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Electric **C**ity **Tra**nsport – Ele.C.Tra

D.6.5 Feasibility Study for East Attica

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Electric **C**ity **Tra**nsport – Ele.C.Tra.

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1. SHORT OVERVIEW OF THE STATE OF THE ART

An ambitious effort related to electric car era started in Greece in the beginning of ’70 at the island of Syros. Three electric mini cars were produced based on the E465 English car. All the production was exported to Britain and Sweden and the production line closed in 1975 as it was not possible for the cars to achieve the necessary type-approval in Greece. After the year 2000, a small electric car was imported in Greece, but with extremely low sales. The modern electric era in Greece started after 2010, as new and efficient cars were delivered in the market.

The situation with transport in Greece and specifically regarding ways to save energy, environmentally friendly use of means is not quite common because of State bureaucratic procedures state and legislative loopholes. However, small steps have been taken in the general field of saving energy - recycling - respecting the environment, in other areas of everyday life in Greece.

For the implementation of the Ele.C.Tra. project in Greece, AVMap has chosen East Attica.

The Prefecture of Eastern Attica is an administrative division of the Attica Region of Greece. It comprises of 13 new Municipalities under the Kallikrates Law. The population of the prefecture was 502,090 inhabitants during the 2011 census. Based on the 2001 and 2011 census results, the Prefecture of Eastern Attica presents an increase of inhabitants of approximately 23,7%. Its area is 1.459 km² and had a population density of 344 inhabitants per km ² in 2001.

The international airport of "El. Venizelos" in Spata, and the ports of Rafina and Lavrion are key competitive advantages for the tourism development and promotion of Eastern Attica.

Modern roads in conjunction with the development of the cruise industry, mainly in the port of Lavrion (next to the International Airport and Sounion), provide an economic breath to the local communities of Messogeia and Lavrion, allowing tourists to visit the area sites, and learn about their history, as a region break destination, before visiting the Cyclades.

Beaches in Eastern Attica, such as Astir Palace in Anavissos, Voula, Black Lithari, Avlaki in Porto Rafti, beaches in Keratea, Cape Sounion, Rafina, Nea Makri and Schinias, are considered amongst the cleanest and best beaches of Attica; awarded with the blue flag, they are considered a destination for foreign tourists, before they embark to a holiday island.

It is also important to note that the Prefecture hosts the 2nd largest seaport in Attica, that of Rafina, serving millions of travellers every year.

Both the touristic and infrastructure nature of the area pose significant challenges in the field of transportation within Eastern Attica.

Although identified as a significant attraction of both touristic sites and transportation junctions, the Prefecture of Eastern Attica lacks the suburban and intercity transportation network which will allow the area to evolve appropriately and provide its citizens and by-passers with the required high level of services.

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- The transportation services available to the public refer to intercity and suburban buses, with an itinerary of 15-45 minutes, based on the weekday and taxi services. It is noted, however, that due to the underdeveloped transportation network in the area, most citizens and by-passers tend to make use of their own vehicles, thus adding the area problem of circulation.
- The city does not contain any e-charging networks, nor do the neighbouring cities. Moreover, no incentives/facilitations for e-light vehicles, such as access to reserved traffic zones, reserved parking or e-charging points are already working in the area.
- The network of e-light vehicle providers is limited to the amount of 4-5, while their fleet includes no more than 2 e-vehicles per provider since they don't want to have stock. According to the e-light vehicle providers, many people have been interested in hiring/buying an electric vehicle, but not even a single sale has been realized yet.

Mobility status

The comparative advantages of Eastern Attica, through a specific marketing plan of tourism product initiate from the area history. The Prefecture hosts world famous monuments, including the Temple of Poseidon at Sounion Lavreotiki, the Marathon Tomb and Battle site, the Temple of Artemis Athena, the Museum in Artemida, the Lion of Kantza, and the Lavrion old mines, which are considered key historic features of the area and have the capacity to become an attraction for both foreign and domestic tourists. The paths of history continue through the oldest continuing theater, that of Thorikos in Laureotiki, the ancient Temple in Vouliagmeni, the paleontological finds in Pikermi and that of the classic Marathon route.

The survey for the transport habits in the area of Eastern Attica was implemented with a target group of residents (72%) and tourists (28%).

The first and second trips occurring five days a week are the trip to work and the trip back home from work. 49% of the sample use their own car and only 22% use the public transport. The origins of the trips to work are usually places in the Eastern Attica such as Pikermi or Rafina. The destinations are usually Athens' downtown centre or areas around the city centre. The average time of each trip is 45 minutes.

The second most frequented trip is the trip back home from work. 52% use their car to return home and only 19% use the public transports. The origins are the opposite. They start from various places in Athens (centre, Chaidari, Thiseio, etc.) with their destination being areas in Eastern Attica such as Pikermi, Koropi and Rafina. The average time of each trip is also described as 45 minutes.

The next most frequent trip refers to people taking trips to Eastern area once a week mostly with their cars, with the main purposes being hobbies (17%), visits (17%) and shopping (17%). 67% of people use their cars for trips in the areas within the Eastern Attica due to lack of appropriate public means of transport. The places that are most visited are the Athens downtown centre and the big urban areas of Eastern Attica such as Rafina, Pallini, Pikermi and Koropi.

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Only 25% use the public transport. Almost half of the residents and tourists are thinking of alternative solutions to car ownership and 64% say that the solution would be car sharing. When asked the same question for scooters, the percentage is obviously smaller. Only 25% have ever thought of alternative solutions for scooters use. The solution the most of them suggest (52%) is the scooter sharing. When asking the target groups about whether they possess a scooter or a motorcycle, only 23% answered yes, 86% of whom have only one motorcycle per household. According to the survey, 85% of responders have never used an electric vehicle but 90% have positive thoughts to testing or buying one.

According to the survey results carried on in Eastern Attica, the common mobility aspects in the area are:

Non pilot city		Eastern Attica
Mobility aspect	**Main attractor places**	Downtown centre Areas around the city centre Port Airport Famous monuments Museums Big urban areas of Eastern Attica
	Day time slot when trips increase	Morning: 07 to 09 Afternoon: 17 to 19
	Raison	Work (48%) Hobby School Visit
	Main Transport mean	Own car – 45% Public transport - 25%

Current situation after 28 months of Ele.C.Tra. project

After the realization of the 1st NSG Greek Meeting in the area of Eastern Attica, the interest expressed by stakeholders coming from different sectors was really impressive. However, the national regulations did not favor the implementation of electromobility at the time being, due to the scheme regarding after-sales or the distribution of electricity in order to charge electric vehicles.

The lack of awareness as well as the familiarization with the idea of electromobility was significantly improved during the project's lifetime. This was achieved via several events (more than 20 e-articles and press releases, 2 NSG meetings, 2 Conferences, 1 rally of electric vehicles and 1 light vehicles show) that have been organised for the e-mobility development.

Furthermore, the electronic platform of use and monitoring of electric scooters and vehicles developed by AVMap company (maps.electraproject.eu) under the Ele.C.Tra

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project, includes the area of East Attica and it will be expanded in the future in other geographic zones as well.

We have reached to the conclusion that everybody is interested regarding the implementation of the Ele.C.Tra. model in Greece, both the public and the private sector. But their interest is only theoretical at the moment, since financial restrictions and political instability of the country forces them to get involved only with the most urgent matters of the society (financial resources, health). As soon as the financial and political situation in Greece is finalised (perhaps not in 2015, since we might have elections again or even worse a bankruptcy), then the public sector will need at least 6 – 12 months to re-consider the electromobility matter. AVMap will be close to all the interested parties and try to find other financial resources directly from EU projects. Though, this is not something we can be sure about its results.

The introduction of electromobility, as a friendly environmental and economical way of mobility in a society such as in Greece, where the traditional mode of transportation was the use of conventional means of transport, can be achieved only via systematic small and realistic but essential steps. For example, the supply of a fleet of electric scooters or cars at that particular time would not lead to any significant change in the way that our society thinks and functions, as there are neither the financial nor the appropriate human resources and infrastructures, in order to utilize this opportunity.

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2. SWOT ANALYSIS OF THE INTRODUCTION OF ELECTRA MODEL

A SWOT analysis is considered to be a great tool and will certainly assist in finding the best way for the Ele.C.Tra. model to be introduced in pilot and non-pilot cities.

The SWOT analysis realized in the context of the underdeveloped area of Eastern Attica showed the following:

	Helpful *to achieving the objective*	*Harmful* *to achieving the objective*
Internal origin	**STRENGTHS** Electric vehicles are noiseless They contribute to better environmental conditions Future vehicles must run on renewable or residual energy The stakeholders involved give an important contribution to the model Agreements signed with municipalities, e-scooter suppliers and Institutes Reduced car transportation Reduced fuel consumption No carbon emissions Increased expression of interest during the past 3 years	**WEAKNESSES** Cost of charging points Recharging is time consuming compared to the fuel refill Electric vehicles are not well known Infrastructure does not exist at the moment If electricity does not come from renewable energy sources pollution problem remains Not all emissions are kept in the electric vehicle; those due to bearings, resuspension of particles, fluids etc. will continue existing National legislation & current financial situation Large percentage of the residents from Eastern Attica have never used an electric vehicle Insufficient number of parking spaces, no parking spaces for scooters

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External origin (attributes to the environment)	**OPPORTUNITIES** Strengthen the stakeholder network and connect with other public bodies, suppliers, firms, etc Expand the platform of use and monitoring of electric scooters and vehicles Promotion of the e-vehicle use both for working/studying day trips and for tourists and more information / awareness campaigns Electric vehicles can be charged at home or in parking lots Energy supply to EV - the current network of gasoline stations could be recycled to be used as recharging points Not to encourage motorcycle use in general but to promote the change from the conventional motorcycle to the electric Price integration between public transportation and sharing systems Concrete actions to allow the supply of e-vehicles and/or easing vehicle use by citizens and tourists - Cooperation between municipal bodies and companies to search for financial resources through local and national funds Supply of vehicles and charging stations can be gradually planned from municipal resources or through leasing Incentives: discount, no local + pollution tax, environmental bonuses Electric vehicles used by the municipal employees Municipality collaborates with local businesses and other organizations (eg port or airport), for joint procurement and maintenance of a network of charging stations	**THREATS** Small companies have many market difficulties Reluctance of the citizens to abandon the ownership to their private vehicles. Car sharing still has very little usage. No interchange nodes, easing intermodality by combining transport means Not enough parking spaces for cars and special parking spaces for scooters Economic difficulties are important on sharing systems management Safety The implementation of sharing services grants more access to scooters to the inexperienced or insufficiently qualified driver An average daily trip to common destinations (e.g. to the center of Athens) requires approximately 45 min.

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2.1. SCOOTER SHARING SYSTEM

No scooter sharing system exists in the area of Eastern Attica at the time being.

However, considering that the climate in Greece is typical of the Mediterranean climate, this is a factor that would favor the use of e-scooters. The dry climate of Attica (Athens' greater area) is characterized by mild and rainy winters, relatively warm and dry summers and, generally, extended periods of sunshine throughout most of the year.

The warm and dry season lasts from April until September. Long stretches of consecutive rainy days are infrequent in Greece, even during the winter, and the sky does not remain cloudy for more than a few days in a row, as it does in other regions of the world.

2.2. PRIVATE OWNERS OF E-LIGHT VEHICLES

	Helpful to achieving the objective	*Harmful to achieving the objective*
Internal origin	**STRENGTHS** Electric vehicles are noiseless They contribute to better environmental conditions They comply to the direction that future vehicles must run on renewable or residual energy Reduced car transportation Reduced fuel consumption No carbon emissions Increased expression of interest during the past 3 years	**WEAKNESSES** Cost of charging points Recharging is time consuming compared to the fuel refill Infrastructure does not exist at the moment If electricity does not come from renewable energy sources pollution problem remains Not all emissions are kept in the electric vehicle; those due to bearings, resuspension of particles, fluids etc. will continue existing Insufficient number of parking spaces, no parking spaces for scooters
External origin (attributes to the environment)	**OPPORTUNITIES** Electric vehicles can be charged at home or in parking lots Energy supply to EV - the current network of gasoline stations could be recycled to be used as recharging points Price integration between public transportation and sharing systems	**THREATS** No interchange nodes, easing intermodality by combining transport means Not enough parking spaces for cars and special parking spaces for scooters An average daily trip to common destinations (e.g. to the center of Athens) requires approximately 45 min.

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	Incentives: discount, no local + pollution tax, environmental bonuses	

2.3. BUSINESS OWNERS OF E-LIGHT VEHICLES

No business owners of e-light vehicles exist in the area of Eastern Attica at the time being.

However, they could encourage the private owners to buy and use electric vehicles by implementing this kind of vehicles in the public sector, in order for them to be used by civil servants during their daily work.

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3. GUIDELINES FOR THE INTRODUCTION OF ELECTRA MODEL

In order to implement the Ele.C.Tra. services, it's necessary to define a set of elements which allow starting of the experimentation in the area of Eastern Attica. In other words, AVMap will create the main requirements so that the implementation can start mainly including agreements and incentives.

Prepare of the implementation

The first step towards the introduction of the Ele.C.Tra. model is to conduct a **research** near the area of Eastern Attica regarding potential stakeholders who will be interested in electromobility and who will agree on assisting during the model's implementation and on providing their facilities in order for the pilot phase to be realized.

AVMap shares with the stakeholders the **Ele.C.Tra. kit**, which includes:

- ✓ a report describing the Ele.C.Tra. model;
- ✓ agreement templates, in order to be signed by the stakeholders;
- ✓ NSG mailing list, in order for the stakeholder to be able to promote the model;
- ✓ Guidelines regarding the proper implementation of the pilot phase.

AVMap has already signed 4 Agreements with the municipalities of Chalki and Spata, with the Geoenvironmental Institution and with the e-scooter supplier "Green Motors".

Start and continue the implementation

The responsibilities of these stakeholders who have signed / will sign an Agreement during the pilot phase will depend on their nature:

Nature of Stakeholder	**Responsibilities**
Public body	1. Introduce incentives for e-scooter users, such as special discounts, no local or pollution taxes, environmental bonuses, reserve parking 2. Promote the use of electric vehicles by civil servants 3. Organize events to raise awareness regarding electromobility 4. Cooperate with private bodies to search for financial resources in order to purchase at least 1 charging station and at least 1-2 electric vehicles 5. Further promote the e-vehicles sharing system by placing electric scooters/bicycles at a central point, such as the port of Rafina
E-vehicles supplier	1. Provide the municipalities with 1-2 electric vehicles 2. Make synergies with other suppliers who will agree on providing the municipality
Institution	1. Search for financial resources regarding the supply of electric vehicles and / or charging stations 2. Organize seminars / events 3. Make synergies with other projects regarding electromobility 4. Promote the Ele.C.Tra. mobile application

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To strengthen the exchanging of information, the dissemination and the relevant stakeholders' involvement through specific actions, the model also includes:

✓ School and university involvement, to focus on young students (at least 16 years old), in accordance with the user target that use scooters very much. This will be achieved:

i. By specific dissemination campaigns to be held in schools, with particular attention to technological device use (website, app, social network, etc.)

ii. By specific events with teachers and pupils

iii. By promoting e-charging points by schools (columns, if present) and/or in schools (thanks to removable batteries), like the main supporting infrastructure available

iv. By raising awareness in families, focusing on safety (topics already noted by interviewees)

✓ Firms Mobility Management involvement, to optimize results in regard to workers' needs, through specific facilities and tools for e-scooter users (e.g. discount to buy/to hire an e-vehicle, reserved scooter places in the firm's park if present)

✓ Info web-based platform carrying out and promotion, in order to ease e-scooter users and linked to the project website www.electraproject.eu. In this way, the platform represents the main virtual info-point to inform oneself and then to use e-scooters by citizens and tourists, and the main communication link between users and the Mobility Manager and other stakeholders, if possible

✓ Other dissemination campaigns, focusing on specific user target and/or local needs.

3.1. POLITICAL AND LEGISLATIVE SUPPORT

Intersectoral cooperation is the key factor for success. The municipality of Eastern Attica could implement the following scenarios in order to adopt electromobility and to contribute towards its promotion and development:

Electric scooters sharing system

In this scenario, the municipality will implement all necessary actions concerning the development of the appropriate infrastructures for electromobility. Its aim is to serve and cover the needs of tourists and residents, who deal with mobility problems due to restricted or insufficient public means of transportation.

One of the initial actions is the supply of electric scooters and the development of all the necessary infrastructures for their proper functionality, including the supply of charging stations and the creation of parking areas and guard stations.

Getting a proper funding is mandatory in order the above actions to be realized. However, in order to avoid big delays until gathering financial resources, the municipality can use for scooters' charging any available socket that exists in public places and can develop suitable charging points in squares or other central places, where the rental points will also be located.

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In addition, the municipality in cooperation with ICT and software development companies will proceed with the creation of software which will be suitable for monitoring all necessary processes. In specific, this software will contain electronic procedures for booking, payment, receipt and delivery of electric scooters, information about any damage, etc.

Tourists and residents will be able to monitor scooters' availability, choose their receipt and return station, be informed about the potential charging points, their connection with public transport, etc. The expenditure of such a system could be practically covered only by funding programmes (for example NSRF – Green Fund). Until that happens, the municipality can gradually proceed with the purchasing of electric vehicles which will be used by tourists and residents during the high season period and by the municipality's staff during the low season period, in order to cover daily municipal functional needs.

AVMap GIS S.A. (www.avmap.gr) provides a prompt solution in reference to the electronic system of use and monitoring of electric scooters and vehicles. The company developed a similar platform (maps.electraproject.eu) under the Ele.C.Tra project, which includes the area of East Attica and will be expanded in the future in other geographic zones as well.

Consequently, the cooperation between municipal bodies and companies whose objectives are on one hand to search for financial resources through local and national funds and on the other hand to develop digital applications is particularly necessary.

Benefits:

- ✓ Urban environment improvement
- ✓ Reduced car transportation and as a result public areas release form cars.
- ✓ Traffic Upgrading
- ✓ Improvement of life quality
- ✓ Greater benefits if it will be implemented in multi-municipal level

Use of electric vehicles by the municipal services

In this case, the municipality implements all the necessary actions for supply and use of electric scooters / vehicles, as they were described in the previous scenario. The difference here is the fact that the electric vehicles will be used by the municipal employees in order to cover their daily needs, such as:

- In-situ measurements of water supply
- In-situ autopsies and fieldwork of urban planning services
- Use by the municipal social responsibility services
- Use by the municipal police
- Use by the municipality's volunteers (e.g. medicine delivery)
- Delivery of intra-corporate documents between the municipality's public services

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The supply of vehicles and charging stations can be gradually planned from municipal resources or through leasing. Nowadays very few municipalities have their own resources for buying a fleet of electric vehicles. The municipality may initially acquire 1-2 electric scooters / vehicles and gradually increase its fleet in accordance to its needs.

Benefits:

- ✓ Reduced fuel consumption
- ✓ More efficient fleet management
- ✓ Example for residents
- ✓ Environmental benefits

Cost-sharing system for chargers' installation

In this scenario the municipality collaborates with local businesses and other organizations (eg port or airport), for joint procurement and maintenance of a network of charging stations.

The target audience in this case is mainly tourists, who will be able to schedule their stay in ports or airports and visit nearby places and tourist attractions.

Benefits:

- ✓ Exploitation of the tourism sector
- ✓ Strengthening of the local economy
- ✓ Example for residents
- ✓ Environmental benefits

3.2. CONSTRAINTS FOR THE DEVELOPMENT OF THE ELE.C.TRA MODEL

National legislation & current financial situation

Financial restrictions and political instability is considered to be one of the main constraints that do not favour the development of the Ele.C.Tra. model to our city. These restrictions force the government to get involved only with the most urgent matters of the society (financial resources, health). As soon as the financial and political situation in Greece is finalised, then the public sector will need at least 6 – 12 months to re-consider the electromobility matter.

No infrastructure available

There are no charging points available at the time being, and an insufficient number of parking spaces are easily noted. Moreover, no parking spaces for scooters have been planned. No interchange nodes that would ease intermodality by combining transport means exist.

Cost of charging points

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Taking into account the current financial situation in Greece, the cost for purchasing and implementing charging points at several central points of Attica is considered prohibitive.

Difficulties in implementing the scooter sharing system

Car sharing still has very little usage, as citizens are reluctant when it comes to abandoning the ownership to their private vehicles. Furthermore, we cannot ignore the economic difficulties on sharing systems management.

Difficulties in implementing the use of electric scooters

Small companies have many market difficulties. Moreover, citizens are not going to be easily convinced regarding the use of electric vehicles, since they consider the duration of the trip a really important factor when purchasing a vehicle. Additionally, recharging is much more time consuming compared to the fuel refill of a conventional vehicle.

Safety

Citizens do not consider that safety is one of the e-scooters advantages. Moreover, the implementation of sharing services grants more access to scooters to the inexperienced or insufficiently qualified driver.

According to the survey results carried on in Eastern Attica, the critical points in the area are:

Non pilot city	Eastern Attica
CRITICAL POITS	▪Lack of appropriate public means of transport ▪Traffic (27%) ▪Buses stop away from their destinations (17%) ▪Buses are too expensive (13%) ▪Too long travel time with PT (45 minutes in average)
MOTOR VEHICLES	▪23% possess a scooter or a motorcycle ▪86% of responders have only one motorcycle per household
FOSCUS ON EV	▪85% never used an EV ▪90% would be interested in testing or buying EV ▪Out of 15% that used an EV, 26% have used electric scooters ▪Solution most chosen: complete ownership (29%), sharing (26%) ▪Incentives: discount (32%), exemption from local taxes (24%) and pollution taxes (20%)

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ELECTRIC VEHICLES PERCEPTION BY CITIZENS	▪**Strengths**: safety (39%), speed (37%), comfort (37%), parking (31%) ▪**Weaknesses**: high cost (27%) ▪**Critical issues**: possibility of being stolen (34%), charging (23%), lack of knowledge (23%) ▪**Benefits**: lower fuel costs (39%), NO carbon emissions (36%), reduction of noise (9%)
SUSTAINABLE MOBILITY PRIORITIES	▪**Sustainable (green) transport infrastructure** ▪**Access restrictions** ▪**Different motorization (electric, hybrid)** ▪**Sustainable mobility (walking, bike, car sharing, collective passenger transport)** ▪**Integrated pricing strategies**
CONSTRAINTS	▪Road network – cars, motorcycle, scooter ▪Public transport: bus ▪Mobility: cycling, walking ▪Parking: lack of parking ▪international airport of "El. Venizelos" in Spata ▪Ports: Rafina and Lavrion

3.3. POSSIBLE SOLUTIONS FOR THE CRITICAL ISSUES

The municipality, in cooperation with the Departments of Technical Service and Development and Planning (NSRF and European programs), should make use of any opportunity in order to achieve sustainable urban mobility.

Studies

For the elaboration of studies, the municipality may use volunteers, municipal department of technical services, local environmental associations or university teams. The studies should emphasize on:

- ✓ establishment of goals for energy saving and gas emissions reduction;
- ✓ recording of the existing situation (total consumption, recording of vehicles - needs - route);
- ✓ cost – benefit studies;
- ✓ infrastructure studies for the installation of charging stations and their interconnection with metro and other public transports;
- ✓ urban mobility studies for addressing the problems (not only for transport, but also for garbage trucks route optimization for example).

Management Committee of Energy Topics

The establishment of this unit / committee can be a sub-section of the municipal Department of Technical Services, a committee of elected or municipal employees or even a

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working group of residents or operators (on the basis of Kallikratis). Among their most important responsibilities will be the:

- ✓ collection and data processing (mainly primary energy data);
- ✓ communication with residents / local businesses for energy-environmental issues;
- ✓ communication with vehicles / chargers suppliers, etc.;
- ✓ actions in reference to energy & environment sectors;
- ✓ coordination of dissemination / awareness actions.

Proper infrastructure

The current network of gasoline stations could be recycled to be used as recharging points that will supply energy to electric vehicles. Supply of vehicles and charging stations could be gradually planned from municipal resources or through leasing. Moreover, a continuous cooperation between the municipality and companies should be built, in order to search for financial resources through local and national funds. Collaboration between the municipality and local businesses or other organizations (eg port or airport) for joint procurement and maintenance of a network of charging stations could also prove to be useful.

Tourists, who arrive at the port of Rafina, would be more than grateful if they could find a vehicle in order to be able to transfer them around the city.

Stakeholder network

The municipality of Eastern Attica could connect with other public bodies, suppliers, firms, etc, in order to strengthen the stakeholder network and build to contribute to the sustainability of the project's lifetime. The organization of several events and information / awareness campaigns regarding electromobility has proven to be a great way of attracting citizens and inform them on the matter.

The further promotion of electromobility could also be achieved via the use of electric vehicles by the municipal employees, e.g. for delivering the mails, for the cleaning services, etc.

The expansion of the platform of the use and monitoring of electric scooters and vehicles is also a good step towards promoting the Ele.C.Tra. model.

Incentives

The citizens should be motivated regarding the use of electric vehicles. For this reason, the municipality of Eastern Attica could trigger them via the following:

- ✓ Integrating the prices between public transportation and sharing systems.
- ✓ Citizens who use electric vehicles could be given a special card in order to get discounts for the municipality's super-markets, parking places, stores, etc.
- ✓ Releasing the citizens from local and / or pollution taxes or awarding environmental bonuses is also considered to be a great motivation for citizens towards the use of electric vehicles.

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- ✓ Free parking for the e-vehicles owners would be highly appreciated, since parking is difficult especially around the area of the Rafina port.
- ✓ Organization of annual events, such as electric vehicles races or annual competitions awarding the citizens who have realized most of their trips by using an electric vehicle.

Education

Children at the age of 16+ have proven to be really caring when it comes to environmental issues. An electric vehicle which is environmentally friendly and, at the same time, functions with state-of-the-art technology would be considered as the ideal vehicle by students.

For this reason, schools and universities should be involved in the students' awareness raising by holding dissemination campaigns during their extracurricular activities or by cooperating with the students in order to organize similar events focusing on the citizens' awareness raising.

Other solutions

- ✓ Cooperation with gas stations, supermarkets, sports facilities, hotels;
- ✓ Configuration of specific municipal areas that already have power sockets;
- ✓ Installation of PV panels in existing parking areas;
- ✓ Cost-sharing solutions for charging infrastructures and use of scooters.
- ✓ Cooperation with other key players and existing networks – projects via Memorandums of Understanding and Cooperation;
- ✓ Exploitation of Covenant of Mayors.

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4. SYNTHESIS OF THE POTENTIAL USERS' NEEDS

The survey has acquired a specific and technical starting point for the model, contextualization and experimentations, as well as a set of elements comparable with the survey's results that concern the situation after the Ele.C.Tra. pilot experimentations in Genoa, Florence and Barcelona.

The main user target is characterized by:

- young people, about 16-35 years old (45%)
- employees (38%)
- those who take short day trips from home to office (~45 minutes per trip) (48%)
- men and women (56% - 44%)

According to the survey, 85% of responders have never used an electric vehicle but 90% have positive thoughts to testing or buying one. The assessment made by the residents about the electric vehicles concerns five aspects, being the worst score for the cost, and speed and comfort on the top.

They estimate among the main benefits the reduction of the fuel costs (39%), reduction of the carbon emissions (36%) and the reduction of noise (9%). The remaining 9% chose the "don't know or no answer" option.

The incentives that would probably motivate the residents and tourists to utilize an electric vehicle are firstly the discount of purchase of electric vehicles (32%) and secondly the exemption from taxes, local taxes for the electric vehicle owners (24%) and pollution taxes (20%).

In the question of whether they would be interested in using a scooter sharing system in their city, 28% would surely use it. The top option was "probably", with 38% of the answers. 7% of the choices were for the option "I would never use the service". The option "not sure" covered 18% of the answers, and the last "probably not" with 9%.

The people who were asked say that the main concern they may have in relation to the use of electric vehicles is the case that the vehicle will be stolen (34%) and the second one is the case of charging the vehicle batteries (23%) and lack of knowledge (23%).

Regarding the cost of the service that they would find suitable about the use of electric scooters/cars/bicycles in their city, 29% think that the more suitable service about the use of electric vehicles is complete ownership and 26% believe that sharing would be better.

The advices issued by the residents and visitors in Eastern Attica with regard to the development of a more sustainable mobility in towns are, in order:

✓ a collective passenger transport:

Bus services, Rail transport, Intermodal transfers, Integrated ticketing, Park & Ride, Accessible transport systems, Bus rapid transit, Quality of service.

✓ a sustainable (green) transport infrastructure:

Greenways, bikeways, bus ways, railways.

✓ access restrictions:

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Access management / Enforcement, Car Restricted Zones /Living Streets, Parking Management, Pedestrian zone, Traffic calming / Speed reduction.

✓ other alternative fuels and other technologies that allow a different motorization (electric and hybrid vehicles):

Natural gas, Liquefied Petroleum Gas (LPG), Bioethanol (alcohol), biodiesel.

✓ means of transport consuming the least energy and producing less pollution per km travelled:

Travel on foot, by bicycle, collective transport and shared car.

✓ integrated pricing strategies:

Congestion pricing, Integrated ticketing, Parking Management.

Being a non-pilot city, East Attica has increased needs compared to those of the pilot cities. In specific:

- more information and awareness campaigns on electric mobility, with particular reference to the economic and fiscal incentives, the benefits of the electric vehicle;
- the need of charging infrastructure within the city;
- the need of infrastructure investment, such as:
  - more parking spaces for cars and special parking spaces for scooters;
  - more facilities for public transportation and effective interchange nodes, easing intermodality by combining transport means;
- the need of traffic decongestion and pollution reduction.

4.1. SCOOTER SHARING SYSTEM

No scooter sharing system exists in the area of Eastern Attica at the time being.

The implementation of one would cover the needs of:

✓ traffic decongestion and pollution reduction

✓ collective passenger transport

Furthermore, the sharing system gives the opportunity of having instant access to an electric scooter when being at central points of attraction. It also gives the opportunity to the tourists to wander around and explore a new town.

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4.2. PRIVATE OWNERS OF E-LIGHT VEHICLES

Accessibility and affordability are two of the main needs covered when using a scooter instead of a conventional vehicle, such as a car.

The scooter offers a fast and quick ride around the city. It also covers the needs of:

- ✓ using a vehicle which reduces fuel costs
- ✓ using a vehicle which reduces the carbon emissions

4.3. BUSINESS OWNERS OF E-LIGHT VEHICLES

No business owners of e-light vehicles exist in the area of Eastern Attica at the time being.

However, they could easily encourage sustainable mobility by implementing the use of electric scooters while working. This adoption would solve the main problems of late deliveries and servicing activities in general, which are being noticed in urban areas.

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5. POSSIBLE BUSINESS MODELS FOR THE IMPLEMENTATION OF ELECTRA

The business model that will be developed should correspond to the following:

- Give alternative solutions to motorised traffic (like sharing, short term rental)
- Reduce traffic congestion, noise and air pollution
- Solve the „last mile" problem by connecting users to public transport networks

Strategies towards sustainable transport – often described as the Avoid-Shift-Improve (A-S-I) approach – requires that governments adopt policies that encourage people and businesses to avoid or reduce the need to travel, shift to more carbon-efficient transport modes, and improve vehicle and fuel technologies, as well as to integrate climate-resilient goals into transport infrastructure strategies, all of which are highly dependent on specific country contexts.

Irrespective of the climate change agenda of each non pilot city, current investment flows are insufficient to meet transport infrastructure needs to support economic growth and social goals. To avoid lock-in into carbon-intensive and climate-vulnerable transport infrastructure development pathways, there is a need to shift investment towards sustainable transport.

A key challenge for Ele.C.Tra non pilot cities is to distribute costs and benefits on sustainable mobility across stakeholders in order to take into account the full social, economic and environmental co-benefits:

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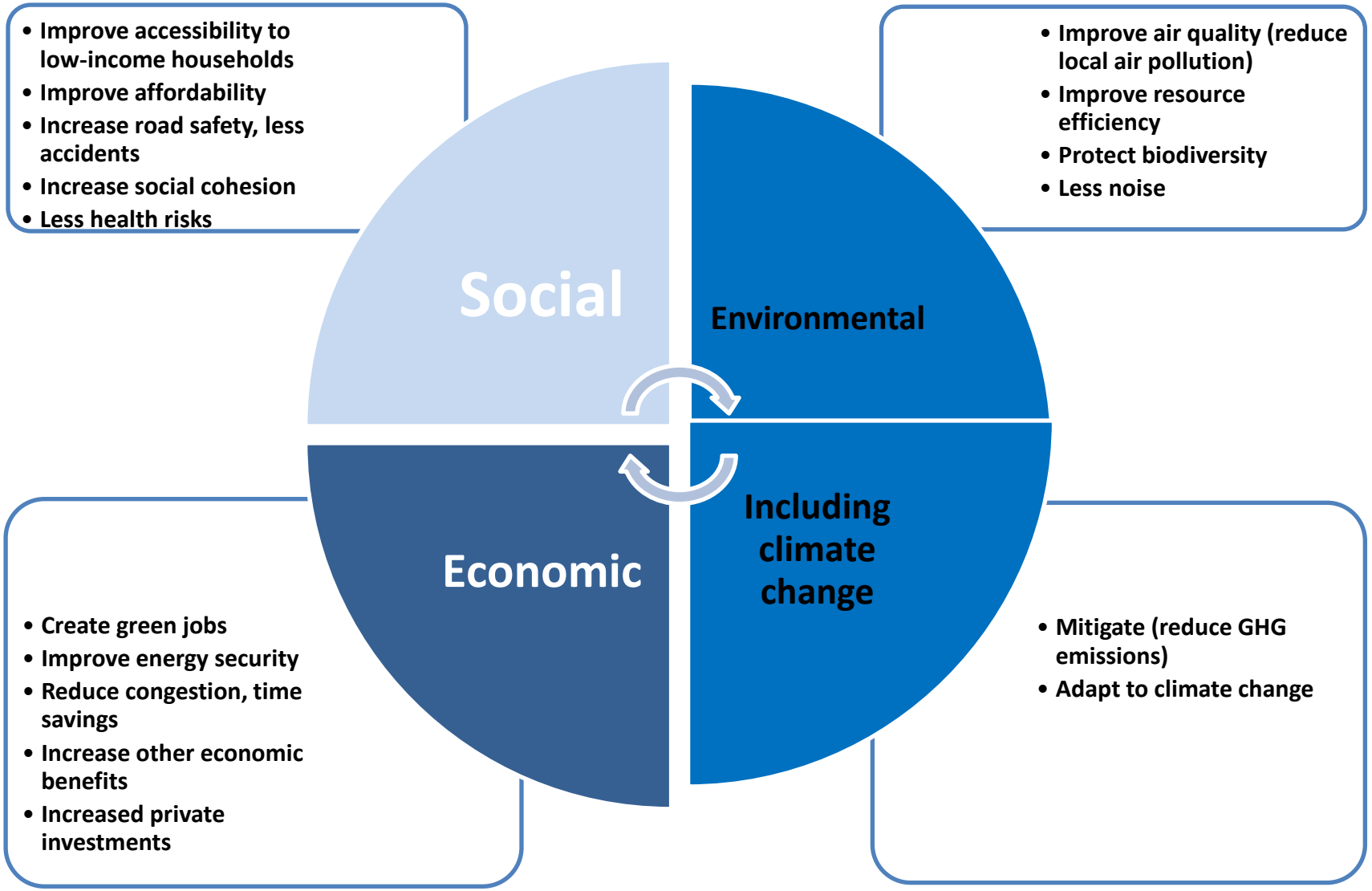

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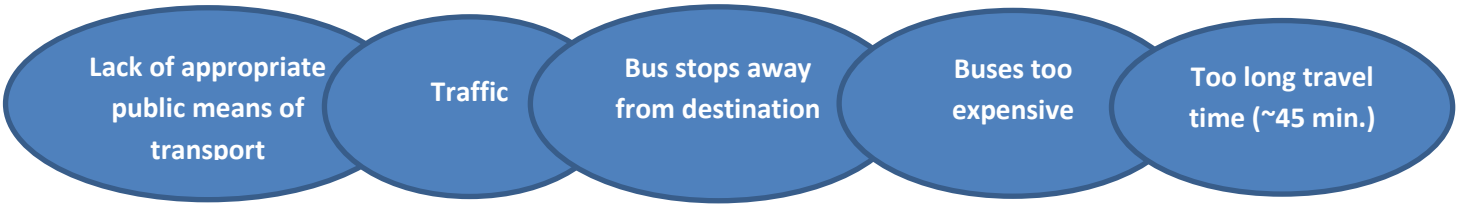
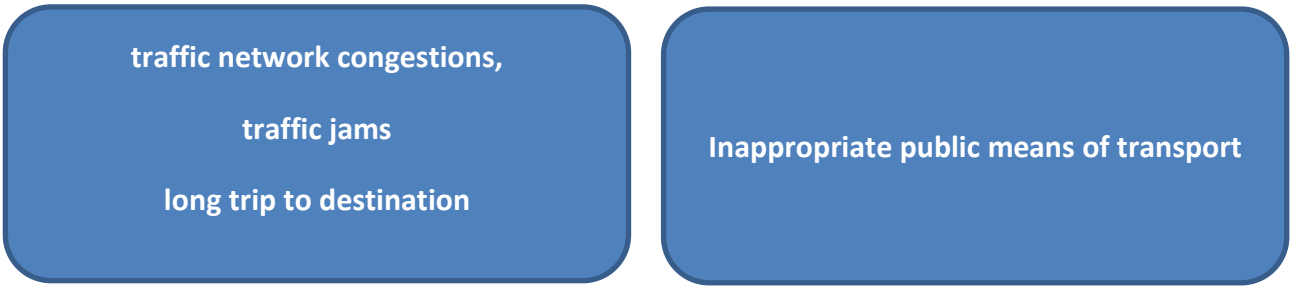
In order to build-up a business model, we need to take into account the following parameters:

- **Value proposition**

The critical points addressed in the area of Eastern Attica are the following:



Those lead to the following main constraints in terms of mobility infrastructure for Eastern Attica for future implementation of the Ele.C.Tra.:



Moreover, being a non-pilot city, East Attica has a high car dependency, while the ante-operam survey has revealed a lack of knowledge regarding alternative solutions to cars.

The users' needs in the case of Eastern Attica could be synopsized to the following scheme:

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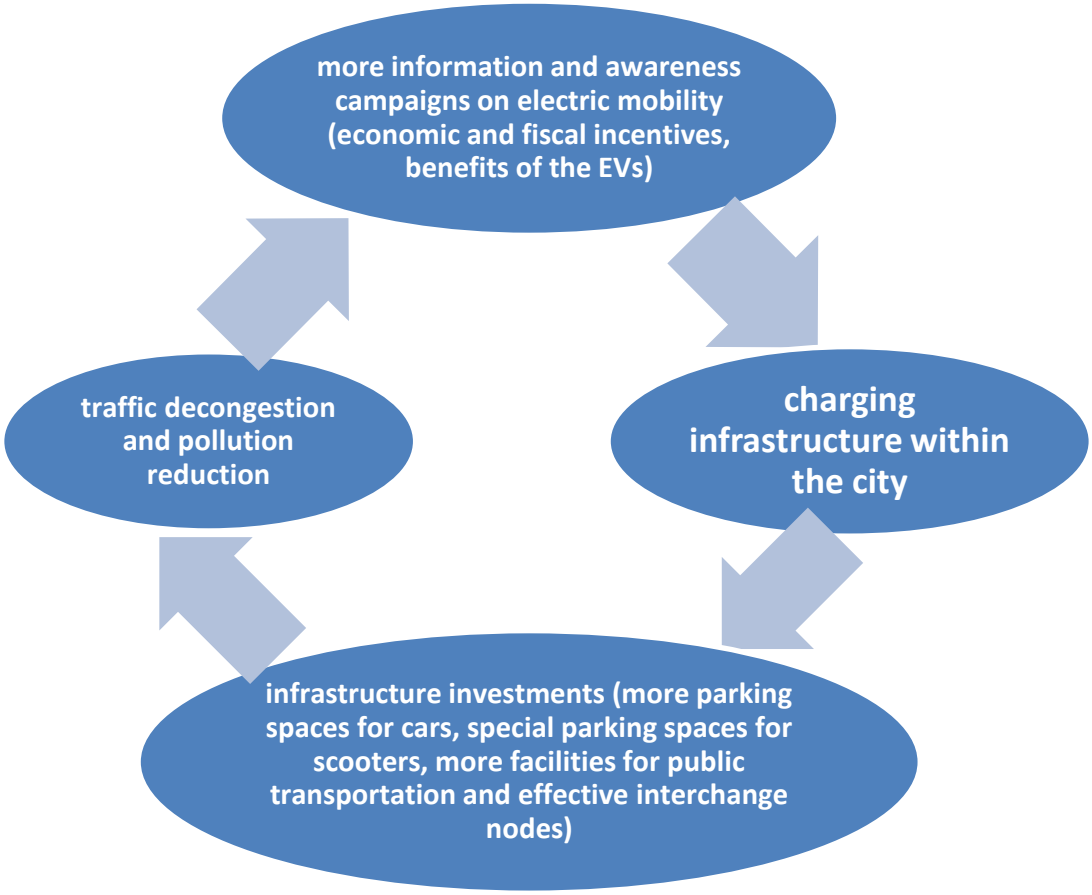

The current model should be suitable for e-scooters, also considering the mode of use (frequent short trips), more stops on the same day and in different areas too, the battery life (more than daily use) and recharge times (between 4 and 6 hours).

➢ **Customer segments**

A high percentage of people would be interested in testing, or even buying an EV. This fact reveals a good potentiality for sustainable mobility in the area of Eastern Attica. The solution most chosen by the residents was **ownership**, while the incentives that would be appreciated if implemented were the **discounts**, the **elimination of local and pollution tax**, as well as the introduction of **environmental bonuses**.

According to the residents' and tourists' perception, the main aspects of an electric vehicle are:

- **Strengths:** safety, speed, comfort, parking
- **Weaknesses:** high cost
- **Critical issues:** possibility of being stolen, charging, lack of knowledge
- **Benefits:** lower fuel costs, NO carbon emissions, noise reduction

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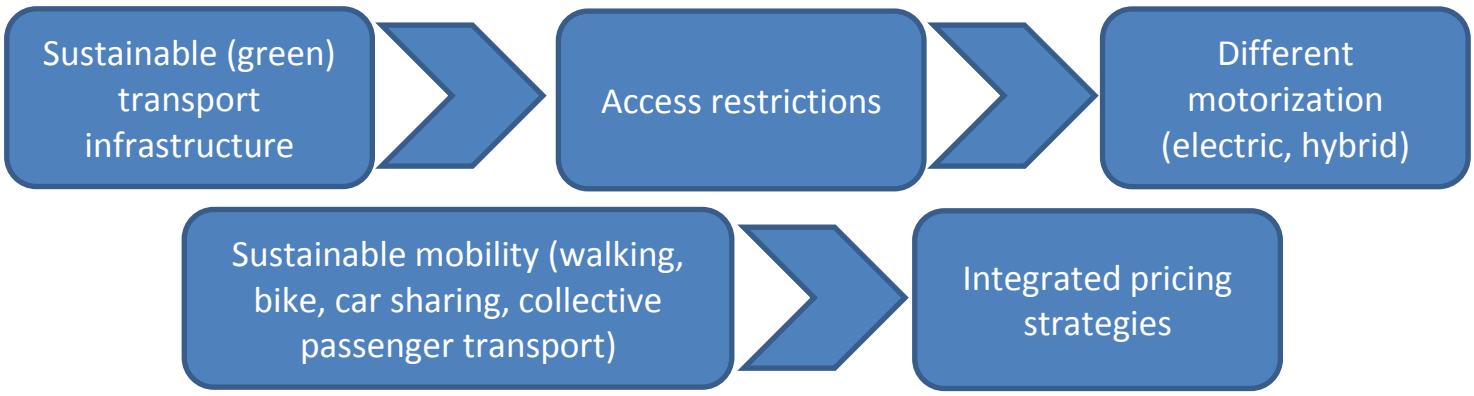
With regard to sustainable mobility, citizens and tourists of Eastern Attica set the following priorities:



- **Infrastructure**

One of the most critical issues is to choose the best locations for public charging installations and their optimal number for a network serving the entire East Attica.

The following common areas could be evaluated and then included in the service implementation:

- Road network: cars, motorcycle, scooter
- Public transport: bus
- Mobility: cycling, walking
- Parking: lack of parking
- International airport of "El. Venizelos" in Spata
- Ports: Rafina and Lavrion

Interoperability – Standardization

EU standards for charging infrastructure are necessary in order to ensure interoperability. Focus should be placed in the following areas:

- Hardware (ex. cables, plugs etc)
- Communication protocols or proposed standards (ex. RFID card standards)
- Interoperability Interfaces
- Guidelines for the required coding data for service providers

Regulatory Issues

The authorities responsible to discuss decide and provide the necessary regulatory framework that will support the spread of e-mobility should answer multiple questions such as:

Who is authorized and responsible for the development of charging points?

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This issue is related directly to the political decision of the model adopted regarding the deployment of emobility infrastructure. In any case rules may be defined related to the permission of installing the charging posts in public areas

What about the installation cost?

It has to do with the model of infrastructure deployment adopted.

Who is the charging post operator?

In the case of integrated market model it is mostly common for the charging post owner to have the role of charging post operator permitting access to different service provider through roaming contracts.

Further issues such as parking place acquirement, ownership of the infrastructure, grid reinforcement, and their depreciation mechanism, type of certificates necessary for the charging posts to be used, as well as, installation of public charging posts in areas with no big market interest, should be somehow clarified.

- **Channels**

The model identifies the following types of systems that could apply to a specific area:

1. Buying the e-vehicle by citizens or tourists, with discounts if possible;
2. E-vehicle hire for periods longer than a few days and until 6 months, focusing on workers' and students' needs;
3. E-scooter sharing for short periods (max a few days), mainly focusing on tourist needs or non-systematic resident trips but also for regular users;
4. End purchase of the e-vehicle after hire/sharing period in a cost effective way (e.g. several deposits until paying it out).

The e-scooter-sharing service is likely to be more successful economically if it provides a dense network and variety of vehicles, serves a diverse mix of users, creates joint marketing partnerships and designs a flexible but simple pricing system.

If EVs are to become a real alternative to internal combustion engine cars (ICEs), charging infrastructure has to be installed on both public and private land so that EV drivers can drive longer than the battery range allows. Most people are expected to charge their EV at home. However, there will be a need for charging points on public land too. Citizens living in apartment blocks without private parking facilities must have access to charging points. These charging points will also ensure that people who normally charge their EV at home can charge it on public land if the need arises.

- **Key activities**

The main activities that will be implemented during the non-pilot testing will cover the following:

1. Make all necessary studies in order to decide:
    a. The locations to which the charging stations will be implemented, as well as their characteristics (power supply, etc.);

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b. The amount and the characteristics of the electric vehicles that will be provided for public use.

2. Prepare the regulatory framework
3. Be in close cooperation with the municipality in order to be granted permission whenever needed.
4. Implement the charging stations.
5. Implement the electric vehicles sharing system.
6. Dissemination campaigns in order for the public to be informed.
7. Measurements regarding the correspondence of the residents and tourists towards the use of the electric vehicles.
8. Measurements regarding the environmental indicators that have been set.

➢ **Key partners**

The following are expected to play a key role during the whole phase:

1. Municipality of Eastern Attica, who will be responsible for formulating the necessary instructions and guidelines that will permit hosting charging posts, and will facilitate their deployment keeping the safety rules and the smooth use of pavements by the pedestrians;

2. Institution of Geoenvironment, who will ensure that sustainable mobility is sufficiently promoted;

3. Trained technicians, who will be responsible for connecting properly the charging stations;

4. Residents and tourists, to whom depends the success of the non-pilot testing;

5. The Municipalities of Eastern Attica, e.g. the Municipalities of Spata-Artemida, Rafina-Pikermi, Vari-Voula-Vouliagmeni, Marathonos, Paiania and Saronikos who will assist in the further dissemination of the non-pilot testing;

6. Electric vehicles suppliers, who will provide the municipality of Eastern Attica with a few vehicles from their fleet in order to assist in the e-vehicles sharing system;

7. Other regional and local authorities, who will be responsible for establishing:

   a. A national plan of e-mobility and the rules that will define e-mobility in Greece, by defining the roles of the old and the new players in the market

   b. The model of e-mobility and its deployment

   c. The licenses for the public charging stations

   d. The economic and other incentives to withdraw the barriers for the deployment of e-mobility

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6. ECONOMIC AND FINANCIAL ASPECTS OF THE MODEL

The main economic and financial aspects of the model could be synopsized to the following:

1. ***Capital costs***
2. ***Operational costs covering the maintenance of the vehicle(s)***
3. ***Estimation of usage levels***

6.1. SCOOTER SHARING SYSTEM

1. Capital costs are often expressed in terms of the "cost per scooter," defined as the total cost of the system—including stations, scooters, redistribution equipment, the control center and other equipment—divided by the total number of scooters in the system.

The capital costs include the assets, such as vehicles, stations (including docking spaces and terminals), IT system components, control center, maintenance equipment, and service and redistribution vehicles.

The cost of a single scooter can range from as little as 1,000€ to as much as 4,980€ for scooters with advanced systems. The acquisition of different types of e-vehicles could reduce the purchasing costs. For instance, it would be cheaper to create a fleet with 10 electric scooters and 10 electric bicycles than to create a fleet with a total of 20 electric scooters. Government funding is often used to cover capital costs, in which case the government owns the assets, and it is sometimes used for operating costs. A win-win option would be the cooperation of the public and private sector. Each sector would be responsible for providing an asset. For instance, the municipality could provide the docking spaces and the charging stations, while an electric vehicle company could provide its vehicles for the sharing purposes.

Stations, specifically the docking spaces, often represent the single largest capital cost in many systems. However, a greater number of docking spaces helps reduce operating costs by reducing the need for redistribution. By developing synergies with more suppliers, the cost can be further reduced.

Developing software is the most expensive option, though the intellectual property can often bring medium-term return on investment through the sale or licensing of the software to other systems. During the project's lifetime, an e-platform was developed, where the residents / tourists of Eastern Attica have the opportunity to search for available e-light vehicles and to book an e-vehicle.

E-vehicles-share depots and mobile maintenance units present an opportunity for cost sharing, as most communities have depots for buses or other public goods and services, as well as maintenance staff. Cost sharing can greatly decrease capital investment in such facilities and personnel.

2. Common **operating costs** are expressed in an annual-per-vehicle amount and can range drastically depending on redistribution mechanisms and needs, labor costs and service level delivery.

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A system's operating expenditure should be based on the number of people, as expressed in the number of trips, using it.

Staffing needs include administration and management, maintenance, redistribution, and customer service. In order to avoid

Redistribution is broadly defined as the rebalancing of vehicles from stations that are near or at capacity to stations that are close to empty. Successful redistribution is critical to the viability of the system from the customer's perspective, and redistribution is one of the greatest challenges of operating a scooter sharing system, accounting for as much as 30 percent of operating costs in European systems.

Maintenance is another large line item under operational costs. Maintenance includes the stations and vehicles, and covers both preventative and repair activities.

The cost of the control and customer service center depends on the goals of the system and the environment in which it operates. A fully automatic service would be more convenient.

Another important operational cost to consider is promotional material and activities associated with running the system. Thanks to the evolution of technology, the system could be rapidly promoted via the Internet in social medias.

The cost sharing could also be applied here, by the cooperation of two or more private entities. Each of the entities will have a specific responsibility (e.g. renting the electric scooters, renting the other electric vehicles, maintaining the charging stations, etc.) and all together will operate the sharing system.

3. Demand is often estimated using what is called an uptake rate, which is an assumption of the likely **usage** as a percentage of the residential population of the coverage area. The survey conducted in the area of Eastern Attica was really promising, so we would expect an 80% of the residents and tourists to use the system.

We should also examine two additional aspects:

4. Projected revenue

To estimate revenue, we need to multiply the demand estimations for usage against the proposed revenue structure. The revenue includes the membership fees and user pricing.

Many scooter sharing systems cannot cover the operating expenses from membership and usage fees alone, which is not unusual for a public transportation system.

There are two types of user fees in most scooter sharing systems: subscription fees and usage fees. Subscription requires the customer to register and allows them unlimited access for a certain time period—a day, week, month, or year. Usage fees are then charged during the time the scooter is in use.

5. Percentage of total trips by casual / long-term members

This metric can reveal which of the two user groups will generate the majority of the system's revenue. In most systems, casual users are charged a higher price per day than annual users, and casual users are the source of more revenue, even if in numbers they are not the largest user group. Casual users are less familiar with the scooter sharing system in a city and are therefore more likely to be charged fees for exceeding time limits.

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6.2. PRIVATE OWNERS OF E-LIGHT VEHICLES

A potential user would consider the capital cost for purchasing an electric scooter as prohibitive. As explained above, the cost of purchase can vary between 1,000€ and 5,000€. The majority of the population would not be very interested in buying an electric vehicle.

However, in a long-term use, the capital cost is being balanced by the operational costs. Earlier, owing an electric vehicle would cost a bomb. But with more technological advancements, both cost and maintenance have gone down. The mass production of batteries and available tax incentives have further brought down the cost, thus, making it much more cost effective. Compared to using a conventional vehicle, an electric scooter needs considerably less money in order to operate. Additionally, it is easier to use, plus it proves to be a great asset when realizing a trip during rush hours (7-9 in the morning & 5-7 in the afternoon).

Moreover, most of the population is expected to use the electric scooters for realizing trips to their work and back home. This results to a high percentage of usage, which results to a higher rate of depreciation.

6.3. BUSINESS OWNERS OF E-LIGHT VEHICLES

The acquisition of an electric scooter would considerably reduce the initial costs running in a business. This could be achieved via fuel cost savings, a federal tax credit, and state incentives.

Electric vehicles offer a great reduction in transport costs for businesses, especially for fleet vehicles with regular journeys of up to 100 km per day. For instance, a delivery company would spend a great amount of money in fuel, in order to make all necessary deliveries. An electric scooter used for business purposes leads to great savings of money that could be used for investing in something else, e.g. for purchasing more advanced equipment.

While the ongoing running costs are highly attractive to businesses, the initial investment costs of electric vehicles can be significant. This could be solved by getting a grant (the NSRF could provide several funding opportunities for businesses) or other support to make electric vehicles an easier choice.

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7. THE APPROPRIATE TECHNOLOGY AND INFRASTRUCTURE

➢ **Electric vehicles**

The categories of electric vehicles, which can meet the characteristics of the project, include the following:

- two-wheeled (scooters , for example)
- three-wheeled (tricycles)
- four-wheeled (quadricycles)

In summary we have:

- mopeds: two- wheeled vehicles, three-wheeled vehicles or quadricycles with a max speed of 45 km/h and a motor max power of 4 kW
- motorcycles: two- wheeled vehicles, three-wheeled vehicles or quadricycles with a max speed higher than 45 km/h and a motor max power higher than 4 kW

In the following table, there are further details about type of vehicles and licences in accordance with each rule and law framework in Greece.

	DIRECTIVE/LAW	VEHICLE CATEGORIES	VEHICLE CHARACTERISTICS	LICENSES
GREECE	separate law framework for e-scooters	Moped Μοτοποδήλατο (“motopodilato”)	max speed of 45 km/h max power of 4 kW	AM (min 16 y.o.)
		Motorcycle Μοτοσυκλέτα (“motosikleta”)	speed and power higher	A1 (min 18 y.o) A2 (min 18 y.o)

In consideration of the greater diffusion of e-scooters in Southeast Asia, it is easy to find an important number of Chinese suppliers.

However, the e-vehicle quality component is an important aspect. For example, the battery can be considered one of the fundamental components that determine substantially the basic performance of the EV (speed, and cost of maintenance parts, etc.). Even the possibility of removal of the battery may affect the performance, in this case for the charging of EV.

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Consequently, the aspects that influence the choice of an EV can be several.

In this light, it is possible to identify the following aspect that could influence the choice of the type of e-vehicles:

- specific weather conditions (e.g. too cold in winter)
- geographical characteristics (e.g. mountains or hills)
- e-charging network and spread of charging points
- road infrastructure critical issues (e.g. width or type of pavement of the main roads)
- strong vehicle congestion in the main roads in cities, that could limit the speed of vehicles

In the Table below, the EV types have been classified according to the type (mopeds or motorcycle):

	POWER	
	≤ 4 kW	**> 4 kW**
SPEED	≤ 45 km/h	> 45 km/h
BATTERY LIFE (km)	30 km-80 km	60 km-80 km
TYPE OF BATTERY	Litium, silicon, silicon gel, lead	Litium, silicon, silicon gel
CHARGING TIME	from 1h to 6 h	from 1h to 6 h
CHARGING CYCLES OF BATTERY	from 400 (silicon, silicon gel, lead) to 2000 (litium)	from 400 (silicon, silicon gel, lead) to 2000 (litium)
MOVABLE/FIXED BATTERY	both	both
CHARGING CONNECTORS	Schuko for household charging 16A single-phase (3A type) for public access areas However there are plug adaptors	Schuko for household charging 16A single-phase (3A type) for public access areas However there are plug adaptors

The main technical characteristics of the vehicles within the specific project users' target are presented in the following table:

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TARGET	POWER	TYPE OF BATTERY	MOVABLE BATTERY	OTHER
SYSTEMATIC SHORT TRIPS (WORKERS AND STUDENTS)	≤ 4 Kw	Lead Lead Gel Silicon Gel Lithium	better YES	
SYSTEMATIC LONG TRIPS (WORKERS AND STUDENTS)	> 4 Kw	Silicon Gel Lithium	better YES	
NON-SYSTEMATIC TRIPS (TOURISTS AND RESIDENTS)	both	Lead Lead Gel Silicon Gel Lithium	Not relevant	2 or more seats in each vehicle
FIRM FLEETS FOR INTERNAL/SHORT TRIPS	<= 4 Kw	Lead Lead Gel Silicon Gel Lithium	better YES	
FIRM FLEETS FOR URBAN TRIPS	> 4 Kw	Silicon Gel Lithium	better YES	
GARAGE	Not relevant	Not relevant	better YES	
SHARING	Both	Silicon Gel Lithium	Not relevant	helmet compartment in every scooters
CHARGING IN OWN DESTINATION	Not relevant	Lead Lead Gel Silicon Gel Lithium	YES	

- **Infrastructure**

In order to initiate the experimentation process, we have come to the conclusion that a total of 10 charging stations would be sufficient for promoting the project and for gaining the population's interest during the first phase of implementation. After a few years (e.g. by 2020) we expect that:

- The depreciation rate of the charging stations will have gradually achieved the desired level;
- The promotion and dissemination of the network will have led to a sufficient percentage of electric scooter users (both residents & tourists).

These two facts will permit the installation of more charging stations.

A critical issue to be taken into consideration is the type of standardized sockets, plugs, as well as which type of Charging Point infrastructure is the most convenient.

- In most European countries the standard outlet is 230V, 16A, up to 3,7kW, which allows to obtain 10kWh of a typical medium-sized vehicle with max three hours of charging

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time and offers adequate power for overnight charging (typical practice for both private and commercial electric vehicles).

- The charging can be performed with a DC or an AC connection between the vehicle and the charging post.

AC Charge Points

the AC to DC power conversion takes place on-board the EV,

Charging times: 1÷8 hours for standard charging or approximately half hour for fast charging

DC Charge Points,

the AC to DC power conversion takes place off-board the EV,

Charging times: approximately half hour for standard charging.

Mixed AC/DC Charge Points,

In the DC case, a fixed battery charger has to be connected to the battery, and heavier and more expensive fixed infrastructure is thus necessary. The DC charging stations may be:

- regulated, where the charging current dispensed by the charger is controlled by a communication signal from the vehicle, or unregulated, where this current is controlled on-board the vehicle; corresponding in this case to a DC grid;
- isolated, where there is a galvanic separation between the DC connection and the AC grid (through transformer) or non-isolated where the DC connection is galvanically connected to the AC grid.

- Charging modes

The **IEC 61851** standard requires that all charging installations be protected by a residual current device (RCD), which will protect persons against electric shock in case of failure of the isolation.

Mode 1 charging: connection of the EV to the AC supply network (mains) utilizing standardized socket-outlets not exceeding 16 A and not exceeding 250 V AC single-phase or 480 V AC three-phase, at the supply side, and utilizing the power and protective earth conductors.

Mode 2 charging: connection of the EV to the AC supply network (mains) not exceeding 32 A and not exceeding 250V AC single-phase or 480 V AC three-phase utilizing standardized single-phase or three-phase socket-outlets, and utilizing the power and protective earth conductors together with a control pilot function and system of personnel protection against electric shock (RCD) between the EV and the plug or as a part of the in-cable control box. The inline control box shall be located within 0,3 m of the plug or the EVSE or in the plug.

Mode 3 charging: connection of the EV to the AC supply network (mains) utilizing dedicated EVSE where the control pilot function extends to control equipment in the EVSE, permanently connected to the a.c. supply network (mains).

Mode 4 charging: connection of the EV to the AC supply network (mains) utilizing an off-board charger where the control pilot function extends to equipment permanently connected to the AC supply.

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- Charging Post Power Level

Both fast and standard charging stations should be considered.

Standard charging stations (Level 2) at homes, workplaces, transport stations (medium and long terms), hospitals, malls, hotels, public parkings in order to ensure the recharge in common places.

Fast charging stations on highways, public parking and strategic locations in the city to ensure user's recharging on their trips and their way back. Fast charging stations along major highways connecting the larger cities are very important, especially in a country where long distances are common.

It’s useful to highlight the fast charging system is now in phase of experimentation and it’s mainly addressed to e-cars only.

Also the following issues should be taken into account,

- Possibility of dedicated parking area.
- The use of land of each specific area (households, offices, industrial area), and the type of buildings (single houses with or without yard, apartment buildings with or without parking).

- Charging post location

The development of the EV charging infrastructure needs to be the optimal in order to serve the immobility without overestimating the investments needed.

The charging points need to be installed at appropriate places that easily serve the EV users’ needs. Furthermore, the selection process needs to take into account certain other aspects such as:

- Area (urban, rural etc)
- Use of land of each specific area (households, offices, industrial area),
- Type of buildings (single houses with or without yard, apartment buildings with or without parking).
- Existence of grid infrastructures nearby / Required grid reinforcements,
- Restrictions of the power system,
- Accessibility,
- Visibility,
- Convenience,
- Coverage area,
- Parking place
- The combined usage of other transport means (i.e. near train stations),
- Trip behavior,
- Future upgrades on e-mobility network

The main charging characteristics for e-charging are summarized in the table below:

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	PUBLIC AREAS	PRIVATE AREAS WITH PUBLIC ACCESS	PRIVATE AREAS
E-VEHICLE CHARGING MODES (IEC 61851-1)	Mod 2/Mod 3	Mod 2/Mod 3	Mod 1/Mod 2/Mod 3
RFID VEHICLE IDENTIFICATION SYSTEM	yes	-Yes, in case of energy trade -No, with free energy supply	Not necessary
SOCKET (IEC 69-6)	Socket for single-phase 16A connector (3A type) for e-charging in public access areas	Socket for single-phase 16A connector (3A type) for e-charging in public access areas	Socket for: -Schuko connector for household e-charging -single-phase 16A connector (3A type) for e-charging in public access areas
SAFETY SYSTEM COMMUNICATION SYSTEM VEHICLE/INFRASTRUCTURE (IEC 61851-1)	Present in the e-charging point and light e-vehicle with safety system	Present in the e-charging point and light e-vehicle with safety system	Not necessary

- Charging Point Equipment

The required equipment for charging point installation depends on host and the location (households, apartment buildings, airports, ports, park facilities etc). Some equipment options that charging point designer should evaluate are:

1. Single or Multiple Charge Interface Pillars,
2. (Under)ground vaults,
3. Protection Equipment.

The charging points for electric vehicles are currently characterized by considerable cost for the charging station that include the infrastructure and the system of management and control (Motherboard and Identification System).

Nevertheless in large urban areas of Mediterranean Europe the strong diffusion and the good predisposition of residents and tourists to use light electric vehicles, such as scooters, could develop a network of "light" charging more focused on the spread of points and connection sockets rather than the station itself, changing the model and how to charge e-vehicles.

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8. THE IMPACT OF THE SUGGESTED SCENARIOS ON THE ENVIRONMENT

The indicators that will be applied in order to measure the project implementation's impact on the environment will be the following:

Category: TRANSPORT

During the period 1995-2007 inland freight transport increased more than GDP in EU-27 (Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden and the United Kingdom) by almost 43% and by 66% in the new Member States. The major contributor was road transport which increased by 54% in EU-27 and by 145% in the new Member States.

Freight and passenger transport contribute not only to greenhouse gas emissions but also to air pollution and noise, and have negative impacts on biodiversity, due to landscape fragmentation caused by transport infrastructure.

Category: ENERGY INTENSITY

The EU aims at improving energy efficiency by 20% by 2020. Energy intensity (energy consumption per unit of GDP) has constantly decreased in the EU since the 1990s and in 2006 was around 202 kg tones oil equivalent per 1000€ GDP. Energy intensity has halved in the new Member States since 1993. In EU-15 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom) it has decreased by almost 17% since 1991.

Category: CLIMATE CHANGE

The aim here is to limit emissions of CO2 and other GHG and to stabilize the concentration of GHG in the atmosphere at a level that would limit dangerous anthropogenic interference with the climate system. This implies strengthening efforts to implement related national and international strategies and to further decouple GHG emissions from economic growth

The indicators presented here relate to GHG emissions and to CO2 emissions from energy use.

Data on GHG emissions are reported annually to the Secretariat of the UNFCCC.

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The total CO_2 emissions in Greece during the period 1990-2012 are shown below:

	Gg CO_2 equivalent					Change from 1990
Party	1990	2000	2010	2011	2012	to 2012 (%)
Australia	276 138	346 621	399 365	398 161	397 831	44.1
Austria	62 018	65 993	72 366	70 354	67 733	9.2
Belarus*	103 807	53 319	58 298	55 381	57 491	–44.6
Belgium	118 989	125 152	113 429	104 271	100 659	–15.4
Bulgaria*[a]	90 092	45 523	47 721	53 197	48 364	–46.3
Canada	459 038	567 738	554 408	557 290	550 547	19.9
Croatia*	23 340	20 100	21 330	20 918	19 233	–17.6
Cyprus	4 627	7 038	7 832	7 566	7 083	53.1
Czech Republic*	164 694	126 130	117 141	115 069	111 302	–32.4
Denmark	54 200	55 277	50 420	45 475	40 799	–24.7
Estonia*	36 701	15 149	17 803	18 427	17 079	–53.5
European Union[b]	4 437 028	4 135 980	3 907 816	3 767 424	3 717 117	–16.2
Finland	56 644	56 829	63 488	56 403	50 733	–10.4
France	398 770	415 079	391 076	364 819	368 845	–7.5
Germany	1 042 066	891 516	829 402	810 441	821 718	–21.1
Greece	82 998	102 572	96 758	94 251	90 472	9.0
Hungary	84 378	58 681	51 008	49 859	46 072	–45.4
Iceland	2 160	2 776	3 432	3 333	3 324	53.9

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The total N_2O emissions in Greece during the period 1990-2012 are shown below:

	Gg CO_2 equivalent					Change from 1990
Party	1990	2000	2010	2011	2012	to 2012 (%)
Australia	18 354	25 478	24 452	25 201	25 775	40.4
Austria	6 198	6 291	5 179	5 283	5 222	–15.8
Belarus*	20 127	14 414	15 891	16 640	16 400	–18.5
Belgium	10 900	11 030	8 329	7 037	6 991	–35.9
Bulgaria*[a]	14 633	5 425	4 848	4 798	5 028	–65.6
Canada	49 169	48 645	47 157	45 918	47 733	–2.9
Croatia*	3 954	3 335	3 395	3 504	3 268	–17.4
Cyprus	551	651	613	615	612	11.1
Czech Republic*	13 483	8 768	7 701	7 861	7 727	–42.7
Denmark	9 821	8 091	6 070	6 136	5 992	–39.0
Estonia*	2 244	912	967	972	1 009	–55.0
European Union[b]	527 804	423 115	343 094	340 892	333 639	–36.8
Finland	7 400	6 501	5 438	5 266	5 185	–29.9
France	91 626	78 465	60 600	61 160	57 766	–37.0
Germany	85 321	61 256	54 562	56 846	55 798	–34.6
Greece	10 225	8 641	7 513	7 209	6 811	–33.4
Hungary*[a]	17 089	8 466	6 540	6 824	6 757	–60.5
Iceland	521	495	453	448	458	–12.1

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Category: AIR QUALITY

Main concerns in this category relate to the effects of air pollution on human health, ecosystems, and buildings, and to their economic and social consequences

The main challenges are to further reduce emissions of NOx and other local and regional air pollutants in order to achieve stronger decoupling of emissions from GDP and to limit the exposure of the population to air pollution. This implies implementing appropriate pollution control policies, technological progress, energy savings and environmentally sustainable transport policies.

Category: NOISE LEVEL

As mentioned above, a main advantage deriving by the electric vehicles use is the reduction of the noise compared to the one produced by conventional vehicles.

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9. PLANNED ACTIVITIES FOR THE INTRODUCTION OF E-LIGHT VEHICLE SHARING SYSTEM

The following activities have been planned in order to introduce the e-light vehicle sharing system to the public:

1. Determine the location of the charging station
2. Evaluation for the adequacy of the grid at the proposed locations for the municipality of Eastern Attica
3. Finalization of the localization process (final positions)
4. Get the permission of installing the charging post to the locations
5. Prepare the regulatory framework, but also the regional and local authorities
6. Charging station and electric vehicles supply
7. Installation of the charging units
8. Connection to the grid – electrification
9. Dissemination events in order to inform the public

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10. REFERENCES

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