

STATE, DEVELOPMENT AND PERSPECTIVES OF USING LPG FOR MOTOR VEHICLES IN REPUBLIC OF SERBIA

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INTRODUCTION

Total technological development in automobile industry in recent decades is directed toward solving two major, global problems: protection of the environment and preservation of natural resources. To a large degree this is reflected on the road traffic, that is, industry of motor vehicles. Ecology, however, is not only about preserving the environment, but also about rational usage of energy. In that framework, attention is given to using alternative fuel sources (liquid petroleum, methane, biodiesel, hydrogen, alcohol). Today, there is a global ecological movement in existence. It propagates the trend of ecologically acceptable (“environmentally friendly”) vehicles in the world market.

Alternative fuels are a very current issue that keeps gaining more and more attention, mostly for two reasons. First is the knowledge that conventional fuels, fuels that are used the most for commercial and passenger vehicles, fall in the group of non-renewable natural resources, so in the near future their replacement with another fuel source should be considered. Second reason is of more ecological nature. Due to growing pollution of the planet and endangerment of people’s health, plant and animal life, more and more stringent ecological conditions are set, that a vehicle needs to fulfil in order to be able to participate in traffic. [1] [6]

From the environmental aspect, considerable negative influence of road transport is air pollution. Every litre of spent fossil fuel when burned produces approximately 100g of carbon monoxide (CO), 20g of volatile organic compounds, 30g of nitrogen oxide (NO_x), 2,5kg of carbon dioxide (CO₂) and many other harmful and poisonous matters such as lead compounds, sulphur and solid particles. All these compounds, to a certain extent, lead to air pollution, whether by direct effect on health or globally, by causing greenhouse effects.

Emissions of CO₂ in the world have increased by 45% between 1990 and 2010 and reached a record breaking 33 billion tons. Around 90% of global emissions of CO₂ comes from burning fossil fuels. The biggest increase was recorded in countries whose economies developed suddenly, such as China and India, but also in already developed countries. The biggest increase of CO₂ emissions was recorded in sector of manufacture and road traffic. In the sector of road traffic the increase of CO₂ emissions was recorded in developed countries and countries in development, with the exception of 2008, when the increase of fuel prices and recession caused the decrease of emissions. [4]

Recently conducted study about climate changes caused by emission of gases from the economy sector showed that the biggest emitter of greenhouse gasses and air polluting gasses is road traffic. [14]

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Experts, who are starting to work on energy efficiency in order to preserve and better use energy sources, are beginning to work on new projects that use alternative fuel sources and renewable energy sources [1]. Energy consumption is constantly growing. Prognoses indicate that in the following years, along with the further development of technologies and increase of population, the transport of people and goods will continue to grow. That will require more and more energy, that is, energy consumption will grow. According to some estimates by 2050, the needs for energy will more than double. Transport will use about 50% of the energy, mostly derived from oil [10]. According to that use of alternative fuel sources is more than justified, especially LPG as a fuel source for motor vehicles.

MOTOR VEHICLES AND LPG

LPG as fuel source for motor vehicles

First motor vehicle that used fuel in the form of a gas was constructed by a French engineer Etienne Lenoir in 1862 [8]. The vehicle used gas produced from coal, and the tank was located on the roof of the car or in the trailer. When a German engineer H. Blan managed to separate liquid gas (similar to LPG we use today) from petrol fumes, for the purpose of illuminating luxurious rail road cars, it was certain that liquid gas is an ideal fuel source for vehicles. During World War II, due to shortages of petrol, Germany recorded large consumption of LPG, to power trucks, busses and military vehicles. LPG in ex-Yugoslavia started to be used at the end of 1960, because of a price that was half of the price of petrol, and several years later due to shortages of petrol, when a state administration used driving system “odd-even”, limiting the sale of petrol and diesel by using coupons. [8]

The application of LPG in IC engines has a very long tradition. First IC engines used different kinds of gasses as fuel sources. LPG started to be used as fuel in 1912 in United States. Today, in United States, that is the third most often used fuel, right after petrol and diesel [3]. The number of vehicles that use LPG as a fuel source exceeds total number of vehicles that use other alternative fuel sources. LPG found its application in vehicles of all purposes and carrying capacity (busses, taxi vehicles, police cars, etc.)

Developed countries have been systematically working, for a long time, on massification of the LPG application as well power motor vehicles. In larger cities, with large volume of traffic, city busses and taxi vehicles use LPG. The longest tradition in that regard has Austria, where in Vienna almost all buses use LPG [3]. Buses that use LPG are the best recommendation and far cheaper solution with most favourable influence on the environment, regarding emission of harmful gasses. Today there are 13 million vehicles that use LPG in the world. [15]

Safety of vehicles that use LPG alternative fuel

Safety of using LPG on vehicles includes beliefs and prejudices that LPG is a very dangerous fuel. It is correct, that manipulation, distribution and storing of LPG are more risky in comparison to diesel and petrol. All that requires knowledge of basic characteristics about the mixture of propane and butane and strict application of safety measures. By applying those measures to their fullest extend the risk is removed, because the working pressure in the tank in normal conditions is slightly higher than the pressure in the boiler for hot water.

Tanks in vehicles are filled to 80% of full capacity, to leave room for expansion of fuel at higher temperatures [11]. All tanks that are installed in vehicles have a device (multi valve) that automatically stops refuelling. Vehicles that use LPG completely rely on this

device that reduces the leakage of fuel during refuelling to a minimum. Refuelling time of LPG and petrol tanks is approximately the same.

Tanks for LPG are made from stainless steel, thick about 3-4 millimeters and have a very rigid construction, so they basically represent additional reinforcement during impact. In that regard, LPG tanks are considerably safer compared to standard petrol tanks. Although the gas pressure in the tank is 10 bars, all tanks are tested to a pressure of 30 bars. LPG tanks in vehicles must have an appropriate plate that confirms that testing was performed. On the tank, there must be a safety valve that releases the gas outside of the vehicle, when the pressure in the tank exceeds allowed level. In case of a fire, when a LPG tank is being heated, there will be no explosion, because the gas will gradually flow out, unlike a petrol tank that easily explodes at higher temperatures, due to presence of petrol fumes. When a LPG tank is emptied, certain amount of gas always remains in the tank and that is why the tank valve needs to be closed, so that there is no air diffusion into the tank and explosion. LPG explosion is possible only at gas concentration of 2-9% of relative volume of the container, which is practically impossible to achieve in open space when the car is in motion [7]. It should be mentioned that explosive mixture of LPG and air can be created in small closed space, where cars that use this space are being parked (especially in underground garages). This danger is successfully removed with only two openings for natural ventilation in underground garages or by installing an electrical valve that will prevent the loss of gas when the engine is shut down.

Installation of LPG system should be used by professional and certified services. Requirements that LPG systems need to fulfill, from a standpoint of traffic safety, can be found in ECE Rulebook No.67/01 and ECE Rulebook No. 115. The exact name of ECE Rulebook no.67/01 is uniform regulations about homologation of specific equipment for motor vehicles that use LPG and vehicles equipped with specific equipment for LPG regarding the installation of that equipment. ECE Rulebook no.115 provides uniform regulations about homologation of specific LPG replaceable systems that are installed in vehicles that use LPG as fuel source.

Safety of vehicles that use LPG in Serbia

Correct installation and reliability of LPG equipment that is being installed in vehicles is very important. In Serbia, there is more and more repairshops (mostly relying on world famous manufacturers of equipment for LPG installations) that with their evident quality of installation considerably contribute to elevation of reliability of vehicles that use LPG as a fuel source.

Practice showed that in Serbia there is no recorded rupture of LPG tank. Several accidents, where there was fire, were caused by human error, with the idea to save space in the trunk, so the LPG tank was not installed, but instead an ordinary LPG tank that is used in households. Poorly secured tank bounced around in the trunk, damaged the pipes for LPG and led to fire.

Guided by numerous prejudices about how safe it is to drive a car that uses LPG, AMSS (Center for motor vehicles) conducted a test in real fire conditions. Two cars were tested—one that used petrol and one that use LPG. In the first part of the test, vehicle with classic petrol engine was set on fire, with little over half a tank of petrol. The vehicle was set on fire simultaneously in several places and already after 5 minutes the flame started to engulf the interior of the vehicle, glass windows started to break, and paint melted. When the fire reached the back part of the vehicle, a faint pop was heard, because the pressure grew in the tank, due to rising temperature, and was released, and the fire continued to expand. That means, if the vehicle is fully functional, there is no danger from explosion.

Statistics show that there is a greater chance of explosion when the tank is emptier (a third or less), that is, when there is more air in it. Complete car burned down in less than 20 minutes. Second part of the test was setting a fire on the car with LPG, which had a completely new LPG device with complete installation, installed in the trunk, in accordance with current regulations and the tank was filled with 25 liter of gas. As in previous case, the fire was set simultaneously at several places, but mostly in the engine and passenger compartment. After only 5 minutes, sensor that were located 3 meter recorded a temperature over 105 degrees Celsius, and only after 8 minutes over 250 degrees. The next moment a huge flame appeared from the vehicle because the LPG started to burn and the gas was being released through a safety valve on the tank. Without this valve there would be an explosion, and this modern LPG device reduces the consequences, even in the case of fire. [5] [16]

If the car is functional and if the device is properly and professionally installed, even in the case of a major fire, there is no danger of explosion. The conclusion is that driving on LPG is equally safe as driving on petrol. In this case it was obvious that LPG tank did not rupture even in the case of fire. Only condition for a safe car that uses LPG is proper installation of LPG device with quality equipment elements. [2]

STATE IN SERBIA, DEVELOPMENT AND PERSPECTIVES OF USING LPG

Vehicles that use alternative fuel sources are extremely suitable for urban environments, where the pollution of man's environment is greatest. These fuels are extremely well suited for city transportation, for powering agricultural machinery, city service vehicles, delivery vehicles, ambulance vehicles, taxi vehicles, indoor transport vehicles (for example, fork lifter), working vehicles (for example, loaders) and vehicles that are used for tourist purposes. Currently, poor economic cost effectiveness of using alternative fuels in road traffic in Serbia certainly plays an important part in its application. Regarding the criteria of cost effectiveness of using alternative fuels it should be pointed out that the fuel price, registration costs, taxes and other obligations that user of vehicle needs to pay come from global and fiscal politics of a country, especially from traffic development and energy politics. That means that the prices of alternative fuels, apart from manufacturing price, are also influenced directly by government with its decisions and measures. In this way the usage of one fuel is increased at the expense of another. The consumption of a fuel for which the government has the greatest interest, whose reserves are greatest and which does not pollute the environment can be supported.

It is very likely that in the following years three types of LPG will be present as alternative fuels in road traffic in Serbia: LPG-mostly from import, compressed natural gas (CNG)-mostly from import as a world trend, and biodiesel-manufactured from raw materials found in Serbia (in the future).

Today, in technologically developed countries of the world, LPG has the most mass use out of all alternative fuels along with considerable increase of CNG. All in all, population and economy of Serbia are not sufficiently familiarized with alternative fuels, they don't recognize the advantage of their use and there are no larger initiatives for expanding the awareness about positive effects of their manufacture and application.

The use of LPG in Republic of Serbia, as fuel source, started in the late sixties of the previous century. Back then the lack of LPG stations in the form they exist today, dictated the primitive way of pumping LPG from household tank, without fulfillment of basic safety measures. In the promotion of LPG and its mass use in the early eighties of the 20th century in Serbia, an important role was played by introduction of petrol coupons, so the LPG became a popular and acceptable fuel source, representing an alternative to other

expensive energy sources. In Republic of Serbia today, LPG as a fuel source is gaining more and more users, which is also a result of relatively satisfactory network of LPG refueling stations.

Consumption of LPG in Republic of Serbia

In Republic of Serbia in 2004, 10.000 vehicles that used LPG were registered [13]. In only 5 years their number increased by 26 times, and according to data from [12], the number of registered vehicles that use LPG was 262.954, and in 2010 it continued to grow and was 302.090. Consumption of LPG in 2010 in Republic of Serbia is displayed in Table 1, by sectors. The biggest percentage of LPG is used in the area of traffic (81%), then in industrial sector (9%) and in the third place are household (7%).

Table 1 Energy balance of consumption of LPG in energetic purposes in 2010 in RS [13]

Sector	Amount (tons)	Amount (%)
Industry	31382	9
Construction	157	0
Traffic	298045	81
Households	27117	7
Agriculture	2439	1
Other	6410	2

Demand for LPG in the sector of road traffic continues to grow each year. In 2011, it is estimated that the consumption of LPG was over 400.000 tons (National LPG association). According to data from [13], the consumption of LPG in Republic of Serbia, in the road traffic sector, for the period from 2007 to 2010, is shown in the Table 2. In 2010 a drop in consumption is recorded, for about 50.000 tons in comparison to 2009, but the estimated consumption in 2011 was about 100.000 higher compared to 2010.

Table 2 Consumption of LPG in traffic sector in Republic of Serbia [13]

Year	2007.	2008.	2009.	2010.	2011.*
Amount (tons)	247.508	300.925	347.856	298.045	400.000

The consumption of LPG is influenced by many factors, of which the most important are:

- The number of registered vehicles.
- Structure of vehicle fleet (the number of converted cars and the consumption of LPG)
- Price of LPG as a fuel source.
- Number of LPG refueling stations
- Awareness of the government and citizens about LPG as an ecologically cleaner fuel.
- The influence of the state on the promotion-use of LPG, by lowering of taxes and providing some form of benefits during regular annual vehicle registration.
- Conditions for procuring LPG device-possibility by credit.
- Removing eventual fear with potential users of LPG.

Number of registered vehicles

In Republic of Serbia, in 2010 1.565.550 passenger vehicles were registered, and in 2011 7.2% more, that is, 1.677.510 passenger vehicles [13]. According to information from RZS, the number of residents in Republic of Serbia in 2011 was 7.276.195. That means that in average 4 people go to one car. For comparison with neighbouring countries that entered in the whole deal with car LPG device much earlier, than it is the case with our country, Table 3. shows statistical information for them.

Table 3 The number of vehicles to 1000 residents

Country	The number of vehicles to 1000 residents
Serbia	230
Croatia	352
Slovenia	518

According to census from 2011, Republic of Croatia had 4.290.612 residents, and according to information MUP of Croatia, then number of registered passenger cars is 1.511.045 [18]. According to these data in Croatia, 3 people came to one vehicle or 352 vehicles to 1000 residents. [19]

According to information of Statistical office of Republic of Slovenia, the number of registered vehicles in 2011 was 1.061.646. In comparison to the number of residents, there are 518 vehicles to 1000 residents, that is, in average one vehicle to 2 people. Slovenia, according to number of vehicles in relation to the number of residents, is at the first place, before Serbia and Croatia.

In Serbia, according to data from RZS, out of all registered car, there are most cars made by Zastava, Volkswagen, Opel, Ford, Fiat, Renault, Mercedes, Pegout and Skoda. In percentages, the number of new Punto Classic vehicles with factory installed LPG system in total number of sold vehicles in Serbia is shown in Table 4. Sudden increase of these cars with LPG is recorded in 2009, when every fifth sold car had LPG system.

Table 4 Sales of new Punto Classic vehicles with LPG in Republic of Serbia in the period of 2009-2011. [17]

Year	2009.	2010.	2011.
Percentage in total sale	2.32%	19.45%	12.30%

Structure of vehicle fleet

In the process of analysis of consumption of LPG and the number of converted cars to LPG, one needs to start from a total number of registered passenger cars on the territory of Republic of Serbia, which amounts to around 1.7 million. Less than 6% of total number of registered passenger cars still use LPG as a fuel source. However, this number is higher, because in Serbia there is still a considerable number of vehicles that are converted to LPG in unauthorized mechanic shops, and a great number of vehicles that do not get tested after the installation of LPG system.

The trend of increase of consumption of LPG on the market of Serbia is mostly caused by the use of LPG as fuel source for motor vehicles. In 2011, the consumption of

LPG in the road traffic sector was increased by 33% in comparison to 2010. Dominant group of LPG users, as a fuel source, consists of taxi drivers, from which majority have LPG device installed in their cars. In Belgrade, according to information from MUP, there were 6.435 registered taxi drivers in 2011. In Serbia, large number of official vehicles is converted to LPG, and those are: part of vehicle fleet of Coca Cola, Pepsi, Grand Kafa, police vehicles, driving school vehicles.

In Serbia, devices for conversion of vehicles to LPG mostly have Italian origin, fairly high price and good quality. They are manufactured for old carburettor vehicles and new vehicles. While in the world, only the newest, sequential systems are installed, here in Serbia LPG is still being installed in carburettor vehicles, due to the vehicle structure. Sequential injection of gas is a mandatory instalment system in all EURO 3 and EURO 4 engines, and in engines with plastic intake manifold, from earlier generations. The most famous Italian manufacturer of installations for LPG is OMVL, LOVATO, LANDI and TOMASSETO. Polish manufacturers of LPG devices are also present in the market of Serbia, such as G.Z.W.M, Dutch PRINS, but also considerably cheaper equipment that comes from Bulgaria and Turkey.

The price of LPG as fuel source

Demand for LPG grows each years, so the expected demand in 2011 was around 400.000 tons. Manufacture in Serbia is nowhere near enough to satisfy the needs of growing number of vehicles that use LPG. Oil Industry of Serbia (NIS) manufactures LPG in its refineries in Pancevo and Novi Sad, and refines natural gas in Elemir. Apart from NIS, there is also a company called "Standard gas" that manufactures and distributes LPG in Serbia, who has is manufacturing plant in Odjaci in Vojvodina. Since the manufacturing capabilities in our country are limited, consumption of LPG in our market if supplemented by import. Table 5 shows the import of LPG in Republic of Serbia, which in 2009 and 2010 exceeded 250.000 tons. [13]

Government of Republic of Serbia, in amendment of the Law on excise taxes in June of 2011, abolished excise taxes for LPG. That freed LPG from excise taxes, unlike all types of petrol whose excise taxes is 48.12 din/l and diesel fuel whose excise tax is 35.57 din/l. Thus the state influenced on additional reduction of LPG price in comparison to other traditional fuels. Current information about excise taxes is not known.

Table 5 Import of LPG in Republic of Serbia in the period of 2008.-2010 [13]

Year	2008.	2009.	2010.
Import of LPG (tons)	241.444	257.458	254.856

The price of LPG is considerably lower in comparison to petrol and diesel fuels. Most experts for oil in the world estimate that the price, with temporary small price cuts, will continue to grow. The same will happen with the price of oil derivates, which means that the petrol and diesel will be more expensive. If that really happens, it can be concluded that the future, due to ecological consciousness and price, will belong to gas fuels.

The number of LPG refuelling stations and their distribution

One of more important elements that influence the usage of LPG as a motor fuel is distribution of stations in Serbia where LPG can be bought. At every major refuelling station in Serbia, apart from conventional fuels there is also LPG. The quality and the price are not the same at each station. There are many stations in Serbia that sell LPG. Exact number of station is not known, but the estimate is that there are over 400. Apart from NIS refuelling

stations, there are a large number of private stations that sell LPG. NIS, as a domestic manufacturer of LPG, has six regional centers for LPG, which are located in Cacak, Elemir, Subotica, Nis, Novi Sad and Ovca. Table 6 shows the number of stations with LPG that are owned by Nis, AMSS and some private companies.

Table 6 The number of LPG stations in Republic of Serbia in 2012 in individual companies

Name of the station	Number of stations
NIS	87
“OMV”	61
“MOL”	31
“EKO”	44
“CryoGas”	8
“EuroPetrol”	15
“EuroLuxPetrol”	11
“Knez Petrol”	20
“AMSS”	9

Awareness of citizens and the state about LPG as an ecologically clean fuel

It is not likely that gaseous fuel will, in a sufficient extent, replace classic fuels without the support of the state. Gaseous fuels have numerous advantages over other types of fuel, above all, ecological suitability is most important for the state and that should be the first initiator for buying new vehicles that use LPG and converting used cars to use LPG.

Residents of Serbia does not have enough awareness about ecology, probably because of other long-term problems in the country, so the average consumer in Serbia takes into consideration the price of conversion and fuel price, when making the decision to take this step. If those facts are taken into consideration, a conclusion is reached that the state, aware of advantages that LPG brings, needs to adopt certain measures to make installation or gaseous fuels cheaper and thus make it sought after energy source. There several ways for the state to reduce the negative influence of traffic. One of those ways is a long-term plan of reduction of air pollution. It can be achieved by:

- Reducing the number of vehicles on the roads (for example, Belgrade, modelled after London, would have success using this politics, by limiting the access of vehicles to the center of the city)
- By reducing the emission of exhaust gasses from the vehicles, and that can be achieved in several ways: by improving the management of traffic flows; insisting on improving the state of vehicles; implementation of modern technologies for control of exhaust gases from vehicles; by supporting the population that uses clean fuels, such as LPG (an ideal solution from ecological and economic standpoint).

The use of LPG in the world rises with great speed, which is the best way to reduce air pollution. There is a huge potential for further development of LPG market in Serbia.

Influence of the state on improvement of LPG use through reduction of taxes and providing benefits

Increasing the use of LPG is possible to achieve if the state lowers taxes on vehicles that use LPG, provides benefits during regular registration of vehicles and similar. The problem comes down to the fact that the state first need to understand all these advantages of LPG, and then provide benefits to citizens that use LPG in their vehicles. The

state needs to offer incentives so that the vehicles of public transport convert to LPG, like other countries do, and that vehicle fleets of major companies start using LPG.

Giving benefits to vehicles that use LPG should be seen in:

- Reducing taxes on gaseous fuels;
- Reducing custom taxes on the import of devices for vehicle conversion;
- Reducing taxes and providing benefits during regular vehicle registration;
- Campaigns that will raise awareness about the influence of vehicle emissions on health;
- Removing eventual fear with potential users of LPG;

Conditions for procuring LPG device

Manufacturers, importers, distributors and servicemen should take the initiative for massification LPG use in Serbia. Their actions on the state and marketing campaigns should persuade a potential buyer of the advantages of this fuel. That can be achieved through reduction of LPG price (margin is lowered, but turnaround is increased and also popularity of the fuel), by buying new vehicles that run on LPG in instalments or by interest-free credits, by more favourable prices for installing and procuring devices for conversion of vehicles to LPG. The state should also take part in these measures. The price of the device and installation of LPG in the car ranges from 250€ to 1200€, depending on the vehicle and the manufacturer of LPG equipment.

Existing fear of users from using LPG

One of often asked questions of citizens is the safety of alternative fuels. Car that run on LPG have safety elements that a cars that runs on conventional fuels do not have, which makes them safer, but public is still afraid. World standard for LPG equipment, installation and using are very high.

Each aspect of LPG industry is under the influence of state standardization in accordance to world regulations. Modern systems for LPG are designed in such a way to be safe in everyday exploitation, maintenance and safe in case of a traffic accident. All LPG tanks are tested according to much stricter criteria compared to classic tanks. In case of a traffic accident, they can withstand enormous forces and impacts without any deformations and fuel leakage.

The most common reason against installing LPG device in the vehicle is the fear of the unknown and prejudices. The fear from possible fire of LPG system in the car is real and that is the most often reason against installing LPG in the vehicle. So far, the experience shows that such fear is not founded, in fact petrol fumes are more dangerous and the risk of spontaneous combustion is higher.

CONCLUSIONS

The possibilities of replacing petrol and diesel with alternative fuels are high. The choice of most favorable alternatives is not simple. It depends on the number of facts, such as world reserves, accessibility, influence of the fuel on the environment, safety of fuel use, modifications on vehicles and the influence on the performance of the car, systems for supplying the vehicle with fuel, and others. Because of that, there should be and legal and fiscal regulation, which by system of taxes and other incentives should influence the use of alternative fuel sources. Gaseous alternative fuels, above all, the LPG, is the most acceptable alternative fuel in our country for the following reasons:

- LPG as fuel source does not contain lead and emits less CO₂ (in comparison to petrol and diesel);
- Up to 50% saving in fuel costs;
- Engine works quieter and smoother;
- Life span of the engine is increased by about 30%;
- LPG device from one car can be transferred to another, under the condition that the cars have the same fuel supply system;
- There is no possibility of fuel leakage during refueling;
- Thanks to protection on multiple levels, the entire system is safe in comparison to forceful fuel unloading;
- LPG tanks, thanks to their constructive solution, quality of material and the way they are made and controlled, are far safer during impact from petrol tanks.

Apart from factors that influence the use of gaseous fuels in traffic, in order to intensify their use in our country, special attention needs to be directed to:

- Familiarizing all interested parties with the problem of securing energy sources for motor vehicles and reasons for application of alternative fuel sources;
- Determining global strategic orientation in order to define efficient energy and traffic politics, from a standpoint of fuel availability and environmental protection, and especially in order to gradually introduce LPG as a fuel source for motor vehicles.
- Wide familiarization of public with reasons and expected effects of using LPG, with safety properties of LPG and effects that are achieved in user and general level.

Consequences of traffic accidents of vehicles with LPG are the same as the consequences of traffic accidents of other vehicles, so this is one more indicator that vehicles with LPG are not less safe than vehicles that run on conventional fuels.

Activities for the protection of life environment, watched from the standpoint of emission of harmful ingredients of exhaust gasses, are seen in the intense development of engines with mandatory constant reduction of exhaust emission and fuel consumption [9]. With the increase of number of motor vehicles and with intensifying of road traffic the influence of exhaust gasses is increased on the environment.

Considering the average age of motor vehicles in Serbia, apart from applying stricter regulations, strategic and simulative state measures are needed, for purchasing modern vehicles that run on alternative fuels, whose use would influence the reduction of emission of exhaust gasses.

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