THE TRANSFORMATION EFFORTS IN THE CITY OF ATHENS (GREECE) TOWARDS ENVIRONMENTALLY FRIENDLY TRANSPORTATION

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INTRODUCTION

Many years have passed since the construction of the first internal combustion engine. Dramatic change in the relevant technologies allows us today to have mass production of vehicles with motors of this kind. It also took years, however, to realize the degree of environmental pollution caused by the emissions of such vehicles. Gases such as carbon monoxide (CO), carbon dioxide (CO_2), nitrogen oxides (NOx) as well as microparticles, create a suffocating environment, especially in densely populated urban areas. Smog, noise pollution and lack of oxygen only make the situation worse.

According to E.U. studies [1], 69% of CO, 24% of CO_2, 63% of NOx and 47% of Non Methane Volatile Organic Compounds (NMVOC) are caused by transport. (Figure 1), while at the same time 21% of the total emissions of the greenhouse gases (G.H.G.) in the year 2000 was from transport [2]. The consequences of such emissions are serious for the natural and built environment and above all for human health.

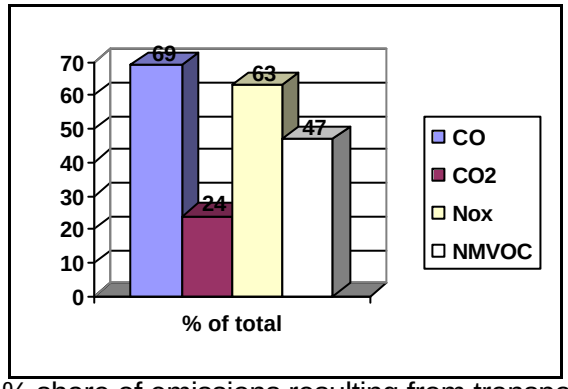

Figure 1. % share of emissions resulting from transportation [1].

However, the demand for reliable transport in urban centers, and therefore in Athens as well, is continually increasing. The need for the confrontation of these problems, in combination with the forthcoming Olympic Games, force the state to design the future substructure in order to satisfy the need of increasing transport with the minimum possible environmental impact.

Dealing with pollution caused by transport is a two-fold problem. It requires, at first, the use of better fuels and secondly the expansion of Mass Means of Transport (M.M.T.) of fixed tracks. Electrical energy and hydrogen seem to offer a future solution towards the first direction while huge steps have been made worldwide towards the second, especially in Europe and most recently in Athens (Metro – Tram – Electric Train – modernization of the existing railway net).

Numerous solutions have been presented by car industries for more environmentally friendly cars in global level. Some examples of such cars, beginning to be used, are electrically

powered cars, hydrogen powered cars and the so-called hybrid cars that use a combination of various forms of energy. However, their use is in a very early stage and thus cannot be relevant to the case of Athens.

Several positive steps have been made in the section of M.M.T. for example in the case of natural gas buses. Natural gas has obviously greatly benefited the Greek capital since it costs less and at the same time it is more environmentally friendly. Trolleys, which have been used in Athens for many years, are an alternative solution. Even though the fleet today is obsolete, some new vehicles have recently been bought.

REASON FOR THE INCREASED USE OF CARS AND CONSEQUENCES

The main reason for the dependence of the city inhabitants on private cars is the separation of residential zones from industrial and trade zones. The separation of activities requires increased use of cars, which means more energy consumption and consequently more environmental pollution. Technological development is also greatly responsible for the use of car. Its mass production has made it cheaper and thus more accessible while road and bridge construction works, the creation of more parking spaces and others, have encouraged the use of cars in everyday transport even more.

There are 4,5 million citizens in the wider area of Athens today who use a means of transport 7.000.000 times per day. There were 2.340.000 cars in Athens 2001 of the total of 5.170.000 in the entire country while 100.000 new cars are added annually in the Greek capital. [3]

It is thus easy to realize how problematic transport can be and that only a reliable system of M.M.T. can offer a solution to problems. Unfortunately, only a 31% of the total transport is covered by M.M.T. while the relevant percentage in other European countries ranges from 50 to 60 per cent. Figures 2 and 3 illustrate the above facts.

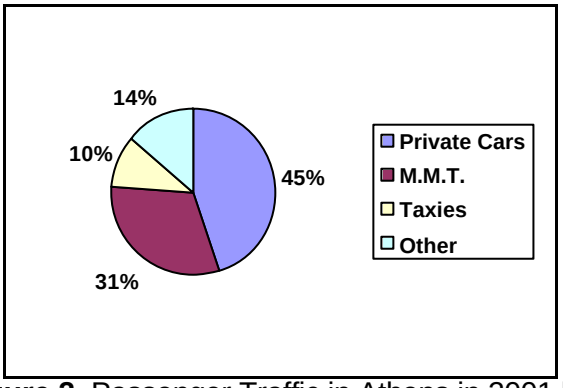

Figure 2. Passenger Traffic in Athens in 2001 [4].

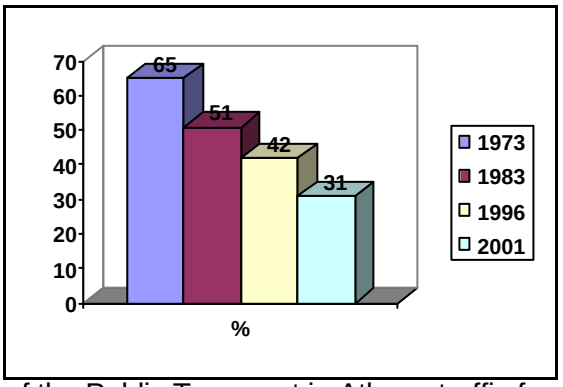

Figure 3. Share of the Public Transport in Athens traffic from 1973-2001 [4].

The most serious effect of the increased number of cars is undoubtedly pollution of the atmosphere and sound pollution. It has been estimated that cars produce half the amount of nitrogen oxides globally, more than half the amount of carbon monoxide and the biggest amount of lead. Furthermore, their great number causes an increase in the percentage of car accidents and traffic congestion. Therefore, the speed and comfort promised is only a utopia especially in the case of some city centers such as the Athenian.

In an attempt to reduce pollution, make cars more comfortable and tackle the problem of the exhaustion of energy resources, big car industries are working towards the construction of innovative ecological cars. Such technology has not yet been developed in Greece. The basic measures taken for the control of car emissions are the installation of catalytic converters and the enforcement of the Law that requires that each vehicle undergoes emission check once a year.

The above was put into action by the authorization of the article 3 of the Law 2052/92 and is included in the measures taken for the confrontation of smog in big urban centers. According to data it has greatly contributed to the reduction of exhaust -gases of cars. More specifically, it has been proved that cars that undergo the yearly emission check, emit less gases than those which are not [5].

THE PROBLEM OF AIR-POLLUTION IN ATHENS AND THE RESPONSIBILITY OF THE MEANS OF TRANSPORT

The fact that air-pollution is lethal is known since 1930 with the death of 60 people in Mez Belgium and the death (within two weeks) of 4000 people caused by smog in 1952 in London. That situation was confronted by a series of measures but since then, no serious attempt has been made. Characteristic is the statement of a Greek politician in Athens in the '70s: "Bring me a casualty of smog and we will take measures". The contemporary picture is quite different: smog is connected with cancer, heart diseases, asthma etc.

It has been unfortunately predicted in global level, that by 2010 there will be an increase of air-pollution caused by transport in a percentage of 45,8% in relation to 1990 and a 7,6% caused by households.

Table 1. Predicted evolution of emission of Greenhouse gases for the period 1990-2010 [6].

In Mt Equivalent to CO_2	*1990*	*Prediction for 2010*	*%? (1990-2010)*
Energy supply	1421,7	1276,6	-10,2
Industry	757,1	686,1	-9,4
Transport	753,1	1098,2	45,8
Households	447,5	440	-1,7
Private and Public Services	175,6	188,9	7,6
Agriculture	417	397,6	-4,7
Waste	6,4	137,3	-4,7
TOTAL	**4138,3**	**4224,8**	**2,1**

According to data given by the local branch of Greenpeace and the World Health Organization, deaths caused by smog in Greece have reached the 8.589. In addition, 24.000 deaths annually caused by smog have been estimated in Great Britain, 40.000 in France, Austria, Switzerland, 200.000 in Europe and 70.000 in the U.S.A.

In Athens, 4,5 million citizens are "packed" into an area of 544 square kilometers, 1,3 mil. households, 1,5 mil. shops and offices and above all 2,34 mil. cars, 1.500 buses, 16.000 taxies, vehicles which, in total, cover a distance of 11.700.000.000 km per year, in 8.600 km of problematic and double-parked streets [3].

While in most European countries transport is responsible for 50% of smog, in Athens it is responsible for 80% of air pollution. As mentioned in a E.U. report, within 8 years Athens will have become the most polluted city, not only in Europe but also among the 140 cities examined in total. The aggravating situation is only confirmed by the European Environmental Agency that states that pollution limits were exceeded 68 days during the summer of 2002.

Far too many cars of old technology still exist in Athens today, while fuel adulteration and half measures are simply not effective. Traffic increases in rates of 3% in the center and 7% in the suburbs and what is more Athenians are used to driving their cars into the city center. Car emissions, sound pollution and traffic congestion only worsen the problematic situation [7].

EUROPEAN UNION POLICIES AND TENDENCIES

After the global Kyoto conference in 1997 and the Buenos Aires conference 1998, great environmental problems caused by gas emissions and the energy problem have been realized by the European Union which made the commitment to limit carbon dioxide emissions until the year 2012 in the levels of 1990, a reduction of 8%.

According to the Kyoto and the Buenos Aires conferences, the European Committee has decided to promote means of transportation that contribute to the improvement of the natural environment. It has also financed energy investments concerning energy strategies, preparation of relative regulations, research for the development of new technologies and others. In the frame of those subsidies various programs have been developed like Auto-Oil, Save, Altener, Thermie, Synergy and inter-European networks. All energy programs concern research and development and have already been financed by the 5th Program Framework [8].

Table 2. Obligations (per % alteration of the six G.H.G. for the period 2008-2012, compared with the levels of 1990 which is considered the starting point) of Member States according to article 4 of the Kyoto protocol as approved by the Minister's Council (burden allocation in the E.U., June 1998) [9].

Member State	*% alteration*
Austria	-13
Belgium	-7,5
Denmark	-21
Finland	0
France	0
Germany	-21
Greece	+25
Ireland	+13
Italy	-6,8
Luxemburg	-28
Netherlands	-6
Portugal	+27
Spain	+15
Sweden	+4
United Kingdom	-12,5

Unfortunately, the realization of the Kyoto aim did not have a very positive course. In Tables 2 and 3, the obligations of the E.U. state members are presented for the reduction of the G.H.G as well as the accomplished deviations between 1990-1998. Obviously, the average G.H.G. levels achieved in the E.U. per 2,5% are quite small. Table 3 illustrates the great increase of G.H.G. in the section of transport.

The E.U. today supports the use of "clean" M.M.T. in its member states so as to reduce pollution caused by the emission of gases. At the same time, bicycle paths are developed, as well as, other systems promoting the use of bicycles by the citizens. More specifically, in many Western European countries, cycle paths and pedestrian precincts exist in urban areas and shopping centers where vehicles are prohibited [10]. In Copenhagen, there are suitable cycle paths that cover the 25% of the distances in the city, while there are shops renting bicycles. What is more, in many cities like Amsterdam and cities of Germany and the U.K. zones excluding cars have been created while in Germany, Holland and Denmark there are systems in the M.M.T. allowing the transportation of bicycles in buses and trains. In these countries "green nets" have been created connecting big cities that are used for cycling exclusively [11].

Table 3. Variations of G.H.G emissions from 1990-1998 in the E.U. of 15 Member States, as a percentage (except fluoride gases and LUCF) [11].

	?.U.15	??	??	DK	FI	FR	DE	GR
GHG %	-2,5	+4,1	+6,3	+8,7	+4,7	+1	+15,8	+15
CH_4	-16,5	-14,5	-3,6	+3	-42,1	-15	-36,2	+5,9
N_2O	-9,9	+13	+11,6	-12,7	+33,9	-12,2	-27,5	-0,3
CO_2	+0,2	+7,2	+7	+13,7	+7,8	+6,5	-12,6	+17,7
Energy	-6,2	-5,9	-14,4	+20,2	+16,3	+3,6	-17,9	+15,9
Industry	-5,7	+9,6	+19,4	+4,2	+8,4	+0,7	-25	+7
Transport	+15,3	+23,5	+20,1	+15,6	+3,4	+13,8	+11,4	+29,4
Small scale combustion	+3	+11,6	+22,3	-6,7	-8,8	+9,6	-6	+30

	IE	IT	LU	NL	PT	ES	SE	UK
GHG %	+19,1	+4,6	-58,4	+8,2	+17,8	+19,4	+1,2	-9,5
CH_4	-+6,2	+4	-4,8	-17,6	-0,2	+26	-9,9	-28,3
N_2O	+10,8	-14,8	-31	+8,8	+6,8	+6,3	-1,2	-14,8
CO_2	+26,8	+6,7	-61,1	+12,4	+24,9	+20,8	+2,7	-6,5
Energy	+36,1	+9,2	-96,5	+11,3	+17,8	+5,9	+9,9	-17,1
Industry	+2,2	+2	-74,8	+5,7	+15,1	+23	-6,5	-6,3
Transport	+76,8	+15,2	-56,2	+21,6	+41,9	+35,1	+13,3	+5,3
Small scale combustion	+2,5	+2,4	+49,3	+2,1	+34	+16,7	-9,9	+5,6

There is equally significant support in the section of ecological vehicles. Railway and bus nets are already very popular in most European cities. Also quite popular lately have become buses using natural gas and propane as fuel. There are already 300.000 cars using natural gas in Italy and 100.000 in New Zealand. Electrical bicycles and creation of Steam-vehicles has started in the U.K.

Important work has been initiated in European cities towards the development of ecological means of transport aiming at the development of sustainable urban areas. However, there are still many areas in need of aid and support so as to improve the quality of their environment and one of those is Athens. The effort towards this aim, especially in the light of the forthcoming Olympic Games of 2004, will be presented below. The E.U. contribution is particularly important towards this direction since it finances a big part of the works planned.

RAILWAY NETS (Trolley, Metro, Tram, Electric Railway)

Railway nets run on electrical motors and are divided into four categories: the fast railway (metro), peripheral trains connecting the city center with the surrounding areas or with other central areas, tram in the streets, trolley which is a modern version of the old tram and the basic railway net which links the city center with the nearby urban centers.

Railway nets have many advantages over highways. They are more efficient in terms of energy consumption, they do not consume fuel and cause less pollution of the atmosphere as they emit less green-house gases. Moreover, they can transport a big number of passengers in great speed. Two parallel railway lines can carry as many passengers within an hour as 16 bus lines. However, these systems can be efficient only when stations are of easy access while the route they cover is specific and can by no means change. This demands the proper design and a combination of terminals and M.M.T. stations.

Additionally, the construction of a railway line of one kilometer demands the 1/10 of the expenses for the construction of a highway while the cost of railway transports is the 1/5 of the equivalent road transports (88 Euros per 1000 passenger-Kilometers compared with 19 in the case of the railway) [12]. It is impressive to compare the percentages for the transport of goods through the railway net or highways where Greece is in the last position, in 2001, with a percentage of 2,3% in railway transport (Table 4). In addition, while the cost for starting a railway net is higher than those of buses, the cost of operation is much lower. Together with trolleys, railways can carry up to 400 passengers per driver compared with the 60-70 passengers of a bus.

Table 4. Shares of Road and Railway Transports in the Member States of the European Union in 2000.

Country	*% Share of road transport of goods*	*% Share of railway transport of goods*	*Country*
Greece	97.7	38.2	***Sweden***
Ireland	93	37.2	***Austria***
Italy	88	26.6	***Finland***
Portugal	87.1	19.3	***Luxemburg***
Spain	85.7	16	***Belgium***
U.K.	84.1	15.8	***France***
France	75.9	15.2	***Germany***
E.U.15 (Avg.)	74.6	13.8	***E.U.15 (Avg.)***
Denmark	73.3	12.9	***Portugal***
Finland	72.2	9.7	***U.K.***
Luxemburg	71.6	8.9	***Spain***
Germany	68.7	8.6	***Denmark***
Belgium	67.5	8.2	***Italy***
Sweden	61.8	7	***Ireland***
Holland	47.3	3.9	***Holland***
Austria	39.9	2.3	***Greece***

The development of railway nets has greatly contributed to the improvement of the quality of air since they reduce the use of private cars and buses and at the same time save energy. This, in fact, is their biggest advantage.

As already mentioned, electricity is used in Athens in certain types of buses, the well-known TROLLEYS. Those have been used for a long time in Athens, greatly contributing to the solution of the ecological problem. Trolleys are connected with an aerial electricity net. In their motor, the electrical power is converted into kinetic energy to mobilize the wheels.

The advantage of trolleys is the fact that they have minimum emissions of gases. For that reason there has been an effort towards the renewal of the old existing vehicles. Thus, 224 modern trolleys have been bought and are of service today with minimum levels of noise, air-conditioning and the ability of autonomous mobilization in case they are disconnected from the net, avoiding in this way the creation of traffic congestions. The aim of the state, however, is to replace all old vehicles with modern ones. [13, 14]

The Athens METRO or underground has greatly contributed to the improvement of the environment. More specifically, after its construction in the past 3 years, the use of private cars has been reduced by approximately 250.000 daily, a fact which resulted to a significant reduction of air-pollution and generally to an improvement of the life-quality in the city. Its total length is 18 km, added to the 26 km of the Electric Railway (Kifissia – Pireus line).

The creation of the two METRO lines and the completion of the Syntagma – Dafni line covers the transportation needs of 446.534 passengers daily [3]. According to the "Attico Metro" research, the function of the underground has reduced private cars entering the center by 70.000 or equally reduced by 335.000 km daily.

At the same time, the operation of the METRO was combined with the restructuring of the other M.M.T. by creating new bus terminals close to peripheral METRO stations. Thus the underground has, apart from private cars, also reduced buses in the center of Athens.

Furthermore, the METRO has given a boost to the use of the Electrical Railway (350.000 transports daily) by 14%, also limiting in this way the use of private cars.

Consequently, the effect of the METRO in the improvement of public transport, the reduction of the use of private cars and the traffic relief mainly in the center of Athens is quite impressive. It has resulted to the improvement of the environment and particularly to the reduction of air-pollution in the Attika basin.

Measurements in the period 30-01-2000 until 29-01-2001 (with METRO) and in the relevant period 30-01-1999 until 29-01-2000 (without METRO) proves there is significant reduction of pollution in the period after the METRO construction. Table 5 presents the measurements performed.

Table 5. Difference in the average measurements for air-pollution before and after the Athens METRO [3].

Gases emitted (mg/m^3)	*Before Metro*	*After Metro*	*% difference*
Sulphur Dioxide	18.3	17.5	-4
Carbon Monoxide	2.43	2.25	-7
Nitrogen Dioxide	58.3	54.3	-7
Ozone	55.7	49.7	-12
Smoke	52.6	50	-5

According to Table 5 there is significant reduction of emissions. More specifically:

- The reduction ranges according to the gas examined and is much greater for gas emitted exclusively by vehicles (carbon monoxide, nitrogen dioxide) and mainly ozone.
- For the rational evaluation of those reductions it should be pointed out that a reduction of the air-pollution, even that of 1%, especially in an urban-planning and population developing city, is something extremely difficult to succeed.
- It is worth mentioning that those reductions reach the reduction degree of the strenuous efforts of an entire 7-year-period.
- The positive effect of the extension of the line Syntagma-Dafni has not been estimated in the results mentioned.
- Positive effects in the years to come are bound to become more noticeable with the completion of the METRO extensions, the upgrading of railway and the creation of the suburban train and the TRAM.

At the same time, a TRAM net is already being constructed in the wider area of the Greek capital with the aim to satisfy the increased transport needs and the need for the development of fast, reliable and environmentally friendly means of transport [15].

There are numerous advantages of the TRAM: it is environmentally friendly, safe, fast, avoids traffic congestions, it is reliable, convenient, compatible to pedestrians, adaptable to green spaces, pedestrian precincts etc. Moreover, its construction is easy with comparatively low cost, easy maintenance and operation, technologically modern, able to move below and above the ground, can be used as a supplementary M.M.T. and finally boarding the vehicle is very easy [16]. The construction of the Athens TRAM is already proceeding quite fast and is expected to be ready by April 2004 so as to satisfy the increased transport needs during the Olympic Games of 2004.

Even though Athens of the '60s had a TRAM 100 km long, unfortunately, the "mighty" car managed to banish it. The constructed net today is 24 km long and will connect the city center via Fix - Nea Smirni - Paleo Faliro with Neo Faliro and Voula areas. The second part of the tram will cover, after 2004, the distance Ano Patissia - Acropolis and a third, the Alexandras Avenue to Goudi.

At this point, it should be emphasized that there was speculation whether the tram should be chosen instead of the underground in certain areas (eg. Nea Smirni - Paleo Faliro). Unfortunately, there was no time for thorough evaluation as the tram was strictly included in the agreement for the Olympic Games. In a first phase, however, other areas like Patissia - Acropolis or Patissia - Goudi could be covered. The extension of the metro to Nea Smirni - Paleo Faliro - Glyfada could be, in a significant degree, constructed with the cost of the today's tram which is 160 billion. What is more, it remains unknown how these busy urban areas and streets could function after being shrunk from the arrival of the tram.

As mentioned above the ELECTRICAL RAILWAY, in combination with the metro, has been operating for a lot of years and has positively contributed to the improvement of the environment as it runs exclusively on electricity with minimum emissions. The electrical railway has been lately renovated with the purchase of 20 six-wagon trains [17].

As far as SUBURBAN RAILWAY is concerned, the original "VISION" was to link "Eleftherios Venizelos" airport with the center of Athens, Thiva, Chalkis, Loutraki, Korinth and Kiato. This was besides, with tram, the basic condition for taking over the Olympic Games. Eventually, the part of Pireus - Aharnon Railway Centre - Spata will be completed until 2004 (51 km of length). It is estimated that it will serve 120.000 passengers daily and will be of great value for the entire basin and the nearby cities as it will develop an average speed of 120 km/per hour in contrast to the 70 km/per hour of the metro. So the route Center of Athens -Airport will last 35 minutes while the route Athens -Korinthos 48 minutes [16]. The big problem, however, is whether to go below the ground in the section of Aharnon Railway Center - Center of Athens as it will divide the city in two with constant interruption of the traffic flow. The programmed works today, in their complete form, will reach the 1 trillion drachmas [18].

NATURAL GAS BUSES

As it is widely known, buses are a very popular means of public transport. Buses, however, add to atmospheric pollution as they emit dangerous gases. For this reason, a new form of fuel has been searched for in order to satisfy public needs and be environmentally friendly at the same time. Natural gas was thus suggested which is both relatively cheap and ecological.

Natural gas is cheaper than petrol (costs the 1/3 of the price of petrol), floating particles and sulphur dioxide are not emitted during its combustion while it has lower carbon dioxide

emissions. Moreover, natural gas reserves existing today are enough to satisfy the demand for the next 20-30 years.

However, the reliability of the fuel for tackling environmental problems is in question. One of the disadvantages natural gas appears to have is its high content in carbon, which even though it appears reduced during its combustion, it is enough to increase the temperature of the ground. On the other hand, methane emitted during combustion is a more powerful greenhouse-gas than carbon dioxide and only adds to this phenomenon. Finally, the funds used for the exploitation of natural gas could instead be used for the development of other milder forms of energy [19].

A car using liquid gas emits less incombustible hydrocarbons and carbon monoxide while it emits no floating particles, sulphur dioxide or lead. What is more, liquid gas is more easily ignited than petrol, in other words, it is better mixed with combustion air and thus causes less wear. Generally, the use of liquid gas provides full safety as, according to global statistics, there are no accidents reported caused by its use [20].

Buses using natural gas, known as CNG, have eight special cylinders on their roof which provide compressed natural gas. Cylinders need only four minutes to fill up and are capable of covering a distance of approx. 350 km.

According to Law 2273, the use of liquid gas is now allowed in Greece as a “clean”, safe and environmentally friendly fuel. New natural gas buses have been imported with the aim to improve natural conditions in Athens and save energy at the same time. New vehicles are safe, inexpensive and environmentally friendly. Their emissions are reduced by 50% in nitrogen oxides and are quite noisyless. They are characterized as the safest vehicles, as leaks are difficult to exist in case of accidents. The 295 natural gas buses cost 22,7 billion drachmas and the 50% of their purchase was funded by the E.U. through the second Community Support Framework, and the rest was given by the Greek state [21].

A significant reduction in the emissions of dangerous gases was achieved by the purchase of the new vehicles while at the same time modern aesthetics in transport was promoted. The CNGs run on environmentally friendly fuel, have modern equipment and design, original colours and above all, respect the environment of the Greek capital. [22, 23]

CONCLUSIONS

In the text above, we aimed to present the existing or promoted ecological means of transport in Athens investigate their advantages and disadvantages. Based on the above, the following results arose:

It has been realized that the attempted redesign in the M.M.T. in the Attica basin should, in any case, improve the condition of the atmosphere. Thus, emphasis was wisely put on ecological M.M.T. which use electrical energy or natural gas.

The use of ecological M.M.T. is obviously more preferable than the use of conventional cars, mainly from an environmental point of view. One very big advantage, however, in comparison with cars, remains their high cost of construction and function. That is the reason why, until recently, priority was given to the construction of highways and generally to facilitating the car instead of relative mass means of transport works.

The E.U. supports actions and works towards this direction, such as:

- Changes in technology and fuels so as to continue reducing emissions of cars, lorries and buses.

- Inter-accounting management of the external cost and use of taxes and financing for encouraging the use of more environmentally friendly means such as the railway instead of road transport.
- Discouraging the use of highways for the transport of loads in big distances and encouraging the transport of passengers and goods by the railway [12].

It is particularly encouraging that the E.U. has made significant steps to this direction and the efforts are proceeding intensively in both legislative and financing level.

At the same time, significant efforts have been made by the Greek state in the past few years for making ecological means of transport as popular as possible in the Greek capital. However, greater efforts are yet to be made so as to have satisfactory results, meaning to reach the final goal which is tackling air pollution.

Even though important action has been taken for the upgrading of the quality of the atmosphere of the capital, this was not enough to eliminate problems caused by pollution.

It should be noted that the use of natural gas has benefited the city of Athens as emission of gases and consumption of energy was reduced. Great are also the benefits deriving from the underground (METRO), electric railway and the TRAM, as well as the suburban railway after their completion. It should be pointed out again, however, that even though important steps have been taken, air pollution remains in high levels, a fact which in combination with the heavy traffic makes the life of the Athenians quite difficult.

Ecological Mass Means of Transport (M.M.T.) demand proper organization and management in order to "relieve" the environment and improve the function of the city. More analytically the following are necessary:

A. Rational measures for the management of traffic

- Enaction of a Traffic Management Centre of the capital which will co-ordinate traffic police and M.M.T. and will inform the citizens.
- Development of a system for limiting traffic of private cars during rush hours (eg. Controlled parking, special cards, tolls etc.)
- Development of traffic regulations – pedestrian precincts – cycle paths – one-way streets etc.
- Completion of the three Traffic Ring-roads of the center and their connection with Attika Highway.
- Upgrading and prioritizing the transport net in the capital using the proper signaling.

B. Development and expansion of M.M.T.

- Completion of Metro – Tram – Suburban Railway net, construction of Boarding Stations.
- Further development of the dedicated bus-lanes network
- Reasonable fare price policy and common fares for all M.M.T.

C. Organizing traffic and parking

- Development of a complete management system of stop and parking, limiting the everyday use of private cars, monitoring traffic and preventing arbitrariness, (e.g. parking on pavements).
- Materialization of a Boarding Station program in chosen spots within the city limits and close to Metro – Tram – Railway Stations. Development of a parallel program of underground Car Parking Stations in the city center.
- Management of stop and traffic of vehicles of special categories (taxies, motorcycles, lories etc.) with special solutions like spots for temporary stops, time-tables etc.

D. Improvement of quality of life and environmental protection

- Effective control system of the emission of gases and sound pollution caused by all kinds of vehicles.
- Securing road safety with the constant control of road works (road maintenance, supervision of the quality of works etc.) and behavior of drivers, dealing with speeding and drunken driving etc.
- Development of a complete system of "dynamic" traffic information (Means of transport, maps, information signs, M.M.T. time-tables etc.) by taking full advantage of telematics.

E. Updating of legislative frame

- Creation of a Metropolitan Co-ordination Body with actual and executive authority in which all existing authorities will be incorporated (services of Municipalities, Traffic Police, Ministry of Environment and Public Works, Athens Urban Transport Organization) In this way, there will be a common design and management of the transport of the capital.
- Legislative regulations for policing traffic and imposition of fines.
- Monitoring the practical aspects of traffic statistics concerning e.g. the average M.M.T. speed, performance of private cars, parking spaces, degree of passenger satisfaction.

Further attempts should, above all, aim at raising public awareness on how important the systematic use of M.M.T. is. Athenians should realize that individual contribution can make a difference towards dealing with problems of air-pollution caused by heavy traffic in Athens.

All the above depend on the willingness of both the government and the citizens. An important step to this direction, however, can be a general upgrading of mass means of transport, cheap fares, more frequent services. In this way Athenians will be encouraged to use trains and buses instead of their cars.

There is no doubt that technology can be an answer to the existing problems. Maintenance and fixing of motors, renewal of old vehicles and promotion of ecological cars with the support of the relevant laws are a big step towards the solution of the problems.

Taxation for environmental consequences imposed on cars according to the fuel used could also discourage the use of private vehicles. Moreover increase, for example, of the cost for the purchase of cars and reduction of road works could also have the same result.

Finally, more sums for the creation of a complex transport net should be invested by the Greek state so as to fully satisfy the transport needs of the Athenians and encourage them to use Mass Means of Transport as much as possible.

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