

## Transport, Telecommunications, Environment and Energy

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**Abstract:** *The presented study takes in consideration the environmental impacts of transportation, transportation and energy, transportation and alternative fuels, including the impact of the transportation in the Albanian Economy. The transportation sector is linked to environmental problems, because the transport activities have resulted in growing levels of motorization and congestion. And also transportation activities support increasing mobility demands for passengers and freight. This is ranging from urban areas to international trade. Environmental impact of transportation can fall within three categories: direct impacts, indirect impacts, cumulative impacts. The environmental impacts of transportation is relate to air quality, water quality, climate change, noise, biodiversity. Energy and the activities of transport are closely related to each other. Energy consumption has strong modal variations: land transportation, maritime transportation, air transportation. Fossil energy reserves are exhaustible. In this study are set out possible solutions to eliminate the negative effects of transport on the environment in Albania.*

**Keywords:** *transportation impacts, energy efficiency, alternative fuels*

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### 1. Introduction

Both transport and environment constitute key issues closely linked to each other. Transport is an activity which is constantly growing. Such a phenomenon is noticed not only in developed countries, but also in developing countries, such as Albania. In the last twenty years there has been noticed growth, in both passengers and merchandise transport. As a result of this, transport is going to be more and more closely related to environmental issues, as it is considered one of the most important factors on environment pollution toward gas emission.

The global concern in environmental issues is focused on its impact in the human life. Environment should be protected from all factors, which might hurt the balance nature-environment-man. Transport impact is one of these factors. Transport in Albania is chaotically developed, because of demographic change and growth of private economic activity. Environmental impact of transport can be divided into three categories:

- Direct impact, transport activity has immediate impact on the environment. In this case, the relationship between cause and consequence is obvious and evident.
- Indirect impact, in this case, transport has an indirect impact on environmental system. The relationship between cause and consequence is not immediate, but the impact on environment is greater than in the first case.
- Additional impacts are unpredictable effects caused by direct and indirect impacts. Additional impacts cause pollution of the ecosystem.

The complexity of this problem has led many contradictions in drafting of environmental policies in Albania. This occurs because transportation is a sector that often subsidized by the state, especially for setting up and maintaining the infrastructure. The problem becomes more difficult in case when the investor is at the same time the entrepreneur (may be the state that invests in infrastructure and maintain it) because there is a risk of not fulfilling this commitment. This may also lead to another controversy: the reconciliation of inefficient transport systems, but costs would be subsidized. Total environmental damage caused by the activity of transport, in general are not taken into account by the transport user. From administrative point of view, the entire road infrastructure system is administered by two authorities: 18.4% of the entire terrestrial network depends from the Ministry of Public Labor and Transport and is managed by the General Roads

Directory. The other share of 81.6% is managed by the local authority. Lack of real fees on transport impacts, may have impact on numerous environmental issues.

The relationship between transport and environment is multidimensional. Some factors are still unknown but new findings may lead to drastic changes on European environmental policies, which, surely will also be reflected on the way Albanian environmental policies could be carried out.

## 2. Transport Impact on Environment

Environmental impact of transport is related to climate change, air quality, water and land quality, noise, biodiversity and land use. Climate change; Transport industry releases in the atmosphere millions of gas tons every year. These include different kind of gases such as: monoxide carbon (CO), dioxide carbon (CO<sub>2</sub>), methane (CH<sub>4</sub>), azoth oxides (NO<sub>x</sub>), nitrogen oxide (N<sub>2</sub>O), chlorofluorocarbons (CFCs), per fluorocarbons (PFCs), tetra florid silicon (SF<sub>6</sub>), instable components of benzene (BTX), heavy metals (zinc, chrome, cuprum and cadmium), granular material in suspension and smut. Even though a continual debate on how much such elements can play a role on climate change and as anthropogenic factor exists. Some of these gases, especially azotes oxide participates having a notable role in ozone layer weakness (O<sub>3</sub>), which protects earth surface from ultraviolet rays.

Air quality, Vehicles, motorboats, train locomotives, airplanes are sources of pollution in gas ad crumbs form in suspension, which affect the quality of air directly influencing to the human health. Air pollution is directly linked to human diseases such as: cancer, cardiovascular, respiratory and neurologic diseases. The presence of monoxide carbon (CO) in blood circulating reduces the oxygen quantity in blood causing serious disturbs at human health. Azotes dioxide (NO<sub>2</sub>) emissions from transport activity bring to lungs malfunctioning influencing respiratory and immunity systems. Sulfur and azotes dioxide (SO<sub>2</sub>) and (NO<sub>x</sub>) emission in cold atmospheric layers, mixing in different kinds chemical and acid components brings the so-called acid rain. Such an acid has nocent effects on the environment especially at agricultural cultures. Visibility reducing by smog directly influence on human life quality. Crumbs emitting in dusty form by vehicle fuel has a direct impact in human and social lives such as eyes inflammatory, skinny irritation, respiratory and other allergic prophylaxis.

Water quality, Transport and circulation activity have a direct impact on hydrologic conditions. Fuels, chemical materials, or other chemical subsidiaries coming of transport engines such as vehicles, trains, airplanes, harbor terminals, may seriously pollute river waters, lakes, lagoons and seas. As naval request and needs in Albania are always increasing, naval pollution, emission has a direct and important impact on water quality in such issue. The main impact of water pollution caused by naval transport mainly comes from cleaning, rubbishes; oil, fuel or other chemical contaminants pouring into water. Cleaning means the process of harbor canals deepening dragging out sediments leading to harbor deepening itself, especially the harbor of Durres that is rather shallow on Adriatic Sea to satisfy request always increasing. Such an activity has double negative impacts on naval environment. They modify hydrology carrying out disturbs which can later influence on naval diversity. These polluted sediments and created disturbs brought by the cleaning process can also ask appropriate suitable techniques against pollution. Generated residues from naval vessel operations may cause serious environmental disturbs as they may contain high level of contamination being dangerous for human public as well for the naval ecosystem. Such kind of residues, which contain metal, plastic composition, can't be destroyed easily. They can't stay for a long time on the surface of the water and sea becoming a serious difficulty and obstacle for naval transport, ships, vessels and other maritime activities. Some maritime species have undergone to deep and fundamental changes to the ecosystem where they live, especially in maritime lagoons, which are deeply damaged especially because of oil, fuel and other contaminants, pollution etc.

Noises, Noises represent general irregular, chaotic sounds effect. Noises bring traumas for both body and hearing having a direct impact on life quality, because of its disturbing nature sound has in noise form. Long-term exposure on noise level higher than 75 dB brings serious hearing system damages and influence on human physical and psychological welfare. Noises coming from transport, moves, vehicle circulation such as cars circulation, harbor and airport operations have a direct impact on human life quality leading to an increase of cardiovascular diseases.

Land quality, Transport impact on terrestrial environment consists on earth pollution and erosion. As result of earth erosion especially on riverbanks, this one for private activities and on seaside we realize that this constitute a very dangerous nocent phenomenon. A great surface of fertile land is being used for roads, airports and other industrial plants construction. Earth pollution may be also caused by toxic material use, this one as transport and industrial material residue, fuel, oil, and other nocent material pouring, which may reach the lowest earth layers seriously contaminating underneath water layers. Dangerous chemical materials transport by via railway constitutes another peril and risk for the population.

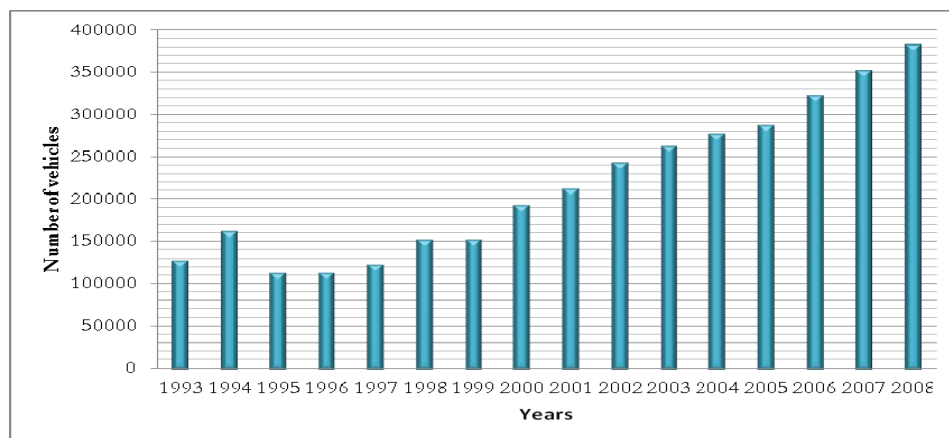
Biodiversity, Transport has also an impact on natural vegetation. The needs for new industrial plants building for industrial purpose have also increased the needs and requests for new virgin free land spaces to exploit. This has brought a massive deforestation phenomenon. Road infrastructure always asks for huge drained terrain to fulfill its needs, reducing fertile land surface. The needs to create new infrastructural spaces have led to massive fertile land surface disappearance. As result of such changes a great number of domestic and wild species are in peril and at the limit of their survival leading to huge biodiversity changes of their habitat. Land use, Transportation facilities have an impact on the urban landscape. The development of port and airport infrastructure is significant features of the urban and peri-urban built environment. Social and economic cohesion can be severed when new transport facilities such as elevated train and highway structures cut across an existing urban community. Arteries or transport terminals can define urban borders and produce segregation. Major transport facilities can affect the quality of urban life by creating physical barriers, increasing noise levels, generating odors, reducing urban aesthetic and affecting the built heritage.

### 2.1. Transport impact on air quality in Albania

Faster demographic growth has led to significant increase in the number of vehicles in circulation which, due to poor road infrastructure, may cause traffic overload. This affects the increase of environmental pollution.

Although Albania still has a number of vehicles in use 4-5 times lower than that of European countries, the traffic in Tirana is overloaded. The chart below shows the trend in growth of the number of vehicles in use in Albania.

**Figure 1.** The trend of the vehicles in use in Albania



Source: INSTAT, Albania

The monitoring of air quality aims to gather adequate data on air quality for some principal Albanian cities, which may help to ensure the necessary adequate scientific basis on developing policies and strategies on this field, objectives to be achieved, air quality evaluation comparing it to national and international data. In Tirana air samples were taken at 5 stations. The same was done in other main Albanian cities. All these samples have been regularly tested each month in Institute of Public Health laboratories. Monitored evidences have been based on European Environment Monitoring Agency and World Health Organization (OBSH).

**Table 1.** Average results for 2010

$\mu\text{g}/\text{m}^3$	LGS	PM10	SO <sub>2</sub>	NO <sub>2</sub>	O <sub>3</sub>	Pb
Tirana 1	283	136	21	35	93	0.27
Tirana 2	206	95	17	27	99	0.27
Tirana 3	145	63	14	26	97	0.22
Tirana 4	960	451	28	60	96	0.50
Tirana 5	235	111	18	30	104	0.32
Shkodra	231	120	11	28	98	0.31
Elbasan 1	260	179	23	30	94	0.26
Elbasan 2	384	101	44	51	88	0.39

Elbasan 3	200	93	15	18	99	0.24
Durres	207	96	16	23	99	0.34
Fier	215	74	20	24	103	0.28
Vlora	167	62	12	21	105	0.26
Korça	137		10	14	87	0.12
Albanian rates	140	70	60	60	120	1.0
Recommendation W.H.O.	80	50	50	40	110	0.50

**Source: Annual Reports Bulletin, Institute of Public Health, Albania**

According to the air monitoring, results that in the atmosphere of urban spaces in Albanian cities, the pollution level is very high. The main contributors of such emission are vehicle discharges, the construction of road infrastructure and different industrial activities. The most exposed areas to contamination, according to the indicators are:

- Areas around crossroads on the main cities
- Areas along the main road axis
- Areas in construction

### 2.2. Impact of transport on noises in Albania

In Albania, has been carried out the urban noise monitoring in several main cities. The capital is on the top of the list for its acoustic noise. Specialists have realized that the level of noise pollution has reached to fearful limits, bringing out negative consequences for the citizens. The main factors that influence to the noise level growth in Tirana are: the circulation of trucks with capacity more than 10 tons, their presence in problematic nodes slows down driving speed and in the same time increases the noise level about 30 %. The lack of car parking and the lack of secondary road network, which could contribute to facilitate the traffic, cause an overloaded traffic. In addition, the technical conditions of engines do not satisfy the asked and needed standards, which influence directly on noise rate emission. Urban noise monitoring has been carried out in several stations, in 5 main cities, covering a total population about 1 093 829 of inhabitants, composing over than 30 % of the Albanian population. These cities have over 60% of the total number of vehicles in circulation (INSTAT, Albania). The monitoring purpose is recognition of the level of noise pollution to judge the extent of population exposure to noise, in areas with heavy traffic and industrial center. Monitoring was concentrated in problematic areas of these cities, where the traffic was most dense and especially in rush-hours where the density is high.

**Table 2.** Noise average results for 2010

Monitored cities (areas with higher noise level)	Value during day (dB)	Values during night (dB)
Tirana	74	65
Durres	71	53
Fier	69	48
Shkodra	72	44
Vlora	71	43

**Source: Annual Report Bulletin, Ministry of Environment in Tirana, Albania**

It is necessary compiling a sustainable policy regarding impact of transport on noise emission, coming from traffic and especially from old vehicle circulation, concluding that use of public transport should be supported and encouraged to reduce such a high level of air and environmental pollution.

### 2.3. Albanian Transport and Economy

Transport is the main sector for the Albanian economy. Mobility is one of the most important elements in a modern society. Road transport has the main importance in Albanian economy, since railway transport system and network does not comply in time, because the technology is old, outdated, without the necessary infrastructure. The Maritime transport plays an important role in overall transport volume in Albania. This type of transportation faces the majority of exports and imports; while road transport plays an internal role. Recent years, the air transport service has found a wide use.

The Albanian economy is developing and increasing rapidly. As the result of this, transport activities (especially terrestrial and naval transport) are increasing with the same speed as Albanian economy. Growth of Vehicles number leads to inevitable pollution increase, which may seriously hurt human health. Pollution level emitted by vehicles, in Albania is beyond standards compared to European countries. The reasons for this high pollution level are:

- Most of the vehicles in use are old and not maintained.
- Over 80% of fuel in use is diesel
- Very poor oil quality in use
- The control of Gas emission is out of standards
- Streets are not well maintained

Road network system in Albania consists of approximately 18 300 km, 3636 km are national roads. 1000 km are urban roads, 3800 rural and 9960 km are not inventoried, most of them in the villages. Density of Road network gives a satisfactory rate, comparing to other neighbor countries, approximately 0,62 km/km<sup>2</sup>, but the amount of asphalted surfaces indicates lower parameters , because only 50% of national roads are asphalted comparing to 65% which are in neighbor countries (Ministry of Public Affair and Transport of Albania).

### 3. Research methodology

#### 3.1. Participants

105 citizens, 72.8% educated, 11.8% Mechanical Engineering, 5.2% Environmental Engineering, from different Albanian cities, were invited to participate in the study. The average age was 25.6 years ranging from 19 to 50 years old.

#### 3.2. Instrument

The instrument used in this study was the questionnaire. The Questionnaire commenced with a brief description of the purpose and objectives. Purpose of the questionnaire was perception of public sensitivity about the impact of transport on the environment. This issue is very important for Albanian citizens while they are aspiring EU integration. Objectives of the questionnaire were: assessing the impact of transport on the environment, finding the gaps that exist in this field and the possibility of choosing a strategy and an action plan on implementation of sustainable transport in Albania. Structure of the questionnaire was organized into three sections. In the first section was requested general information on participants. The second section consisted in determining the degree of use of public transport in Albania and the deficiencies that exist in this sector. The third section consisted in assessing public opinion on the impact of transport on the environment. Respondents are expected to indicate how much they agree with each item on a scale from one to five. Each number notes a certain measurement such as: (5) strongly agree, (4) agree, (3) undecided, (2) disagree, and (1) strongly disagree. A high score on the scale indicated a positive opinion and a low score on the scale indicated a negative opinion.

### 4. Findings and Discussion

#### 4.1. Development of transport in Albania

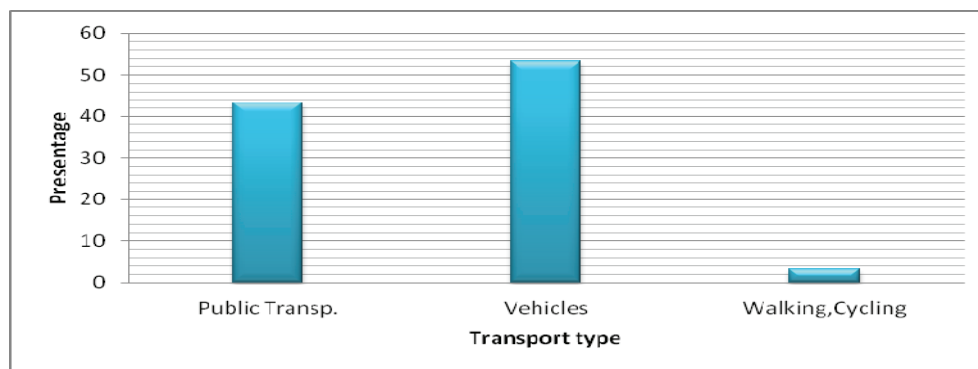


Figure 2. Use of different types of transport

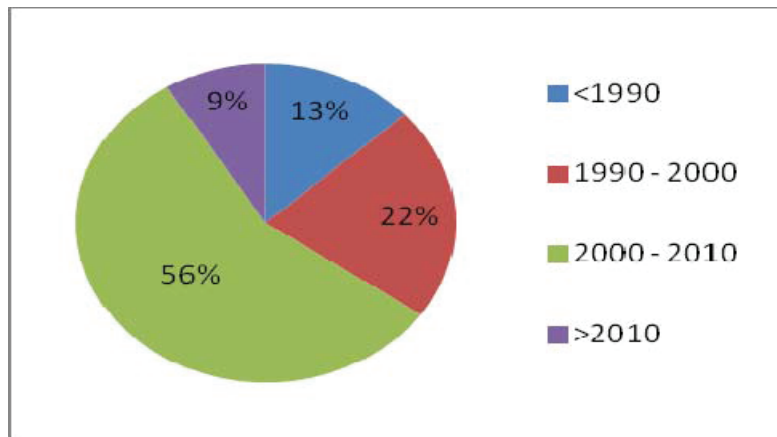


Figure 3. Percentage of car use by production year

Most of the transportation in Albania is done with individual machines. This is due to several key factors as:

- Lack of investment in rail network
- Not applicable bus schedules
- Lack of some bus stations
- Lack of road safety for walking or cycling
- Lack of public awareness

4.2. Transport and Energy Consumption

Although, every transport activity has specific consumption, the interaction between transport and energy consumption are direct. The transport activity takes approximately 25% of the world energy requests and more than 62% of the entire oil quantity used every year. Energy consumption has strong modal variations. Terrestrial transport calculates the highest level of energy consumption. Terrestrial transport spends 85% of the total energy. Meanwhile, the Albanian railway transport system spends the smallest energy quantity consumption because this sector is not yet at desirable European level, and it consists in passenger transport rather than in merchandise transport. Maritime transport constitutes 7% of the total transport energy consumption. In Albania, this transport activity is used for passenger and merchandise circulation. Aerial transport, although it does not occupy a specific position in transport, it needs a high rate of energy consumption (Official Journal of Albanian Republic).

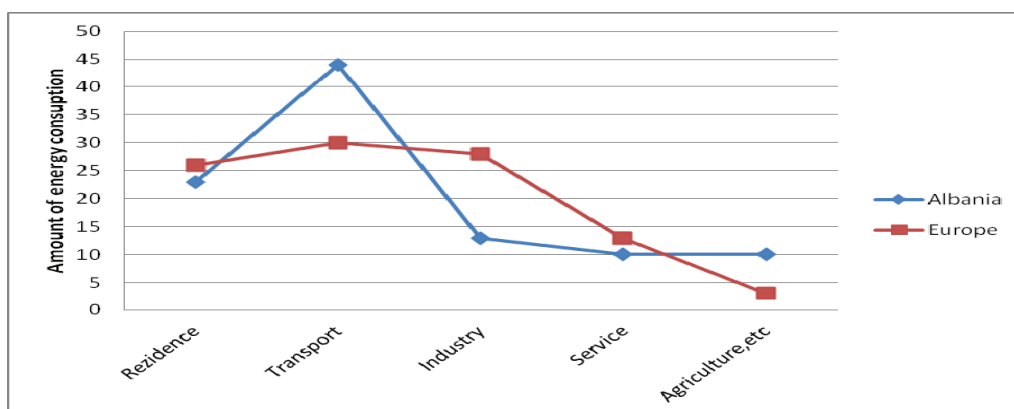
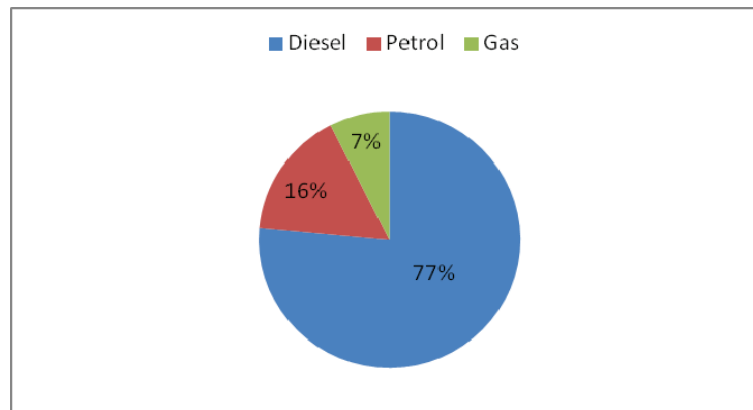


Figure 4. Amount of energy consumption for various sectors

Results of questionnaires indicate that diesel is used from 77% of the Citizens for their personal vehicles. In the figure below it is shown the usage of fuels in Albania for the transport sector.

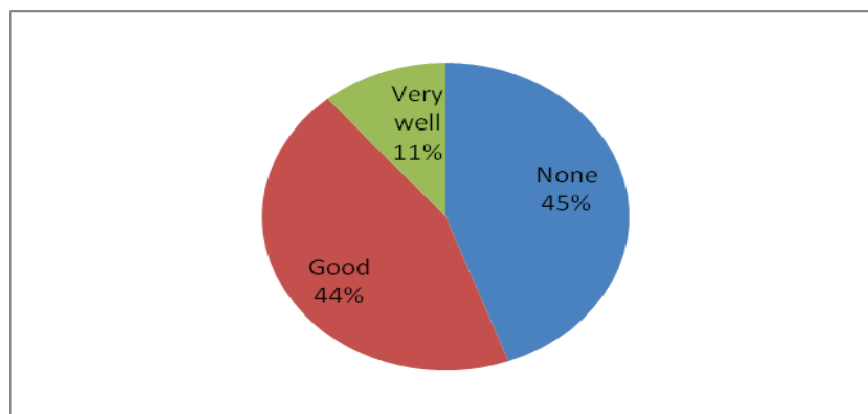




**Figure 4. Fuel use rates in Albania**

#### 4.3. Environmental issues and Renewable energy

Given that the transport activity needs big energy consumption, which is closely linked not only to economic markets but also to environment pollution; it would be useful considering other alternative energy sources and production to reduce environmental effects. Renewable fuels are always effective because of oil reduce, price growth, increased needs for environmental protection and gas emission restriction.



**Figure 5. Percentage of knowledge on environmental policies implemented in Albania**

To be considered are:

Biogas, such as ethanol, methanol and biodiesel can be produced from food crops fermentation (sugar cane, corn, cereals, etc) or wood-waste. Their production however requires large harvesting areas that may compete with other types of land use. Besides, it is estimated that one hectare of wheat produces less than 1,000 liters of transportation fuel per year which represents the amount of fuel consumed by one passenger car travelling 10,000 kilometers per year. This limit is related to the capacity of plants to absorb solar energy and transform it through photosynthesis. This low productivity of the biomass does not meet the energy needs of the transportation sector. In 2007, the US government proposed to reduce oil consumption by 20% by using ethanol. As the US is currently producing 26 billion liters of ethanol each year, this objective would require the production of nearly 115 billion liters of ethanol by 2017 which amounts to the total annual US maize production. Besides, the production of ethanol is an energy-intensive process. The production of 1 thermal unit of ethanol requires the combustion of 0,76 unit of coal, petroleum or natural gas. Biodiesel can also be obtained from a variety of crops. The choice of biomass fuel will largely depend on the sustainability and energy efficiency of the production process. Hydrogen is often mentioned as the energy source of the future. The steps in using hydrogen as a transportation fuel consist in: producing hydrogen by electrolysis of water or by extracting it from hydrocarbons; compressing or converting hydrogen into liquid form; storing it on-board a vehicle; and using fuel cell to generate electricity on demand from the hydrogen to propel a motor vehicle. Hydrogen fuel cells are two times more efficient than gasoline and generate near-zero pollutants. But hydrogen suffers from several problems. A lot of energy is wasted in the production, transfer and storage of hydrogen. Hydrogen manufacturing requires electricity production. Hydrogen-powered vehicles require 2-4 times more energy for operation than an electric car which does not make them cost-effective.

Besides, hydrogen has a very low energy density and requires very low temperature and very high pressure storage tank adding weight and volume to a vehicle. This suggests that liquid hydrogen fuel would be a better alternative for ship and aircraft propulsion.

Electricity is being considered as an alternative to petroleum fuels as an energy source. A pure battery electric vehicle is considered a more efficient alternative to hydrogen fuel propelled vehicle as there is no need to convert energy into electricity since the electricity stored in the battery can power the electric motor. An electric car is easier and cheaper to produce than a comparable fuel-cell vehicle. The main barriers to the development electric cars are the lack of storage systems capable of providing driving ranges and speed comparable to those of conventional vehicles. The low energy capacity of batteries makes the electric car less competitive than internal combustion engines using gasoline. An electric car has a maximum range of 100 kilometers and speed of less than 100 kph requiring 4-8 hours recharging. Yet, as technology improves, cost effective batteries will become available.

Hybrid vehicles consist on propulsion system using an internal combustion engine supplemented by an electric motor and batteries, which provides opportunities combining the efficiency of electricity with the long driving range of an internal combustion engine. A hybrid vehicle still uses liquid fuel as the main source of energy as the engine provides power to drive the vehicle or is used to charge the battery via a generator. Alternatively, the electricity generated by the battery can provide the propulsion. When the battery is discharged, the engine starts automatically without intervention from the driver. The generator can also be fed by using the braking energy to recharge the battery. Such a propulsion design greatly contributes to overall fuel efficiency. Given the inevitable oil depletion, the successful development and commercialization of hybrid vehicles appears on the medium term the most sustainable option to conventional gasoline engine powered vehicles.

Although these alternatives have zero effect on environment, they have not yet found adequate application. One of them has neither been yet applied in Albania, because our economy cannot face this challenge which needs high costs to produce.

## 5. Concluding remarks

Albania, being one of the countries aspiring to integrate into the European Union, has considerable potentials for developing a sustainable transport.

In the last ten years, the government has been invested mainly in road infrastructure. Increasing the contribution of public transport, development of logistics in transportation and public awareness has a significant impact on the environment protection. Albania's geographical position and its resources are an attraction for foreign investors in the production of renewable energy (solar energy, wind energy, water energy). European network connection to the pipeline will bring not only economic development but also development in the transport sector.

Several laws have been recently adopted on environment and air protecting. The National Action Plan on environmental issues proposes the Strategy and Action Plan for a Stable Transport. The objective is to develop stable transport practices and systems, which would integrate protective measures of environment and human health.

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