

## DIRECTIONS FOR REDUCING THE EMISSION OF POLLUTANTS FROM MOTOR VEHICLES IN PRISTINE REGION

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### SUMMARY

*Together with development of the industry, there is present continuous increase of motor vehicles that contribute to the growth of the emission of pollutants. This is the main reason that during '80th of the last century, a special attentions has started to pay on pollution emissions from vehicles. It is important to note that most of the current emissions are formed directly present in urban areas and aim of this research was to determine the emission of pollutants in Prishtine area, when circulates more than 100,000 motor vehicles. Taking into consideration the daily traffic jam, and the fact that gasoline engines are responsible for most emissions of CO, while diesel engines for NO<sub>x</sub> emission, the conclusion arises that there is necessary a special dedication to the emission of pollutants and to define measures to reduce or control them.*

*Based on the performed tests and realistic assessment of the overall situation in Prishtine region, we can have a real situation on the amount of pollution in Prishtine, compared with development countries in the region we have used in our research. The results obtained, suggest us to the most important causes that increase pollutant emission from motor vehicles and offer actions to keep the same level or to reduce them.*

**Keywords:** ecology, urban environment, vehicle, etc.

### 1. INTRODUCTION

The first link between motor vehicles and pollution of human environment in urban areas is set at 50 years of last century when researchers come to the conclusion that transport was the main culprit for the sky filled with clouds of smoke over Los Angeles, California, USA. This conclusion is supported enough fact that industrial development after World War II has increased the total number of characteristic motor vehicles. The second factor, and probably most important in establishing the connection of motor vehicles and human environmental pollution is the source of energy for driven motor vehicles, respectively fuel. With continued growth in the number of motor vehicles, amounts of fuel consummation and number of passed kilometres emitted significant pollutants which are my most important: carbon monoxide CO, non burned hydrocarbons C<sub>x</sub>H<sub>y</sub>, volatile organic compounds not metal NMVOC, nitrogen oxides NO<sub>x</sub>, particle and carbon dioxide CO<sub>2</sub>. In Prishtinë the situation has changed after the last war in Kosova, except Kosovo's power plants have not the industries that will participate in environmental pollution in the Prishtinë region. Recently, pollution can be defined as motor vehicles, the city's heating system and power plants in Kosova. Bypassing power plants and heating system in this paper are presented results of

ecological review that defined the region of Prishtinë in 2009, and the possibility of reducing pollution in urban environments.

## 2. ANALYSIS OF THE EMISSION OF POLLUTANTS AS PER THE SOURCE AND THE CATEGORIES OF THE MOTOR VEHICLES

As per the creation of the pollutants in the atmosphere the division can be done in the transport sector, industry, fuel use for power generation, commercial use etc. .

According to the figure 1, that represents the analysis of the pollutants' component like CO, NO<sub>x</sub>, C<sub>x</sub>H<sub>y</sub> and CO<sub>2</sub> according to the source of creation, it is evident that transport sector is the main pollution source in the world with 89 % CO, 44% C<sub>x</sub>H<sub>y</sub>, 52% NO<sub>x</sub> and 29% CO<sub>2</sub> from the total emission of all the sources.

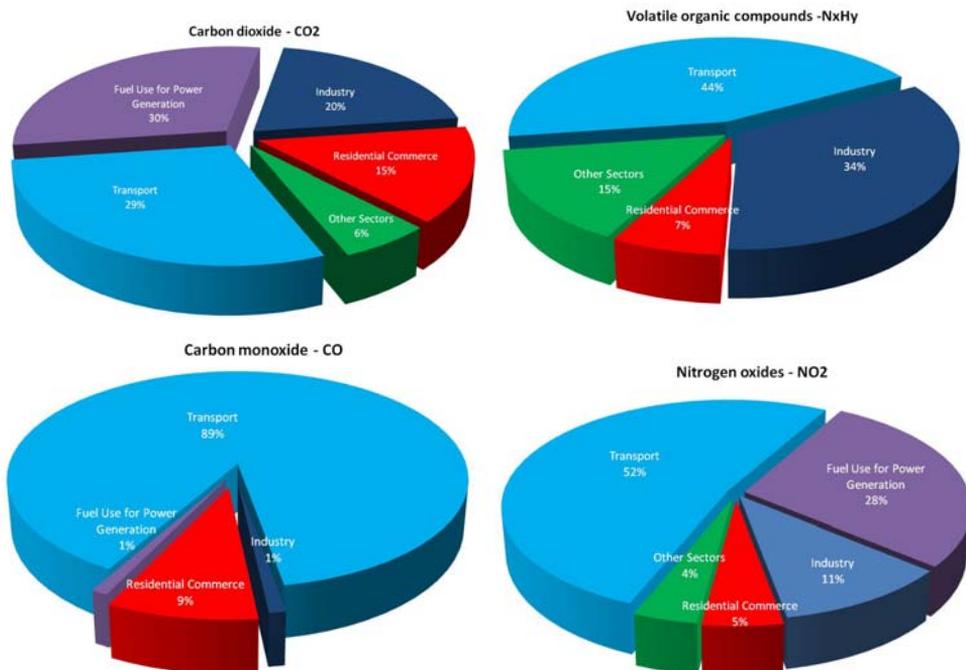


Figure 1. Analysis of the pollutants' component

Further breakdown of the transport sector according to the types of motor vehicles [3], shows that the use of the passengers' motor vehicles, firstly, in urban environment and short relations contributes the greatest deal of the emission of the pollutants' components CO (91%), C<sub>x</sub>H<sub>y</sub> (77%), NO<sub>x</sub> (42%) and CO<sub>2</sub> (53%), whereas motor vehicles for transport take the biggest part in emission of NO<sub>x</sub> (57%), CO<sub>2</sub> (5.5%), C<sub>x</sub>H<sub>y</sub> (9%) and CO (34%). Remaining emission falls with motorcycles (CO – 3.5%, C<sub>x</sub>H<sub>y</sub> – 14%, NO<sub>x</sub> – 1% and CO<sub>2</sub> – 3%) as a category of the motor vehicles that is being used a lot recently and a category that is paid less attention so far.

## 3. INDICATORS TO ESTIMATE EMISSION OF POLLUTION MATERIALS - IN THE FUTURE

Motor vehicle represents the most used machine for individual transport, goods for general consumption, special deliveries etc. due to its flexibility. [1] shows how much the motor vehicles are famous telling the increase of the number of registered motor vehicles in Europe from 1990 to 2010 and projections for their increase until 2030. Whereas in 1990 there were

182.67 million registered motor vehicles, at the end of the 2000 the increase of the number of the registered vehicles reached 226.869 million. This fast increase of the registered motor vehicles is expected due to overall fast industrialization of the economically under-developed. With the urbanization and geographical extension of the residing spaces in Europe, then improvement of the infrastructure and development of the economy, motor vehicles with its flexibility takes first place in the total transport sector among means for transporting of passengers and goods (with 70% of the total performed transport).

Whereas in the past it was noticed the highest rate of increase of motor vehicles in the countries with highest economic growth (North America and Western Europe), in the future it is expected a huge increase of motor vehicles in the countries that are not OECD members, forecasting that almost 50% of the total number of the motor vehicles will be registered in those countries. Total average increase of motor vehicles is foreseen to be 3%.

This increase of motor vehicles in every aspect will contribute to the evident increase in emission of the pollutant components. Researches done by OECD by MOVE project (Motor Vehicle Emissions) verify the possibility of reaching positive aspects from emission aspect of pollutant components from the external gases of motor vehicles with the help of two scenarios of which one foresees application of harsher measures and more extensive control of emission of pollutants and measures that will fall until the decrease of consumption of fuel from fossils. Second scenario is based in the control and before all in reducing of increase of transport by 3% in real value that can be realised by 2%.

#### **4. SITUATION IN THE PRISHTINË REGION AND IN THE REPUBLIC OF KOSOVA**

The republic of Kosova as a new country still does not have the entire institutions organized which can uniquely would monitor all the issues regarding the transport that is being developed by road transport, in principle it is thought in emission of pollutants' components in the country level. According to the data maintained until 2009, the number of registered vehicles in Republic of Kosova was 380552. In figure 2b, it is shown the percentage of participation of vehicles in Prishtina regions to the total number of vehicles in 2009. In figure 2c and 2d, shown the age and average age of vehicles in Prishtinë region according to the vehicles' categories.

Figure 2a shows that out of total number of the registered vehicles in Kosova in 2009, 31.18% of them were registered in Prishtinë region. This region has the biggest number of vehicles registered with newer that 5 years old and older than 15 years old that makes the Prishtinë region more representative for more detailed analysis than other regions.

According to the data, [7] in Prishtinë region, vehicles newer than 5 years old make 7.5% of the total number of the registered vehicles, whereas 77.36 % of the registered vehicles are older than 10 years. 66.82% of the vehicles are older than 15 years old from the total number of the registered vehicles.

From the total number of the registered vehicles 84% are passengers' vehicles, 13% are transporting vehicles and the rest are buses, motorcycles, tractors and other vehicles in this region.

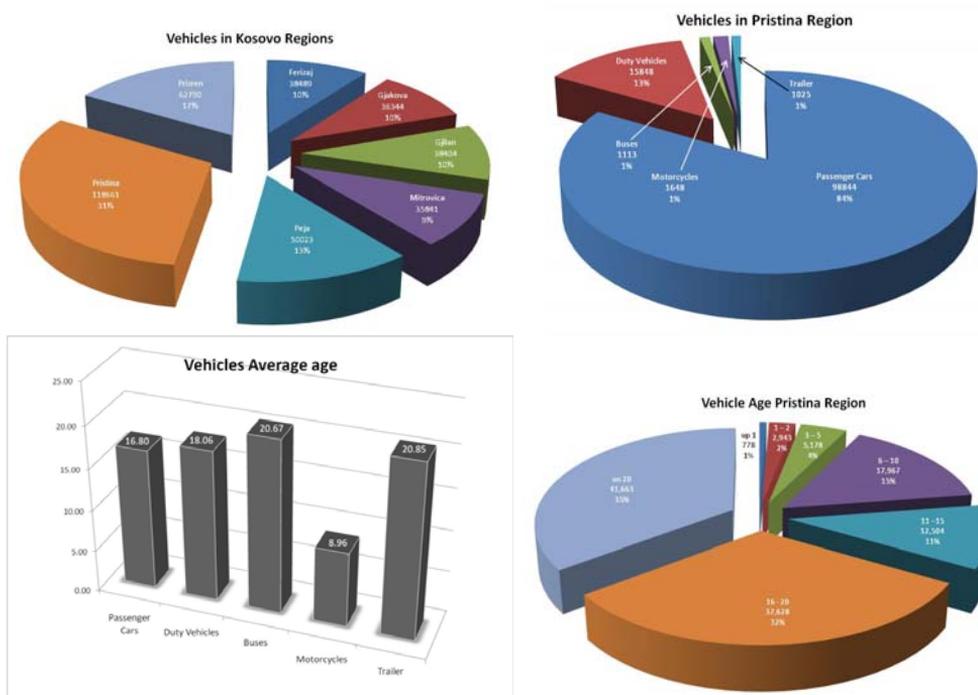


Figure 2. a) Vehicle in Kosovo Regions, b) Vehicles in Prishtina regions, c) Vehicle Average age in Prishtina regions, d) Vehicle age in Prishtina regions

## 5. CALCULATION OF EMISSION OF POLLUTION MATERIALS FROM EXTERNAL GASES IN PRISHTINË REGION

According to the analysis of the situation of the vehicles park for Prishtinë region as well as verification of value of the calculated results (with aim patterns), below there will be analyzed pollution materials using the calculating programme COPRET IV.

To perform calculation with COPERT IV, we need data for kilometres spent, type of road used, average speed as well as the total amount of the spent fuel. Due to non-existing of some of these data it has been done their estimation.

If the imported amount of the fuel is compared to that calculated, the difference with the programme is 3.6% that represents an acceptable value according to [8].

The cause for this difference can be non-existence of data for parallel registration of vehicles from Serbia in Kosova as well as the border problems in north Kosova.

Calculation is made for version 1 also where only the situation of the car park would change, other parameters remain the same in the calculating programme where cars with conventional gasoline and diesel up to EURO 1 have moved to EURO 2 (suppose that old vehicles were out of use and replaced with new imported ones in Kosova – 12911 passengers cars with gasoline with volume < 1400 before EURO 1 are replaced with 12911 cars EURO 2 with gasoline with volume < 1400, as well as 15686 diesel passengers' cars with volume < 2000 conventional are replaced with 15686 diesel passengers' cars with volume < 2000 with EURO 2).

## 6. COMPARING ANALYSIS OF EMISSION OF POLLUTION MATERIALS AND CO<sub>2</sub>

Definition of emission of special pollution materials from external gases of cars of road transport being released in the environment when we live would have been possible if we could compare the emission with the region countries and the countries where traditionally

there is high ecological awareness. Because of this, in this paper the comparison of coefficient of pollution materials from motor vehicles CO, C<sub>x</sub>H<sub>y</sub>, NO<sub>x</sub> and CO<sub>2</sub> as gases that influence sera effect is made with appropriate results from countries of the region as well as Europe OECD countries. Comparison data are taken from [1,5,6,7].

In order to compare coefficients of emission of special pollution materials from external gases of cars of road transport, there were compared results for Prishtinë region (initial situation and version 1), OECD countries – EU, Federation of Bosnia and Herzegovina for 2005 and Serbia for 2009. The comparison is made in the emitted amount of a car per one kilometre of road.

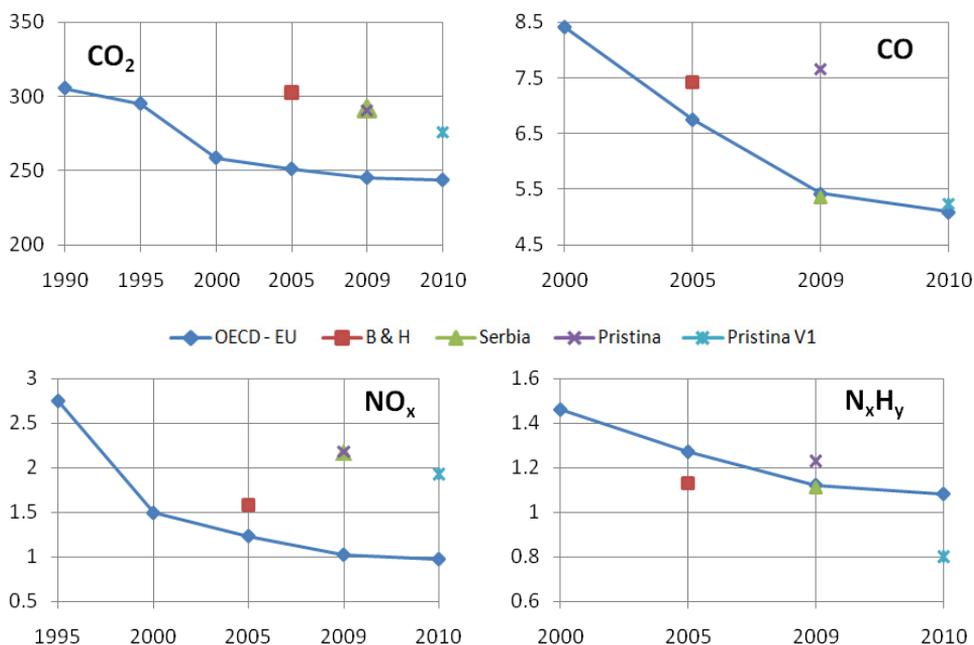


Figure 3. Compare coefficients of emission of special pollution materials from external gases

Emission of carbon dioxide (CO<sub>2</sub>) as the gas of the sera effect, even after the application of the renewal of the car park remains above the values of OECD – EU. The reason is the very old structure of the car park and the suspicious quality of the fuel. The situation of the carbon monoxide (CO) with the application of renewal car park is becoming closer to the values of OECD – EU. Emission of nitrogen sub oxide (NO<sub>x</sub>) even after the application of the renewal of the car park remains above the values of OECD – EU. Emission of hydrocarbons (C<sub>x</sub>H<sub>y</sub>) after application of renewal of car park is reduced under the values of OECD - EU

## 7. CONCLUSION

The problem of urban pollution from motor vehicles represents one of most important problems with whom taken the contemporary world. Given the geographical position of Prishtinë and set it near the Kosovo power plants, park vehicles on the average ages of 16 years, the pollution problem should be given significant attention. Analysis of pollution from motor vehicles in the Prishtinë region in 2009 has shown that the current level of pollution is the pollution level of the average of OECD countries - Europe before seven years. Recognizing the above facts are analyzed “renewing” of the vehicles park is shown in this paper. Besides “renewing” of the vehicle park the measures for reduction the emission of pollutants should be directed to: Increasing efficiency with alternative fuels consumption; use

of alternative fuels for vehicles which use in public transport and for passenger cars, by providing appropriate infrastructure, permanent monitoring of the emission of pollutants in characteristic urban environments of countries with the goal of defining regulatory measures, It is certain that only continued activities in all mentioned directions can be achieved desired results in controlling and reducing the emission of pollutants in urban environments.

## 8. REFERENCES

- [1] Motor vehicle pollution – reduction strategies beyond 2010, OECD, Paris 1995
- [2] Dr. sc. Bashkim Baxhaku, Dr. sc. Naser Lajqi, Mr. sc. Shpetim Lajqi, Ing. bach. Hajredin Tytyri: Possibility of reducing emissions of pollutants in urban areas, 1st International Scientific Conference on Engineering, "Manufacturing and Advanced Technologies" MAT 2010, Mostar Bosnia and Herzegovina, 18-20 November 2010
- [3] Dr. sc. Bashkim I. Baxhaku, Dr. sc. Naser B. Lajqi, Mr. sc. Shpetim B. Lajqi: Ecology and road transport in republic of kosova , 14th International Research/Expert Conference "Trends in the Development of Machinery and Associated Technology" TMT 2010, Mediterranean Cruise, 11-18 September 2010
- [4] Dr. sc. Bashkim Baxhaku, Dr. sc. Naser Lajqi, Dr. sc. Heset Cakolli, Mr. sc. Shpetim Lajqi: Influence of motor vehicle in pollutant emission in urban environments, 14th International Research/Expert Conference "Trends in the Development of Machinery and Associated Technology" TMT 2010, Mediterranean Cruise, 11-18 September 2010
- [5] Džeko M.: Modeliranje emisije zagađujućih materija u izduvnim gasovima cestovnih vozila u saobraćaju, Magistarski rad, Mašinski fakultet univerziteta u Sarajevu, 2008.
- [6] Univerzitet u Beogradu - Institut saobraćajnog fakulteta: Određivanje količina emitovanih gasovih zagađujućih materija poreklom od drumskog saobraćaja primenom copert IV modela evropske agencije za životnu sredinu, Beograd, oktobar 2010.
- [7] MS.c. Hajredin Tytyri -Modelimi i emisionit të materieve ndotëse nga gazrat dalës të automjetet motorike te komunikacionit rrugore, punimi Master, Prishtinë, prill 2011
- [8] Copert III - Computer programme to calculation emissions from road transport - User manual, EEA, November, 2000,