicles propulsion system could serve as a bridge to go to the application of fuel cells.**

***Key words: CO2, combustion, reduction, alternative fuels***

# Introduction

In the last 15 years an increase in annual fuel consumption, resulting in increased emissions of carbon dioxide (CO2). Annual fuel consumption increases due to rising transport people and goods, higher traffic density in urban areas, population mobility, etc. In order to achieve lower emissions caused by higher fuel consumption, is to study the areas of automotive and transportation infrastructure to reach better solutions. As carbon dioxide is constantly increasing, technical innovation is the basic concept of environmental policy, which accepts the motor industry to reduce CO2 emissions into the environment. The purpose of this research was to study the effect of CO2 on the environment during combustion of motor fuels and to bring new solutions to the problem of how to release CO2 into the environment could be reduced to as small as possible. Questions that sought to answer the burning of motor fuel are: what is the CO2, how it affects the environment, in which everything branches present, and what proportion of CO2 emissions by motor vehicles, to reduce CO2 emissions. During the study used a method of analysis and synthesis and compilation methods. In the introduction, this problem, subject and object of research, working hypotheses and auxiliary hypotheses, the purpose and goals of research, scientific methods and explained the structure of work. Title of the second section is generally of carbon dioxide and its emissions. In this part of the analysis are carbon dioxide, its genesis, and listed other consumers who emit CO2. CO2 emissions and its impact on the environment is the third title of the paper which presents the parameters for the assessment of emissions, the impact on CO2 emissions and environmental consequences. In the fourth part of the paper with the title of the possibility of reducing CO2 emissions were analyzed trends in emission reductions, alternative fuels and emission limitations of the European Union. The conclusion is a synthesis of research results which confirmed the hypothesis.

# CO2 emissions in different sectore

Of the total CO2 emissions into the environment, 3% caused by men's activities and of which 12% is related to anthropogenic[[1]](#footnote-2) emissions of CO2 transport vehicles, which use fuels. Distribution of anthropogenic emissions in other sectors is shown in Table 1.

1. distribution of anthropogenic emissions by sector

|  |  |
| --- | --- |
| **Fuel energy consumers** | **Portion [%]** |
| Thermo power plants | 25 |
| Ships | 1,5 |
| Airplanes | 3 |
| Industry | 19 |
| Biomass burning | 15 |
| Automotive vehicles (cars) | 5,5 |
| Trucks, buses | 6,0 |
| Domestic heating | 23 |
| Other means of transportation | 2 |

Source: Dobovišek Ž., Samec N., Kokalj F., 2008, Goriva i maziva., p26

It should be noted that the costs of technical operations, reducing one ton of excess CO2 emissions by motorized vehicle emits into the environment, three to eight times higher than the cost of the project with the same goal in other sectors of industry, energy industry and households [1].

# Combustion of the co2

Combustion of motor fuels, every year the Earth's atmosphere drop 8 billion tons of carbon dioxide. According to the data the carbon dioxide emissions growth from year to year, and during 2005. The carbon dioxide emissions responsible for global warming rose to 15.1 billion tons. Annual emissions of the carbon dioxide in air is 26 Gigatonnes. It should be noted that 50% of the oceans absorb CO2 [2].

 Forests, grasslands and oceans which act as drains and dump carbon, over and absorb almost half of overall carbon dioxide emissions and thereby mitigate and slow the accumulation of CO2 in an artificial atmosphere.

Scientists believe that due to the accumulation of carbon dioxide in the atmosphere could lose permanent ability to absorb carbon. Increasing amounts of carbon dioxide in the atmosphere, increasing the amount of CO2 reacts with seawater, causing bicarbonate[[2]](#footnote-3) and hydrogen ions[[3]](#footnote-4), which increases the acidity of the surface layer. Although, the oceans and vegetation absorb huge amounts of carbon dioxide, their absorption capacity is limited, and every year, because of excessive burning of fossil fuels, a certain amount of greenhouse gases remain in the atmosphere, it condenses and enhances its ability to retain heat, contributing in this way global warming [3].

## CO2 Concentration

Greenhouse gases keep Earth's average temperature at 15 ° C. Without their performance, and the greenhouse effect[[4]](#footnote-5), temperatures on Earth would be approximately 18 ° C below zero, and life would not be possible. Change in concentrations of greenhouse gases in the atmosphere could lead to changes in heat balance in the Earth-atmosphere system. The concentration of CO2 is steadily rising. Increased concentrations in the atmosphere causing the Earth's average temperature increase. Double the concentration of carbon dioxide would increase the temperature of the Earth by about 2.8 ° C.

U.S. scientists have warned that the concentration of CO2 in the atmosphere reached a record level. According to recent data, the concentration of CO2 in the atmosphere rose to 387 ppm, which is 40 percent more than the industrial revolution. It is also the highest concentration of CO2 in the atmosphere over the past 650,000 years. CO2 levels rising faster than scientists predicted even the increasingly popular view that the country has lost the ability to absorb vast amounts of carbon.

*B: Expected effects of increasing CO2 concentration*

The latest report of the Intergovernmental Committee on Climate Change (Eng. Intergovernmental Panel on Climate Change, IPCC) emphasizes the danger of global heated planet. Eleven of the last twelve years has been the warmest since weather observations are made. Sea levels rising faster than it had predicted. In large areas of the globe, are increasingly climate disasters (hurricanes, droughts and heat). The IPCC is that the climate change responsible for human activity and the burning of fossil fuels (climate change, 2010).

Increased amounts of carbon dioxide and other greenhouse gases are released into the atmosphere is the result of burning fossil fuels (oil, coal and gas), deforestation for agriculture and other human activities. Reducing fossil fuel use is currently very hard to achieve due to the constant growth of the economy and the constant need for production optimization, and optimization of itself means a reduction in investment in clean and renewable energy sources because such sources of energy at the beginning generally more expensive than fossil fuels. The automotive industry is increasingly takes into account alternative sources of energy. The consequence of increased concentration of carbon dioxide, and thus global warming is primarily the climate change. Because climate change is coming to an increase in temperature on Earth, and the melting of glaciers and glacier, and thus to sea level rise and ocean that according to some experts estimate could be 18-59 cm by the end of the 21st century. Melting glaciers, will initially cause increased discharges, and then water shortages in some parts of the world. While the rise in temperature on Earth affect the melting of ice at the poles, is not expected that it would raise sea levels. Sea levels will sharply raise the melting of glaciers on land that will be dissolved within a very short time. Due to rising sea levels will be many small islands in the oceans disappear [4].

Climate change caused extinction of some plant and animal species and the emergence of new ones. The impact of climate change on marine life can be manifested in the trees in each park or garden. Listing and flowering trees are common in November and December, which is not natural. Awakening of plants has so far been reserved for the spring. Spring is coming 2 weeks earlier than it was before the 50-odd years, and autumn arrives about a week later.



Figure 1. Glaciers melting (source:www.meteo-info.hr)

Since the changing structure of the food chain in nature, with trees leafing through the changes in the lives of insects which results in reducing or increasing the number of birds that feed on them. Coral reefs as highly sensitive ecosystems will also suffer. If temperatures rise by 1-2 degrees, coral reefs will fade and eventually die. Changing weather conditions will greatly affect the changes in agriculture in certain areas. Cultures that were grown in a specific area for centuries, will not prosper, but will grow something else. Lately, we monitored more storms, storms in the summer, heat waves and floods. A warmer environment conducive to the spread of various diseases will significantly affect human health. Increased concentrations of carbon dioxide affect the food we eat and drinking water. People will be more likely to die of heat stroke, a consequence of excessive UV radiation and food poisoning, a flood will cause diseases to spread water. The estimated effects of global warming are not always negative. Global warming leads to climate change which will have positive effects in some regions while other regions will feel the negative consequences of climate change. Scientists currently are unable to predict exactly what will happen and what will be the extent of the consequences of global warming. Scientists warn that the very uncertainty of what will happen to the best reason that the effects of global warming an attempt to reduce to a minimum and that we should respond in advance. It is believed that the uneven impact of global warming will be a great motivation for future migration.

# Options for reducing CO2 emissions

       Increasing human population causes an increase in the use of motor vehicles, which directly affects the rise in consumption of motor fuels. Motor vehicles are one of the biggest polluters of the atmosphere with carbon dioxide and to reduce CO2 emissions in the atmosphere are introduced novelties.

Agreement of the representatives of the European automotive industry VDA (Verband der Deutschen Automobilindustrie), ACEA (European Car Manufacturing Association), governmental institutions within the EU and others, it was concluded that in the resolution of global environmental problems, tested the value of the standard consumption (g) and thus CO2 emissions (es) of newly produced cars after the 1995th was gradually reduced without reducing the effective power of the engine, using the abundant resources of innovation and optimization of the propulsion system and vehicle design [5]. Environmental Strategy, proclaimed the automotive industry, based on the application of telecommunications technology and telematics, with the aim of reducing traffic congestion, to the introduction of quality fuels and lubricants, tires with low coefficient of friction and alternative propulsion systems further reduce fuel consumption and reduce CO2 emissions. It should be noted that one of the most important elements of this strategy of promoting the increase of diesel engines, which compared with a vehicle with a gasoline engine has a lower specific fuel consumption. Summary of proposals VDA, ACEA is shown in Table 2.

1. a gradual reduction in specific CO2 emissions and consumption of standard fuel fleet of passanger cars

|  |  |  |
| --- | --- | --- |
| **Year** | **Specific CO2****emission** | **Standard****Fuel consumption [ l/100 km]** |
|  | [gCO2/km] | Reduction [%] | Gasoline | Diesel |
| 1995. | 186 | - | 7,8 | 7,0 |
| 2003. | 165 | 11,3 | 7,0 | 6,0 |
| 2008. | 140 | 24,7 | 5,8 | 5,3 |
| 2020. | 120 | 14,3 | 4,9 | 4,5 |

Source: [www.vda.de](http://www.vda.de)

# ALTERNATIVE FUELS

The use of bio-fuels[[5]](#footnote-6) in transport vehicles, propulsion systems, will play an important role in reducing CO2 emissions in the interim period, while the hydrogen (H2) used as fuel. In the past ten years has made ​​great progress in developing bus powered fuel cells[[6]](#footnote-7), which are used in public transport around the world, which makes a very important milestone in the reduction of CO2 in the atmosphere. In the debates on the quality of motor fuels due to CO2 emissions need to refer to the direct application of hydrogen combined with fuel cell propulsion system to transport vehicles, with the ultimate goal that in due course replace the internal combustion engine. Development and Planning Technology retardant article and large-scale introduction of hydrogen vehicles on road transport in order to significantly reduce CO2 emissions, are faced with a number of very serious problems.

The problems are the construction of infrastructure (it is anticipated that the costs of building infrastructure in Europe amount to at least 10-20 billion €), charging vehicles at retail outlets, operating costs, reliability (can not compete with internal combustion engines for which you have more than 100 years of development and use in vehicles) [6].

The use of alternative fuels in combination with hybrid power trains[[7]](#footnote-8) transport vehicles could serve as a bridge to go to the application of flammable articles. Bio-fuels provide more benefits in terms of reducing global CO2 emissions. The problem is that their use is now limited due to insufficient quantity of bio-fuels in the marketRječnik - [Prikaži detaljan rječnik](http://www.google.com/dictionary?source=translation&hl=hr&q=&langpair=hr|hr)

# Conclusion

Combustion of carbon dioxide and its circulation in the atmosphere during combustion of motor fuels has become one of the major environmental problems. A number of natural disasters, large temperature differences, health problems, are just some of the consequences of global warming which is one of the causes of rising concentrations of carbon dioxide in the atmosphere. At the present time have begun to introduce standards that could limit CO2 emissions and the automobile industry increasingly focused manufacturing cars that meet all standards to reduce emissions.

Alternative drives are the future and make their application in the automotive industry, which should encourage more to reduce CO2 emissions and thereby preserve the environment in which we live.

# References

1. Dobovišek Ž., Samec N., Kokalj F., 2008, Goriva i maziva, online: http:// hrcak.srce.hr/index.php?show=clanak&id\_clanak\_jezik=10524 (12.11.2010.)
2. Nasa-Giss, 2010., online:http:// www.giss.nasa.gov (22.12.2010.)
3. Nasa-Giss, 2010., online:http:// www.giss.nasa.gov (22.12.2010.)
4. Goodstein, E.2003, Ekonomika i okoliš, 2. Izdanje, Grafotisak, Zagreb, p.45
5. Verband der Automobilindustrie, 2010, <http://www.vda.de/de/verband/index.html> (24.03.2011).
1. Anthropogenic: The consequence of human activity on the environment [↑](#footnote-ref-2)
2. Acidic carbon acid salts (sodium bicarbonate, NaHCO3) [↑](#footnote-ref-3)
3. The particles are electrically charged due to differences in the number of protons and electrons [↑](#footnote-ref-4)
4. Heating of Earth's atmosphere due to the difficult reemisije heat received by radiation [↑](#footnote-ref-5)
5. Biofuels: Fuels which are obtained by processing biomass [↑](#footnote-ref-6)
6. Fuel article: Device that converts chemical energy into electrical energy [↑](#footnote-ref-7)
7. Hybrid Technology: The combination of electric motors and internal combustion engine as you drive the car [↑](#footnote-ref-8)