Automotive fuel as an environmental factor

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Abstract

This issue is based on certain claims and extremely alarming facts. First, the increase in production and transport of material goods is directly related to the development of society with the resulting greater consumption of energy sources that are becoming one of the very serious causes affecting the environment, especially regarding air, soil and water pollution. Second, the latest scientific research (carried out by drilling of the Antarctic ice) have proven that the concentrations of greenhouse gases—such as methane and carbon dioxide—are now higher than they have ever been during the last 440 thousand years. Third, in global world dimensions, apart from households, heating plants and thermal power plants, as well as industrial production – transport traffic (especially road vehicles propelled primarily by petrol and diesel fuel) represent the most significant polluters of the human environment considering the atmosphere. Fourth, the available relentless exact data and technical analyses thereof provide a realistic assumption that there will soon come a moment (sometime around the year 2010) when the world will start to feel the lack of the currently expensive oil which is the basis of modern civilisation and economic development. Fifth, respecting the ideas of scientists according to which the development and use of advanced technologies will result, sooner or later, in general catastrophe – it is only logical to conclude that the automotive industry and the use of automobiles certainly have their important share in the mentioned apocalypse. Within this context a question is raised: IS THERE A REASONABLE ALTERNATIVE?! Some of the possible answers are the topic of this paper.

Keywords: ecology, production and exploitation of automobiles, alternative sources of fuel, environment.

1 Introductory elaboration of the problem of environmental destruction

The past unusual and as yet still insufficiently studied phenomena such as:
• increase in emission, i.e. raising of the level of the so-called greenhouse gases in the Earth atmosphere;
• increase in the atmospheric temperature;
• warming of the world seas and oceans;
• melting of the icebergs and thinning of the sea ice;
• rising of the sea level;
• reduction of snow precipitation in high mountains;
• extremely dry periods and increased number of forest fires;
• increase in the quantity of precipitation and the so-called acid rains;
• frequent occurrences of catastrophic floods and hurricanes;
• disturbance of the established changes and the usual features of the seasons;
• changes in the habitats and species of flora and fauna and the so-called biological homogenization;
• spread of various malign diseases and epidemics, and
• occurrence of quite a high number (ca. 25 million) of the so-called ecological refugees, i.e. exiles in the world,

THESE ARE ONLY SOME OF THE SIGNS sent by our planet regarding the alarming warning against the evidenced advanced environmental problems that are direct consequence of the past unplanned and too self-interested world industrial and overall development. When speaking of human responsibility for the current ecological crisis started as early as the beginning of the 20th century namely, several basic reasons and factors are usually mentioned as the main causes. Topping the list is human LACK OF CONSCIENTIOUSNESS as well as various forms of PERSONAL AND COLLECTIVE EGOISM which are characterized by the fact that during their reshaping of nature, people thought only of themselves and advocated only the direct impact of the technical development of industrial revolution led by the inventions of the steam engine and the internal combustion engine using fossil fuels, not considering the series of negative side-effects (huge amounts of harmful gases, ashes, soot, unused raw materials and useless communal and technological waste) which mercilessly and almost irretrievably destroy the environmental system of the Earth exceeding the limits of its recovery, which may lead to global catastrophe, since acting in the (lack of) knowledge humans have created sources of potential dangers that may destroy the human race. The second important factor of increasing destruction and pollution of the human environment is FAST GROWTH OF THE NUMBER OF INHABITANTS, i.e. the world demographic explosion and its territorial distribution. Thus, at the beginning of the 20th century there were only 1.6 billion people on Earth, in 1960 there were 2.5 billion, and today there are almost 6.5 billion people. The fact is that more than 90 percent of the world population growth occurs in the poor, economically underdeveloped countries (the exception is only the USA), where there is the expansion of the so-called urban population that is soon to exceed the available, increasingly scarce resources (food, energy, water, air, ore findings, etc.) and cause unsustainable environmental pollution and collapse of the society. This is especially worrying if one takes into consideration the results of the existing demographic forecasts.
which say that by the mid 21st century (year 2050) there will be some nine billion-odd inhabitants living on this planet of ours. The same forecasts use the data that somewhat more than six billion people will live in conurbations (the majority in the so-called megapolises with ten and more million citizens) which means an almost 70-percent share of the urban population compared to the total forecast number of the world citizens. Understandably, the existing and (planned) demographic population density, due to increased consumption of energy and raw materials affect directly, among other things, the air, soil and water pollution, the depletion of the ozone layer and the greenhouse effect caused by uncontrolled emission of the combustion products. The third factor relevant for global environmental pollution belongs to the group of advanced AGROTECHNICAL AND AGROCHEMICAL METHODS IN AGRICULTURE regarding the use of artificial fertilizers and protective means (toxic pesticides) against pests and parasites on agricultural products. Thus, the fact is that the climate (as a collective condition of the atmosphere over a longer period in a certain area) represents a complex interactive system influenced by various extraterrestrial (solar radiation, Earth orbit) and terrestrial factors such as the presence of greenhouse gases in the atmosphere whose every change of concentration (condensation) necessarily results also in the change of climate. Therefore, most of the scientists agree that the greatest problem are the climatic changes caused by the air temperature increase as consequence of global warming of the atmosphere due to the greenhouse effect caused primarily by the emission of exhaust gases in urban centres and industrial zones as result of the combustion of fossil fuels (coal, oil, gas) mainly in the manufacture of electricity in industry, households and exploitation of transport means.

2 Role and significance of automotive industry in causing environmental damage

Respecting the basic reasons of climatic changes, i.e. increase in the average air temperature on Earth's surface as consequence of undesirable concentration, mainly of atmospheric carbon dioxide (CO₂) – the automotive industry, although not without certain resistance, has accepted its share in the responsibility for the increased care of the people for their environment. The results, namely, of the past research in the world have undoubtedly shown that there has been significant deterioration of the ecological balance due to the exploitation of (traffic) transport means among which the road motor vehicles (mainly passenger cars) occupy the leading position. The basic reason for such a situation is the past unstoppable invasion (four times greater world growth rate in the number of cars than the global population growth) and the current overall distribution of cars and other similar vehicles during the total "automobilisation" of the modern world in which more than 50 million cars are produced annually, and almost 700 million are used every day (about 220 million in Europe) of various motor vehicles propelled mainly by petrol and diesel fuel. Logically, such a noticeable motor pool is a big consumer of classical propulsion energy which affects differently air pollution. In other words, the amount and quality of
the gaseous exhaust air polluters is a variable product whose level of influence during a certain period depends mostly on the amount and structure of the motor pool regarding the vehicle categories and the type of their propulsion aggregate, then on exploitation conditions (driving method and style) and on the age and roadworthiness of vehicles, as well as on the meteorological condition of the environment. Each of the mentioned forms of air pollution deriving from automotive traffic requires certainly also appropriate obligatory measures of prevention and protection whose concrete realisation, more or less, does not depend only on the available financial means and the current level of technology development in general – but, unfortunately, also on the influence of the interested groups (lobbies) and politics. Besides, the mentioned measures regarding automotive industry can be generally classified into four basic groups:
1. LEGISLATIVE – LEGAL (legislative provisions, norms, bans, restrictions, standards);
2. ORGANIZATIONAL – REGULATORY (cadastre of the polluters, integral information system, so-called green traffic-light, etc.)
3. TECHNICAL – TECHNOLOGICAL (construction and design of vehicles, engine performance, type and quality of fuel), and
4. EDUCATIONAL (improvement of driving skills and habits, information on proper maintenance and servicing of vehicles, public discussions).

The listed measures of prevention and protection regarding environmental devastation by air pollution have become part of our everyday lives for the profitable competitive world automotive industry in which each manufacturer is trying to maximally meet the requirements and the desires of the today's stratified market.

2.1 Interaction of automotive industry and ecology regarding energy efficiency

If legal measures are excluded (kind of environmental taxes based on the "polluter pays" principle), and the non-popular measures of interventions into the fuel retail price, and regarding today's level of the technological development of automotive industry (as well as its complementary economic activities) – its impact on the Earth's environmental system affected by air pollution can be analysed in three basic causal areas:
1. production of small light urban vehicles propelled by advanced economical limited-batch conventional SUS engines using ecological classical fuel;
2. implementation of design modifications in the domain of technical novelties (innovations) on single elements and/or assemblies of vehicles propelled by classical aggregates, and
3. research and implementation of ecological alternative sources of energy for conventional engine propulsion.

Each of the mentioned areas, regardless of its efficiency, individually does not mean at the same time the final optimal solution, so that they need to be inter-combined in order to achieve major effects.
In the area of series production, offering affordable prices and safety, of small (but spacious), light and economical urban vehicles, propelled by modern economical low-batch conventional SUS system using ecological fuel (unleaded petrol and low sulphur content diesel), it is almost impossible to find any major world manufacturer that has not included in its manufacturing range at least one original concrete product (apart from the concept study prototype) of an automobile from the spectrum of the so-called urban models that are characterized by new attractive designer solutions and the application of extruded composite materials and innovative technical solutions regarding the construction of chassis elements and assemblies, as well as the engine. Thus, almost all the leading, but also those less known, world manufacturers of automobiles, offer certain high-quality models of versatile little cars propelled mainly by Ecotec economical engines of innovative so-called Twinport and Common-rail technologies of direct fuel injection with obligatory fitting with various catalytic converters and filters for the soot, dust and smoke particles. In this group of small cars includes also several European attractive models (CHATENET – Media; AIXAM – 500; CASALINI – Ydea, CMC – Gipsy) with very low-fuel-consumption engines (3 - 5 lit/100 km) that represent a compromise between an automobile and a scooter, and are intended in certain European countries for legal driving by inexperienced young drivers already at the age of 15+.

In the implementation area of the design modifications in the domain of technical innovations crucial for the reduction of fuel consumption in SUS engines, today’s advantages of the world automotive industry can be evaluated by a range of patents and modifications that through their limited scope improve the exploitation characteristics of the standard automobile as polymer technical product. Apart from the solutions mentioned in the previous area of activities, the improvements of automobile design and the engine performances regarding environmental requirements and directives are, among other things, reflected in the following practical solutions:

- gasification of automobiles by converting engines to gas propulsion;
- installation of a magnetic fuel activator;
- insulation of the water-cooled engine block using polyurethane foam;
- installation of innovative drive system ECODRIVER (Energy Conversion and Driveline Efficient Reengineering);
- installation of computer-controlled ERGOJET system for management and coordination of basic engine parameters and automatic transmission ECU (Electronic Control Unit);
- application of VALVETRONIC technology of valve control in the cylinder head;
- application of TWIN SPARK configuration – twin design with two spark plugs per engine cylinder with staged, time-separated ignition of fuel/air mixture;
- installation of HYDRONIC engine pre-heater to facilitate ignition;
- installation of the so-called vibrating electromagnetic gas pedal;
installation of the so-called LAMBDA SENSOR for improved control of the engine operation and regulation of the pressure injection process on the turbocharger,

installation of the so-called FAP system, that is, self-cleaning silicon – carbide filter for removal of solid particles from diesel engine exhausts;

installation of computerized so-called TWIN-TURBO system of air charging in the diesel engine by using two serially acting turbines;

installation of seven-staged software-controlled automobile transmission 7G-TRONIC which chooses the optimal stage by continuous change in the transmission ratio;

application of PCR-3 injector of a new generation which uses piezoelectric effect for diesel fuel injection;

replacement of the control servo-device by a much simpler and environmentally friendlier variable ELECTRICAL servo instrument;

application of alternative, environmentally less harmful gases (primarily CO₂) as working medium in automobile air-conditioning systems instead of that previously used;

application of efficient SVC (Saab Variable Compression) concept of unique revolutionary two-part flexible engine with variable compression ratio between them;

use (optionally in combination with a tyre air pressure control display) of the so-called GREEN (ecological) car tyres with the tread made of materials of special chemical composition that reduces the rolling friction;

design of serial automobiles of specific aerodynamic forms and the use of aerodynamic wheels (felly) which when moving generate low resistance and lift, i.e. which achieve minimum aerodynamic coefficient;

installation of ECOMATIC instrument (semi-automatic transmission with automatic coupling) for automatic engine stall during standstill at light-controlled intersections.

In the area of research and application of alternative energy sources for conventional engine propulsion today’s world automobile and oil companies turn more and more toward nature, offering “green car” models propelled by ecological energy whose development is oriented to intensive work on the so-called secondary fuel types as well as electrical energy (i.e. autonomous electro-drive) emitted from various sources. Currently, regarding the propulsion of ecological transport means by using energy from renewable alternative sources, the following concepts and feasible modalities are being developed and concretely used more or less commercially:

- compressed natural gas and liquefied petroleum gas (propane-butanec)
- compressed biogas
- biodiesel (vegetable oil),
- synthetic diesel,
• methyl and ethyl alcohol (methanol and ethanol),
• liquefied nitrogen,
• emulsion of diesel fuel and natural water,
• hybrid propulsion (usual combination of thermal SUS and electrical engine),
• hydrogen propulsion,
• compressed air propulsion,
• innovative steam propulsion, and
• electrical propulsion (electrical power from various sources),
  o classical lead battery,
  o sodium nickel chloride super battery,
  o solar cell,
  o fuel cell (member) using compressed hydrogen.

Every mentioned concept and/or feasible modality of energy from renewable alternative sources is characterised by various autonomous technological and exploitation features.

2.2 Concluding considerations

Respecting the doctrine of the initial orientation of the humankind according to which it is more important to eliminate causes than to remedy the consequences of a certain phenomenon – let us hope that the oncoming years will be characterized by strong environmental awareness and promotion that will result in big ecological revolution, among other things, also in the automotive industry regarding substantial gradual phase-out (all the way to elimination) of the harmful exhaust gases emission from the engines into the atmosphere. It happens, namely, that in the world of sheer necessity for sustainable development and our responsibility towards ourselves and future generations, the risk of climatic changes initiates far-reaching, fast and efficient measures of environmental protection, primarily in the sphere of industrial economy, households, and transport, but also in other spheres of human activities. This has made and forced the governments of the great majority of countries in the world (primarily the USA, that is California, followed by the European and other countries) to accept various laws and other acts restricting the emission of harmful gases in order to make the manufacturers produce in compliance with the new environmental requirements. Regarding automotive industry, its manufacture is subjected first of all to standards that have been determined for all the vehicle categories, regardless of whether these are petrol, diesel, cargo or passenger vehicles. Also, the deadlines have also been strictly determined for the introduction of new, in principle much stricter standard that has to be complied with by the newly manufactured vehicles if these are to be marketed worldwide. The mentioned processes of automotive industry operation regarding the reduction of pollution are optimistic indicators of automotive and wider future.

Besides, there is a lot more in the play than just the Kyoto protocol declaration – these are the way of living that we have been used to and the future of the humankind.
References


