

## THE RELEVANCE OF GHG EMISSIONS FROM MOTOR VEHICLES

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### ABSTRACT

Greenhouse gas (GHG) emissions of road transport amount to less than 0.3 % of global emissions. Therefore, it would be more efficient to reduce them in other fields, e.g. in the building industry. In spite of that, road transport is pointed out, even in the Kyoto Protocol, as one of the most important targets when the reduction of the global GHG emissions is concerned. However, Germany is the only country among all European countries which has reached the planned decrease in GHG emissions, which means that there are considerable difficulties in achieving the promoted goals. Looking to the future, demands like improved engines and fuels have more chances to sustain the mobility than new power train systems based on expensive, disputable hydrogen technology. Bearing all this in mind, there is room for doubt whether GHG emissions from road transport should be so severely restricted.

**Keywords:** greenhouse gas (GHG) emissions, motor vehicle

### 1 INTRODUCTION

Road, sea and air transports are undoubtedly lifelines of the modern world. It is also true that they produce approximately one eighth of man-induced GHG emissions. Yet, the automotive industry has come under most fierce attacks as a source of GHG emissions. On the other hand, the fact is that the automotive industry has made the most significant breakthrough in the effort to reduce harmful emissions in the last twenty years. For example, since 1990 (Euro 0) until now (Euro 5), the CO emission from the most widely used M1 category vehicles propelled by petrol engines has been reduced by more than 97%, and the (HC + NO<sub>x</sub>) emission by almost 96% since 1990. Fuel consumption, which is directly proportional to the CO<sub>2</sub> emission, has been reduced to 6.7 l/100 km, i.e. by 22%, for the vehicles produced by German manufacturers, if considered at the fleet level.

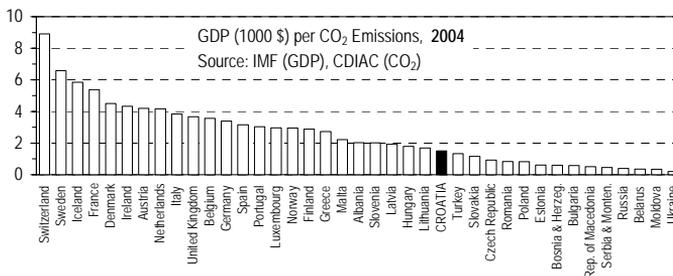


Figure 1. Energy efficiency in industries of European countries considered through the GDP per ton of carbon dioxide equivalent emissions (IMF - International Monetary Fund, CDIAC - Carbon Dioxide Information Analysis Center)

The policy of accepting the obligation to reduce GHG emissions is fatal to the future development of the Republic of Croatia for two reasons. The first is because the Kyoto Protocol states as the referent emission the one from the year 1990 in which the industrial production level in Croatia was very low. The other, a more fatal one, is our very low GDP per ton of CO<sub>2</sub> (Figure 1). Since the volume of industrial production is directly proportional to energy consumption, to accept low levels of allowed GHG emissions means to accept the death sentence to the reconstruction and development of Croatian industry.

## 2 GLOBAL GHG EMISSIONS AND THE CONTRIBUTION OF TRANSPORT

Total anthropogenic emissions of GHG on the Earth amounted to 31 Gt in 2007 (according to CDIAC). The share of road transport in these emissions was only 8.2%, or 2.5 Gt, according to IPCC; the total share of transport was 13.1%, or 4.1 Gt. On the other hand, according to UNFCCC, emissions from deforestation have been approximately 5.8 Gt per year ever since 1990. This is more than double what is emitted from road transport, and 50% more than what is emitted from transport in general. According to TU Wien, anthropogenic emissions amount to only 3.5% of total GHG emissions on the Earth. Thus, **road transport** has a share of only **0.29%** in the total GHG emissions on the Earth. It is hard to believe that there are reliable methods which can distinguish the effect on climate changes of such a small increase in the GHG concentration in the atmosphere from the effect of significantly higher emission levels from other sources. Moreover, the arguments of those who claim that global warming is not related to GHG emissions but rather to the processes going on the Sun's surface. The question is whether CO<sub>2</sub> has caused major climate changes or whether it has been hastily found guilty of that crime in order to start and develop a business in which the happy few make profit and by which famine is caused for many.

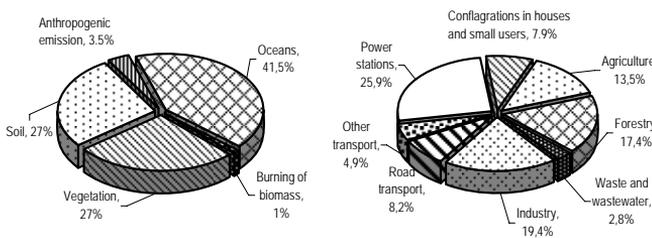


Figure 2. Total GHG emissions on the Earth (left) and anthropogenic emissions (right). Sources: TU Wien (published in [2]) and UNFCCC [7]. (UNFCCC - United Nations Framework Convention on Climate Change)

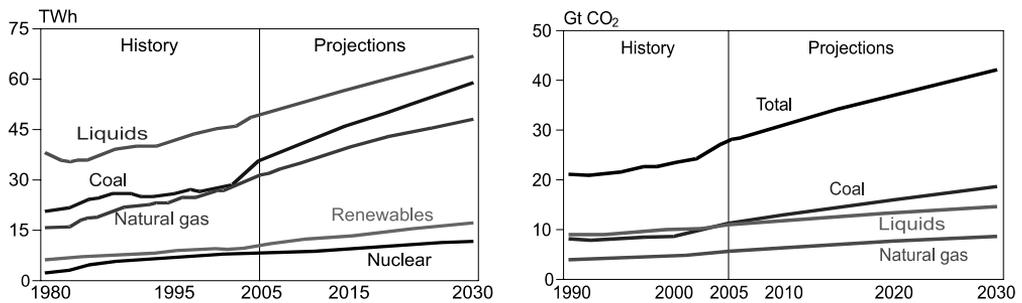


Figure 3. World energy consumption by the fuel types (left) and GHG emissions from these fuels expressed in CO<sub>2</sub> equivalents (right). Coal is most often used for the generation of electrical energy and in industry, but also for the production of synthetic liquid fuels. Source: EIA [9].

## 3 CO<sub>2</sub> EMISSIONS FROM ROAD TRANSPORT AND AUTOMOTIVE INDUSTRY

Automotive industry has set targets related to the CO<sub>2</sub> emission reduction in accordance with the Kyoto Protocol which lists transport as one of the sources of CO<sub>2</sub> emissions. It is obvious that the main objective of the obligations imposed by the Kyoto Protocol is to preserve the current balance of power between developed and less developed countries. This is a new way how to colonize the less developed countries; this is an unjust agreement which ensures the preservation of the same disproportions between the rich and the poor in the allowable GHG emissions of the year 1990. The Kyoto Protocol imposes the relations which enable the population of a rich country, e.g. the U.K., to produce 1.9 times more GHG, making a very comfortable life possible, than the population of Croatia. In addition, the UK population has a 2.5 times higher GDP per every ton of emitted GHG per year, which finally results in a 4.6 higher GDP per capita. This means that the average UK inhabitant lives at least 4 times better than the average Croatian inhabitant and this ratio is very discouraging. Another argument suggesting that the most developed countries are neither consistent in their attitudes nor honest is the fact that the right to exceed limitations can be bought and the money is with the rich. In

this way, less and least developed countries are condemned to the vicious circle of poverty. Can huge investments into the development of technologies to further reduce emissions, each time to a lesser degree, be accounted for? Or, is it only an end in itself in order to justify a continuous increase in vehicle prices and probably to conceal the profit that “successful” management of automobile concerns? Instead of being only a vehicle used for transporting people from point A to point B in a most efficient way, an automobile is presented as a special universe in which a passenger can enjoy the comfort, internet access, GPS and other modern gadgets during the everyday short drive to/from work, while she/he probably does not have all these things at disposal at home where she/he spends far more time.

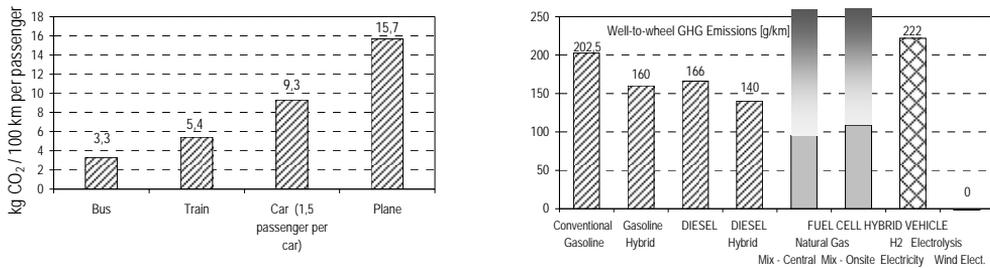


Figure 4. LEFT: In interurban traffic, a coach propelled by a Diesel engine is today the most cost-effective vehicle which consumes the smallest amount of energy per passenger/kilometer and emits the smallest amount of CO<sub>2</sub> [2]. RIGHT: Unpleasant truth concealed in the General Motor’s study on GHG emissions from power train systems with internal combustion engines and with hydrogen fuel cells: CO<sub>2</sub> emission in the case when hydrogen is obtained from natural gas does not show the amount of wasted carbon which has tree times higher mass than hydrogen. If that fact had been taken into consideration, and it should have been, the 5th and the 6th column would indicate not the lowest but much higher values than the first column. (Results from the study “GM Well-to-Wheel Analysis ..., 2002”, published in [5].)

#### 4 NEW POWER TRAIN SYSTEMS

Some 10 years ago, automotive industry started publicly announcing hydrogen as a solution to sustainable mobility in the near future. In the meantime, this has proved to be a disputable orientation for several reasons. For example, fuel tanks of modern vehicles are not adequate for storing hydrogen, not even for several days. In the light of this fact, the storage and transport of hydrogen can hardly be imagined. Even if these problems were solved, what is still disputable is the main condition on which the whole concept is based and on which automotive industry relies, and that is the generation of large amounts of ecologically clean electrical energy required for the production of hydrogen at an acceptable price. This problem could be solved by nuclear fusion, but the technology is said to be feasible in some fifteen years or so. The thing is that the same has been in announcements for some forty years. There is no alternative solution in sight.

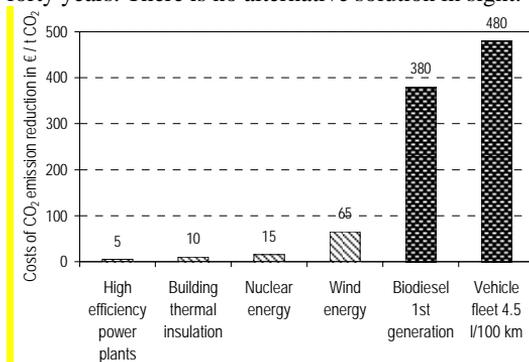


Figure 5. The price of emission reduction of 1 t CO<sub>2</sub>. Source: VDA [3].

The production of hydrogen from natural gas does not make sense from the point of view of CO<sub>2</sub> emissions. Natural gas consists primarily of methane (80-98%) and 1 kilogram of methane has only 25% of hydrogen and 75% of carbon (which will not be used and will finally burn into CO<sub>2</sub>). If, for example, one million tons of fossil diesel fuel (43 MJ/kg) were substituted by hydrogen (120 MJ/kg), we would need only 1/3 of the mass of the diesel fuel in order to produce the same amount of energy. However, if natural gas was used to produce hydrogen, then the mass of remaining carbon would be three times higher, i.e. it would be 1 million tons, i.e. exactly the same as the mass of fossil diesel fuel. For Croatia, which consumes 1.5 million tons of diesel fuel, it would result in 500 kg of carbon per capita. Where would such a vast amount of carbon be stored and at what expenses? If world politicians really cared about the reduction in the GHG emissions, it could be done more cost-effectively and efficiently in other sectors of industry (Figure 5).

## 5 CONCLUSION

With respect to GHG emissions from road transport, two conclusions may be drawn. The first is that the reduction of anthropogenic GHG emissions from road transport results with second rate effects. In all other sectors, the reduction can be achieved significantly more cost-effectively and efficiently. Internal combustion engines, exhaust gas cleaning systems and fuels have reached their reasonable maximum far as harmful emissions are concerned. There is not much that can be done in this respect. The other conclusion is that whatever is done to reduce GHG emissions from road transport, the global effect would be negligible as these emissions represent only 0.29% of the total emissions produced on the Earth. Reduction in fuel consumption to save the precious oil is a necessity, but there are no valid arguments to prove that road transport is among the main guilty parties that contribute to the increase in GHG concentrations in the atmosphere. This statement can be best accounted for by the fact that annual deforestation caused double GHG emissions than road transport, amounting to one fifth of global emissions from fossil fuel consumption in the same period.

## Acknowledgement

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