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**ElectricCityTransport – Ele.C.Tra**

# D.6.5 Feasibility Study for Murcia

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**ElectricCityTransport – Ele.C.Tra.**

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## 1. SHORT OVERVIEW OF THE STATE OF THE ART

Economic development and population growth in urban areas in recent years has created new challenges for urban mobility. For this reason it is necessary to make constant efforts so that the mobility solutions that are implemented in our cities serve to converge to a sustainable scenario.

In the transport sector, almost 99% of the energy needs are covered by petroleum products, which represents an extreme dependence on imported non-renewable energy sources and whose combustion is the main source of generation of greenhouse gases. This causes a considerable increase in air pollution in urban areas, where vehicular traffic is the main source of pollution.

To avoid this, for years a work has been done to transform the current transport system into one that is environmentally and socially sustainable, that is, to develop a transport system that contributes to the economic and social welfare without depleting natural resources, destroying the environment or harming human health. And it is in this scenario that the electric vehicle assumes a key role in reducing the growing need for petroleum products.

### Electric mobility in the Municipality of Murcia

In the city of Murcia the development and growth of electric mobility has been promoted as the centerpiece of a better and more effective sustainable mobility.

The commitment to the use of electric vehicles in Murcia serves to optimize mobility in the Municipality, which, due to its demographic characteristics and geographical distribution, where there are large groups that perform daily moderate length movements to and from the center of the city, makes the electric vehicle an ideal solution.

In line with the **Local Strategy to Combat Climate Change (ELCC)** and in cooperation with **the EU Covenant of Mayors**, Murcia promotes the replacement of fossil fuels with clean energy sources. In this sense, presently the city of Murcia has one of the proportionately biggest municipal fleet of electric and reduced emissions vehicles in Spain. The maintenance of parks and gardens and cleaning services use electric vehicles for daily work assignments and help to maintain the city clean while avoiding the emission of polluting gases and noise generation.

On the other hand, the Local Agency for Energy and Climate Change (ALEM) is working on the **Local Strategy on Electric Vehicle (ELVE)** of the Municipality of Murcia where the fundamental objectives and priority actions to promote affirmative action for electric vehicles are defined.

This strategy includes a set of measures boosting the demand for electric vehicles, the realization of bigger and most modern infrastructure of electric charging points and increase in public awareness through advocacy and outreach campaigns.



Similarly, the activities of ELVE will allow to adapt the urban environment of Murcia to this new type of vehicles, encouraging their use and changing citizens 'mobility habits, which undoubtedly will serve to promote the complementarily and gradual alternation between conventional and electric models.

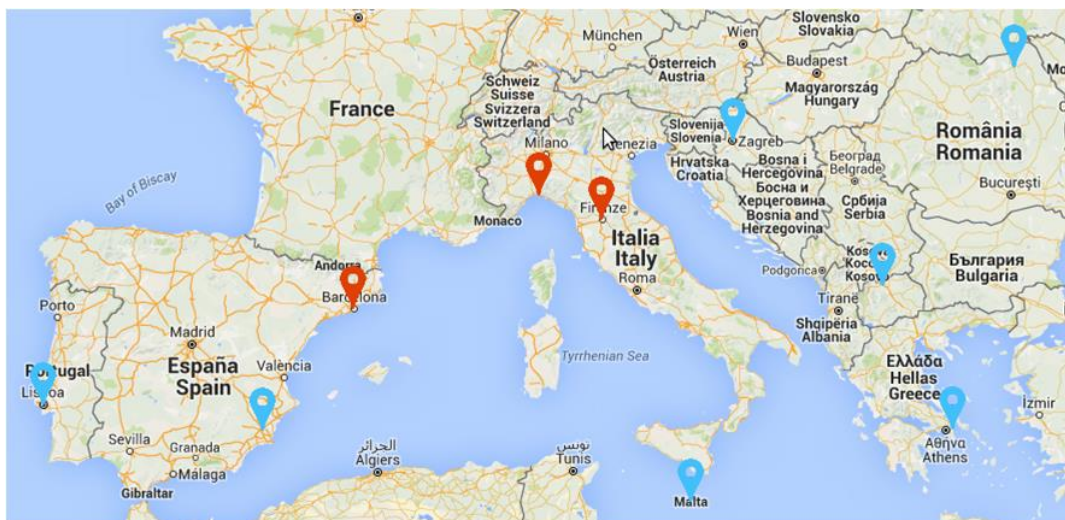
The objective of a gradual increase in the ratio of electric to conventional vehicles will have a positive impact on the Municipality, through greater air quality, lower noise pollution and economic savings for the users of these electric vehicles.

The expected penetration of electric mobility in the Municipality will contribute to the improvement of the expected results of the Covenant of Mayors, helping in particular to reduce the emissions of greenhouse gases by 20% or more by 2020.

**Project EleCTra in Murcia**

Murcia is one of 11 partners from 8 countries, as can be seen in Map 1, participating in the Project EleCTra, which aims to introduce loan systems for electric motorcycles in urban environments.

Map 1: Electric City Transport (EleCTra). Participating cities



Source: European Union, EleCTra WebApp

Regarding the development of the supply of sustainable mobility in our city, it is worth noting the existence of a private market for electric vehicle, consisting of two Murcian companies collaborating in the project: Emisiones 00 and Murcia SobreRuedas. Taken together, these companies have a fleet of more than 120 motorcycles for sale, rent and sharing. There is already a rental service of electric motorcycles, with daily and monthly and yearly options. The annual rent mode allows for rent-to-own, that is, after using the service for a year, user can buy the motorcycle for its residual value.

Regarding the electric charging points, as can be seen in Map 2, Murcia has a network of 9 charging points for the electric vehicles distributed throughout the city, with 1 of them being public charging point and 8 being privately run points for public use.

Map 2: Network of charging points for electric vehicles. Murcia. November 2015



Source: European Union, EleCTra WebApp

As for the available supply close to Murcia forming the auxiliary network of charging points, towns like Cartagena (6), Lorca (1), Orihuela (4), Torreveja (4) and Alicante (12) contribute more than 27 electric vehicle charging stations. The characteristics of these charging points are heterogeneous, being chargers both publicly and privately managed, located in commercial areas, car parks and other areas of influence.

In this scenario, the incentives that have been launched in the city in recent years for the promotion of electric mobility must be pointed out. Among them we find discounts and incentives in line with the principles of EleCTra project, like free parking areas and incentives for the purchase of electric motorcycles.

Regarding the reserved parking areas, recently 20 places for e-scooters have been created and indicated in strategic places of the city, all of which serve a double purpose. Firstly, they encourage the purchase of these vehicles and secondly, promote the visibility of these vehicles among the citizens of Murcia.

Regarding the incentives at national and regional level, it is worth noting the project MOVELE led by the Institute for Diversification and Energy Saving (IDEA), which pursues the introduction of electric or plug-in vehicles of different categories, performance and technologies in urban environments for the use of broad group of companies, institutions and individuals, as well as installing recharging points for these vehicles.



Among the various annual calls by IDAE for strategic projects for energy saving and efficiency, there is an option to receive support for the renewal of large fleets with energy-efficient vehicles, including electric vehicles.

Regarding the dissemination and development activities related to electric mobility held in the city of Murcia it is worth noting "Seminar with the Spanish Network of Intelligent cities", "The regional Event for the EleCTra Project" and "The shooting of the EleCTra Project Spot" on the streets of Murcia. Similarly, the European Mobility Week of 2014 and 2015 allowed bringing electric motorcycles closer to citizens through exhibitions and free trials on public roads thanks to the collaboration of two local companies which sell and rent electrical motorcycles: Emisiones 00 and Murcia SobreRuedas.

As for the planned future actions for the development of electric mobility, it should be noted that, while there is a political will to amplify the network of the available charging points, there is no line of funding available for this investment. Similarly, it is the limited funding that limits the offer of new incentives for the promotion of electric vehicles.

In any case, despite the limitations due to the awareness and commitment of the City of Murcia regarding the importance of developing sustainable mobility, there are scheduled events for the dissemination and promotion of electric vehicles among the citizens of the municipality. Other dissemination activities in the social networks and various official websites will be launched with the aim to inform and promote the use of electric vehicles in Murcia.

In short, electric mobility is one of the pillars on which rests the sustainable scenario that the city wants to take. The Local Strategy on Electric Vehicle is in the process of creation. It will include the contributions and participation of various social partners and stakeholders, thus the Municipality of Murcia will have the outlines of its electric mobility policy to further develop sustainable mobility in its local area.





## 2. SWOT ANALYSIS OF THE INTRODUCTION OF ELECTRA MODEL

The development of the electric motorcycle in Murcia presents clear advantages, as there is a need to strengthen and promote new models of more efficient and sustainable urban mobility in terms of energy consumption, not incurring negative externalities such as those generated at the moment by conventional vehicles.

This analysis takes the form of a matrix in which there are reflected and identified both the external opportunities and threats that may affect the introduction of EleCTra model in the Municipality of Murcia, and the strengths and weaknesses associated with the project itself.

As we can see below, depending on the deployment area (shared / private / business), there is a series of different internal and external factors. However, these aspects should be taken into account when searching for an interrelation which would allow the positive factors to minimize or offset the negative ones in these three systems.

In the **internal analysis**, Table 1, of the current and future framework of electric vehicles, we can see a number of weaknesses (traits that though are under control, limit the ability to achieve the desired goals) and a number of strengths (positive intrinsic attributes) of the electric vehicle itself.

At the same time, **there are exterior factors** detailed in Table 2, not associated exclusively to the electric vehicle, which must be analyzed to offset them in the case of threats (as they may jeopardize the achievement of the objectives) or to use them, when dealing with possible opportunities (as they are positive and attractive).

**Table 1:** Summary of the **internal analysis** of the introduction of EleCTra model by sectors (SCOOTER SHARING SYSTEM "S", PRIVATE OWNERS OF E-LIGHT VEHICLES "P", BUSINESS OWNERS OF E-LIGHT VEHICLES "B")

<b>WEAKNESSES</b>		<b>S</b>	<b>P</b>	<b>B</b>
W01	Misinformation among citizens about the electric vehicles			
W02	Limited supply of auxiliary services related to the electric vehicle			
W03	Need of improved and cheaper batteries			
W04	Reduced range of the vehicle			
W05	High cost of the maintenance of the charging infrastructure			
W06	Road safety problems due to the low noise emissions			
W07	Limited public charging infrastructure			
W08	Electric vehicles are not seen as energetically viable			
W09	Long charge time			
W10	Lack of standardization of batteries and charging systems (connections)			
W11	High cost of the public recharging infrastructure			
W12	Insufficient commercial supply of electric vehicles			
W13	High price of the vehicle compared to its performance			
W14	Low number of electric vehicles in the fleets			
W15	High seasonal temperatures that affect the battery life			
<b>STRENGTHS</b>		<b>S</b>	<b>P</b>	<b>B</b>
S01	Increased energy efficiency			
S02	Non-polluting vehicle			
S03	Conditions of comfort similar to the internal combustion vehicles			
S04	Acceleration 0-100 km / h comparable to conventional vehicles			
S05	High degree of satisfaction among users			
S06	Ease of parking			
S07	Simpler mechanics of the electric vehicles			
S08	Predictable and lower maintenance costs			
S09	Low noise emissions			

Source: Own elaboration.

**Table 2:** Summary of the **external analysis** of the introduction of EleCTra model by sectors. (SCOOTER SHARING SYSTEM "S", PRIVATE OWNERS OF E-LIGHT VEHICLES "P", BUSINESS OWNERS OF E-LIGHT VEHICLES "B")

THREATS		S	P	B
T01	Recycling and / or management of used lithium ion batteries			
T02	Increase in price of lithium if the reserves are limited and the demand is high			
T03	Simultaneous existence of the hybrid vehicle			
T04	Increasing efficiency of internal combustion engines			
T05	Complexity of the sector and lack of a standard model of electric motorcycle			
T06	Absence of specific legislation regarding massive installation of charging stations in buildings			
T07	Uncertainty of the electricity prices			
OPPORTUNITIES		S	P	B
O01	Daily trips compatible with current battery range			
O02	Promotion of new auxiliary industries			
O03	Improvement of the image of the fleets of the institution or company			
O04	Contribution to the improvement of the grid management			
O05	Creation of new market actors (charging operators)			
O06	Implementation of charging infrastructures in new or renovated buildings			
O07	Promotion of intermodality between public transportation and electric vehicles			
O08	Reduced dependence on fossil fuels			
O09	Increase in prices of fuel associated with transport sector			
O10	Growing demand for green technologies			
O11	Stricter legislation on emissions of pollutants associated with mobility			
O12	Existence of financial incentives and tax breaks			
O13	Existence of specific legislation for the implementation of private charging stations in residential buildings			

Source: Own elaboration.

## **2.1. Weaknesses**

### **W01. Misinformation among citizens about the electric vehicles**

One of the main weaknesses of the introduction of the electric motorcycle is the misinformation of citizens, the main potential consumer segment of the vehicles. This misinformation is mainly due to the situation of the electric vehicle, which in Murcia is in the early stages of development.

### **W02. Limited supply of auxiliary services related to the electric vehicle**

There is currently a limited supply of initiatives specialized in this sector given the low demand for them, though a gradual increase is expected when the use of vehicles spreads. The initial critical mass must be sufficient to create security in the supply of spare parts as well as solutions of possible problems

### **W03. Need of improved and cheaper batteries**

The current existing technology for batteries for traction applications has high specific weight when compared with fossil fuels. It takes 60 kg of lithium-polymer batteries to achieve the energy available from 1 kg of gasoline. So far this has made it impossible to achieve high range without increasing the weight of batteries and presents a high cost as well.

### **W04. Reduced range of the vehicle**

The big disadvantage of electric vehicles is their range. Current models are adapted for use in the city, as their range is 80-160 km. This disadvantage resides mainly in the current technology of batteries for traction applications, which has high specific weight when compared with fossil fuels used in conventional vehicles. Moreover, the cost of increasing the basic range of the vehicle (batteries exceeding 400 km range), can cost 75% of the value of the vehicle.

### **W05. High cost of the maintenance of the charging infrastructure**

The cost of maintaining a recharging infrastructure is medium-high due to the routine processes of the stations and the management system of the charging network

### **W06. Road safety problems due to the low noise emissions**

Given the zero-emission nature of these vehicles and zero noise they emit when driving, there might be an increase of the number of accidents due to the habit of associating the noise with the passage of vehicles at intersections and roads.

### **W07. Limited public charging infrastructure and difficulties in the development of private charging infrastructure**

As noted above, there are 9 public and private electric vehicle charging stations. The initiative to place these charging points is being held back by the lack of a common regulatory framework.

### **W08. Electric vehicles are not seen as energetically viable option for the regular journeys**

The acquisition of electric vehicles, taking as a point of reference the low cost of kWh per kilometer against the cost of the fuel per kilometer for vehicles with internal combustion engine, and extensive charging infrastructure can encourage higher use of private vehicles for regular journey.

**W09. Long charge time**

Depending on the charging system, it can take 8 hours for full load, when using a 16 Amp single phase power supply; 4 hours when using a 32 Amp single phase power supply or 15 minutes when using a three-phase power supply for a 65% load (30 minutes for 85% load).

**W10. Lack of standardization of batteries and charging systems (connections)**

Currently each manufacturer establishes their own technical conditions for connection / recharging of the energy storage system of the vehicle, without standardization of the systems. This will reduce the effectiveness of the charging infrastructures, as there may be duplicate charging stations on the same site due to the different technologies.

**W11. High cost of the public recharging infrastructure**

The initial investment in charging infrastructure is high. Currently it is estimated that the slow recharging stations represents an investment of 4,000€ and a fast charging station may cost 40,000€.

**W12. Insufficient commercial supply of electric vehicles**

So far there has not been a sufficiently large and competitive supply of electric vehicles, as there are only two suppliers of electric motorcycles in Murcia, EMISIONES00 and SOBRERUEDAS. In this sense, as we have announced, the automotive industry itself is expecting the development of offer in the coming years.

**W13. High price of the vehicle compared to its performance**

Given the low market supply, although the electric vehicle has 90% fewer moving parts, the prices are 1,000 / € 3,000 higher when compared with their internal combustion counterparts.

**W14. Low number of electric vehicles in the fleets**

The electric vehicle is not an actual option for fleets of private enterprises in Murcia, due to unfamiliarity.

**W15. High seasonal temperatures that affect the battery life**

Lithium batteries used in electric vehicles work best with soft ambient temperatures of 20°-25°C. In Murcia the high seasonal temperatures stimulate the aging process of the lithium battery, both when the vehicle is in use and parked. Therefore the batteries deteriorate significantly slower in winter than in summer. Hence, during the summer months it makes sense to protect the batteries with proper cooling.

## **2.2. Strengths**

### **S01. Increased energy efficiency**

In general it can be said that the energy efficiency of an electric vehicle is four times higher than that of a conventional vehicle, as the energy is used better in the cycle generation + recharge + use of electricity than in the cycle oil extraction + transport + refinement + burning in the combustion engine.

### **S02. Non-polluting vehicle**

Electric vehicles can reduce emissions from the exhaust pipe by 100% and have lower levels of emissions of greenhouse gases and other pollutants than internal combustion vehicles. If the energy used in charging stations comes from renewable sources, it reduces the CO<sub>2</sub> emissions by 100%.

An internal combustion vehicle using gasoline with an average consumption of 5.8 liters / 100 km and an average journey of 15,000 km compared with an equivalent electric vehicle with a range for the regular routes and the electric energy system emission factor of 0.223 kg / kWh would reduce the emissions by 1,600 kg of CO<sub>2</sub>, that is, by more than 80% when compared with internal combustion vehicle.

### **S03. Conditions of comfort similar to the internal combustion vehicles**

The performance of an electric vehicle has no impact on the commodities when compared to a vehicle with internal combustion engine. The interior and exterior features do not depend on the energy source (electricity), but on the design choices made by the manufacturers. In fact, having an electric motor can give a better performance from the point of view of pollution, noise emissions and stability (having a lower center of gravity) among others.

### **S04. Acceleration 0-100 km / h comparable to conventional vehicles of equivalent power**

The emergence of electric vehicles in the market has led to their comparison with vehicles with internal combustion engine of equivalent power, in order to draw parallels or point out the differences. These comparisons have demonstrated the versatility of the electric vehicles and their ability to transmit all the power created by the electric motor to the wheels, as these vehicles have an intrinsic axis of rotation (motor shaft driven by magnetic fields) and do not need a cylinder –axis transmission shaft.

### **S05. High degree of satisfaction among users**

The electric vehicle gives a high degree of satisfaction to its users as it is not different from a vehicle with internal combustion engine in terms of commodities when driving, and it has reduced maintenance costs and lower cost per kilometer.

### **S06. Ease of parking**

There is a greater selection of small-sized electric vehicles models than similar internal combustion models. Size requirements in an electric vehicle come mainly from the size of their batteries, and, in case of small vehicles, such as the motorcycles, these batteries are smaller than in mid-sized motorcycles.



**S07. Simpler mechanics of the electric vehicles**

The mechanics of an electric vehicle are less complicated than those of an internal combustion vehicle, because it only needs an electric motor and the management unit. Thus the electric vehicles have up to 90% less components than the conventional vehicles. This usually decreases the maintenance costs and time spent on maintenance.

**S08. Predictable and lower maintenance costs**

Another strength of the electric vehicle is the foreknowledge of the costs, as the depreciation of the vehicle is linear. By knowing the cost and useful life, based on the expected kms, we can foresee the maintenance costs of the company.

**S09. Low noise emissions**

The electric vehicle does not emit noise when generating a motion (silent electric motor), although it does create noise in its displacement due to the contact of the wheels with the surface and, from certain speeds, as an effect of the wind on the body of the vehicle.



### **2.3. Threats**

#### **T01. Recycling and / or management of used lithium ion batteries**

Currently the number of companies dedicated to recycling is very low due to low overall demand, and in general the main field of activity of these companies is the recycling of mobile phone batteries. Lithium-ion batteries contain some lithium carbonate, this is why it is important to ensure that recycling is done responsibly and that this process (recycling), is profitable.

#### **T02. Increase in price of lithium if the reserves are limited and the demand is high**

According to the latest figures from the United States Geological Survey (USGS), the current producers worldwide have sufficient lithium reserves to supply the number of electric vehicles forecasted for the next 10 years. After that, the recycling of lithium in the batteries will have to supply the demand.

#### **T03. Simultaneous existence of the hybrid vehicle**

At the moment the hybrid vehicles are more developed than the electric vehicles. Currently low-carbon mobility consists of mainly hybrid vehicles. This type of vehicle is expected to coexist for at least a decade with electric vehicles, but may be in circulation for a couple of years more, if the use electric vehicle is not properly implemented.

#### **T04. Increasing efficiency of internal combustion engines**

There are still opportunities for advance in the efficiency of internal combustion engine through mechanical improvements and optimization of combustion.

#### **T05. Complexity of the sector and lack of a standard model of electric motorcycle**

This fact causes market fragmentation and many divergent lines of development, which increase the complexity of the electric motorcycles' market and fosters uncertainty among the potential users.

#### **T06. Absence of specific legislation regarding massive installation of charging stations in buildings**

The absence of specific regulations regarding the installation of charging points for fleets or commercial points established in public spaces creates legal uncertainty and therefore very significantly affects private investment in such infrastructure.

However, according to the amendment of the Law of Horizontal Property, parking owners must simply inform the homeowners regarding the installation of recharging stations without being required approval by the homeowner association.

#### **T07. Uncertainty of the electricity prices**

Electricity demand is growing in Murcia, and there is no legal certainty that the prices will remain affordable kWh, even when coming from renewable sources.

## ***2.4. Opportunities***

### **O01. Daily trips compatible with current battery range**

The range of an electric vehicle is sufficient for urban trips made by users of the Municipality of Murcia, where there are large population centers that perform moderate daily commutes.

### **O02. Promotion of new auxiliary industries**

The possibility of new companies making electric vehicles or adaptation of existing companies to production of components for electric vehicles can encourage the establishment of local businesses assembling certain parts for these vehicles.

### **O03. Improvement of the image of the fleets of the institution or company**

The inclusion of electric vehicles in the fleet improves the image of the organization or company, associating them with a green and clean economy, which is like having socially and entrepreneurially excellently accepted seal as a company respectful with the environment.

### **O04. Contribution to the improvement of the grid management**

The ability to manage the demand has important advantages as it provides the electrical system a chance to improve its overall efficiency by flattening the demand curve and facilitating the integration of renewable energies into the system.

### **O05. Creation of new market actors (charging operators)**

Royal Decree-Law 6/2010 on Measures to Boost Economic Recovery and Employment states in Article no. 23 that, according to the existing regulatory framework, a new agent, charging operators, is being introduced in the electricity sector. These operators will provide electricity recharging services necessary for rapid development of electric vehicles. These agents are part of the liberalized activities of the sector.

### **O06. Implementation of charging infrastructures in new or renovated buildings**

The mandatory implementation of charging infrastructures in new buildings or in buildings with certain levels of rehabilitation activities can encourage the use of electric vehicles, as the buildings will already have an implemented and operational charging facilities.

### **O07. Promotion of intermodality between public transportation and electric vehicles**

The combination of the use of electric vehicles with public transportation will improve intermodality between these two possibilities. The existence of incentives for the use of public transportation for users of electric mobility will encourage intermodality between private vehicles and public transportation.

### **O08. Reduced dependence on fossil fuels**

Currently all of the energy consumed by the transport sector in Murcia comes from the fossil fuels, including most of the electricity used for recharging electric vehicles. The implementation and use of more electricity from renewable energy sources will lead to a significant reduction in dependence on fossil fuels.



**O09. Increase in prices of fuel associated with transport sector**

The dependence on fossil fuels in the transport sector is absolute. This leads to the need to assume any change in the price of these fuels, for which there is a provision of a price increase due to their progressive scarcity. This evolution in prices will lead to the switch from gasoline / diesel vehicles to electric vehicles, as the users will try to flee the rising prices.

**O10. Growing demand for green technologies**

Society is demanding environmentally friendly technology, because the effects of climate change are becoming more and more palpable. Technologies that use the resources sustainably represent an opportunity for both corporate and private users.

**O11. Stricter legislation on emissions of pollutants associated with mobility**

European and national legislation on emissions of pollutants associated with mobility is increasingly restrictive, with higher taxes for vehicles with higher emissions of CO<sub>2</sub> in g / km.

Law 34/2007 on Air Quality and Atmospheric Protection by the 8th additional provision amends Article 70 (tax rates) of Law 38/1992 on Special Taxes. Thus, the registration tax is determined by the official CO<sub>2</sub> emissions, measured in g / km.

**O12. Existence of financial incentives and tax breaks**

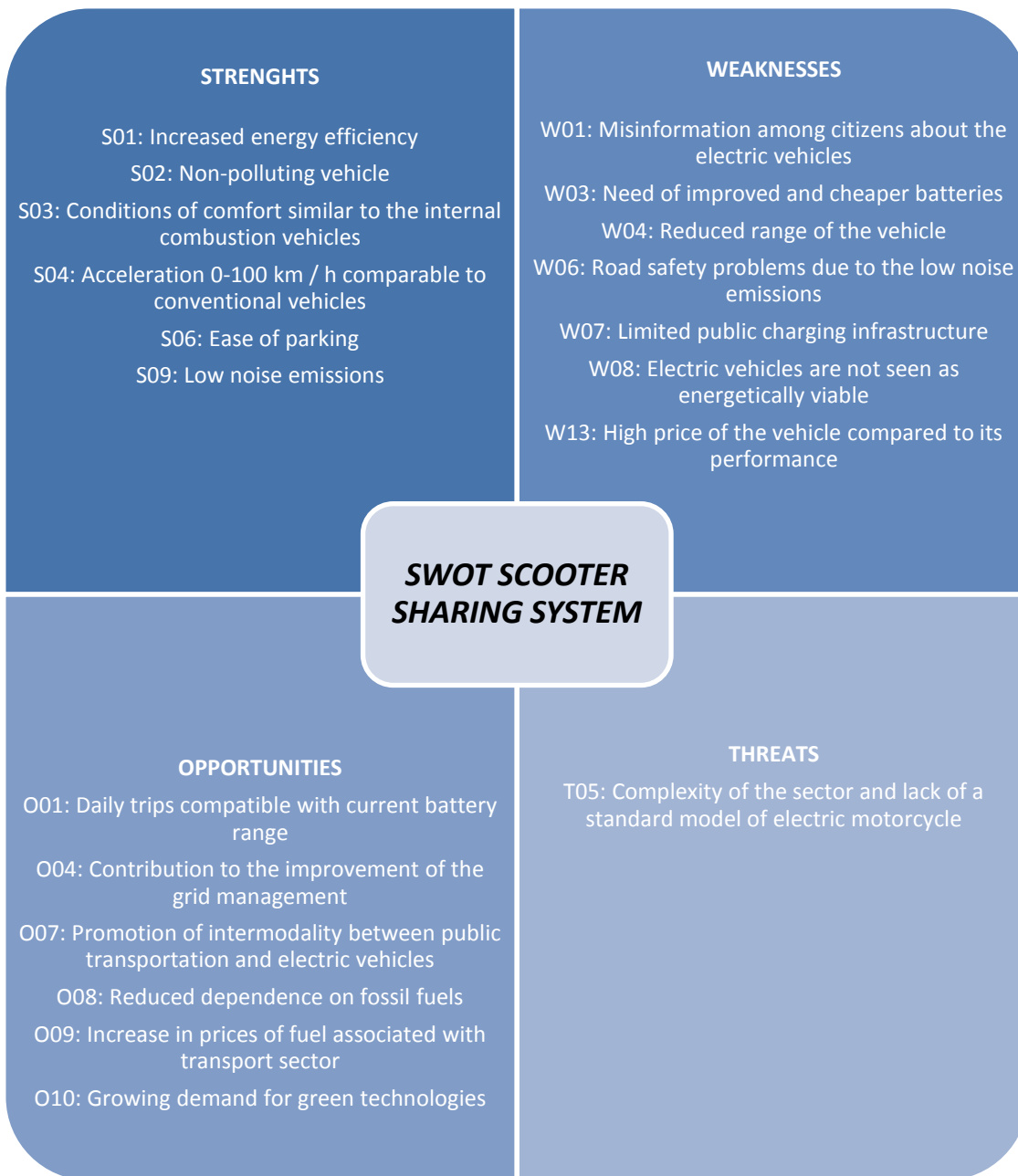
There are direct incentives for the purchase and tax exemptions for the purchase through the circulation tax. Similarly, the Local Strategy on Electric Vehicle of Murcia, which is in the making, includes, among other initiatives, free parking in regulated parking areas for vehicles with mark of 0 emissions provided by The Directorate-General of Traffic and the development of more parking areas reserved for electric motorcycles

**O13. Existence of specific legislation for the implementation of private charging stations in residential buildings**

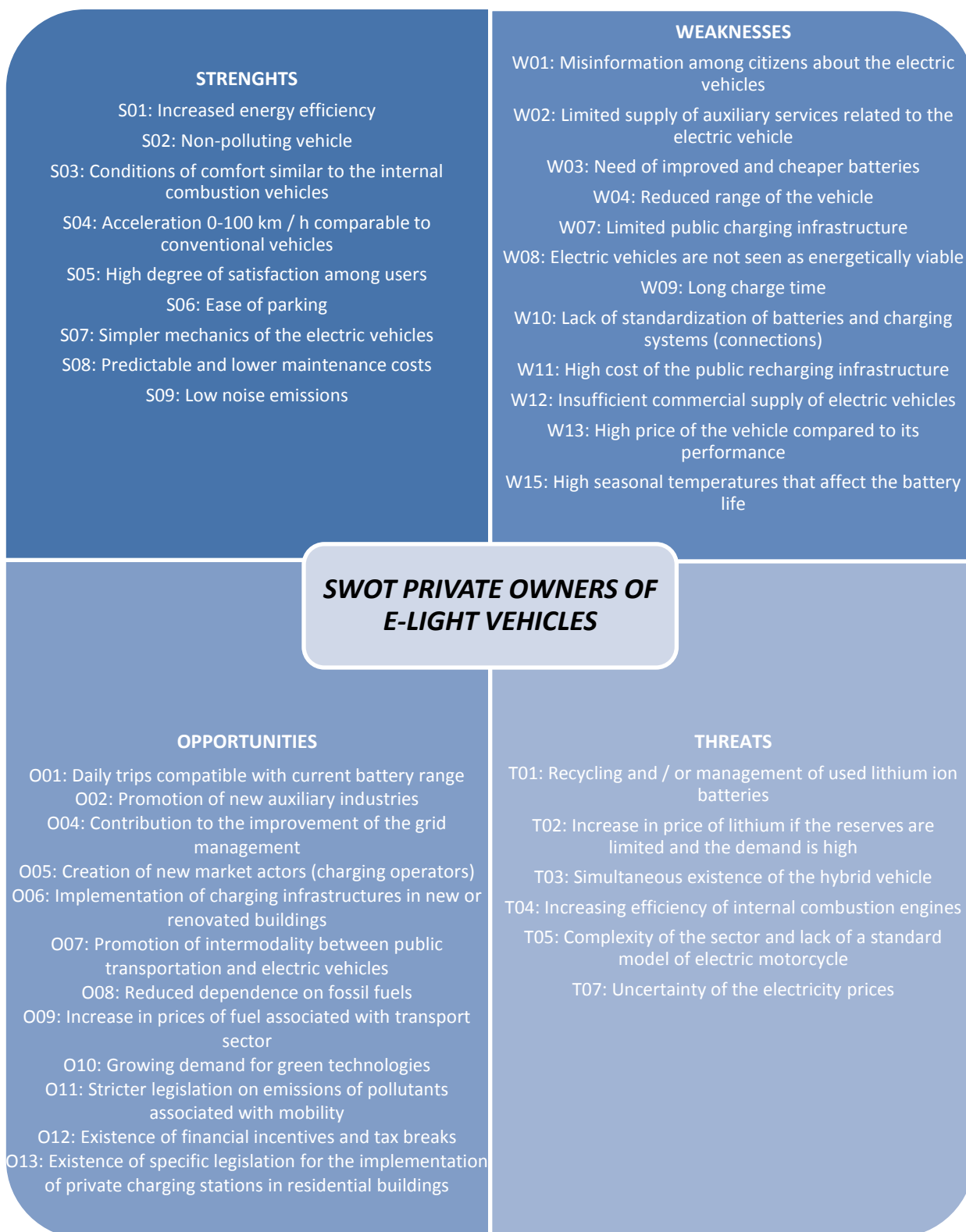
Charging stations for residential use are possible under the framework of Law 19/2009, of November 23, on Measures for Promotion and Procedural Facilitation of Renting and Energy Efficiency of Buildings, amending Law 14/1960, of July 21, on Horizontal Property, indicated in its third article that "to install a charging point for the electric vehicles for private use in the parking of the building, as long as it is located in an individual parking place, only advance notice to the community that the installation will proceed is required. The cost of the facility will be fully assumed by the direct stakeholder(s)".

In addition, since July 1, 2015, the ITC BT 52 has come into force. It regulates "Special purpose facilities. Infrastructure for recharging electric vehicles". This regulation establishes the technical conditions to be met by public, resident community and private facilities for charging of electric vehicles in Spain. This is a breakthrough in the harmonization of technical and safety criteria regarding the electrical installations and infrastructure associated with electric mobility.

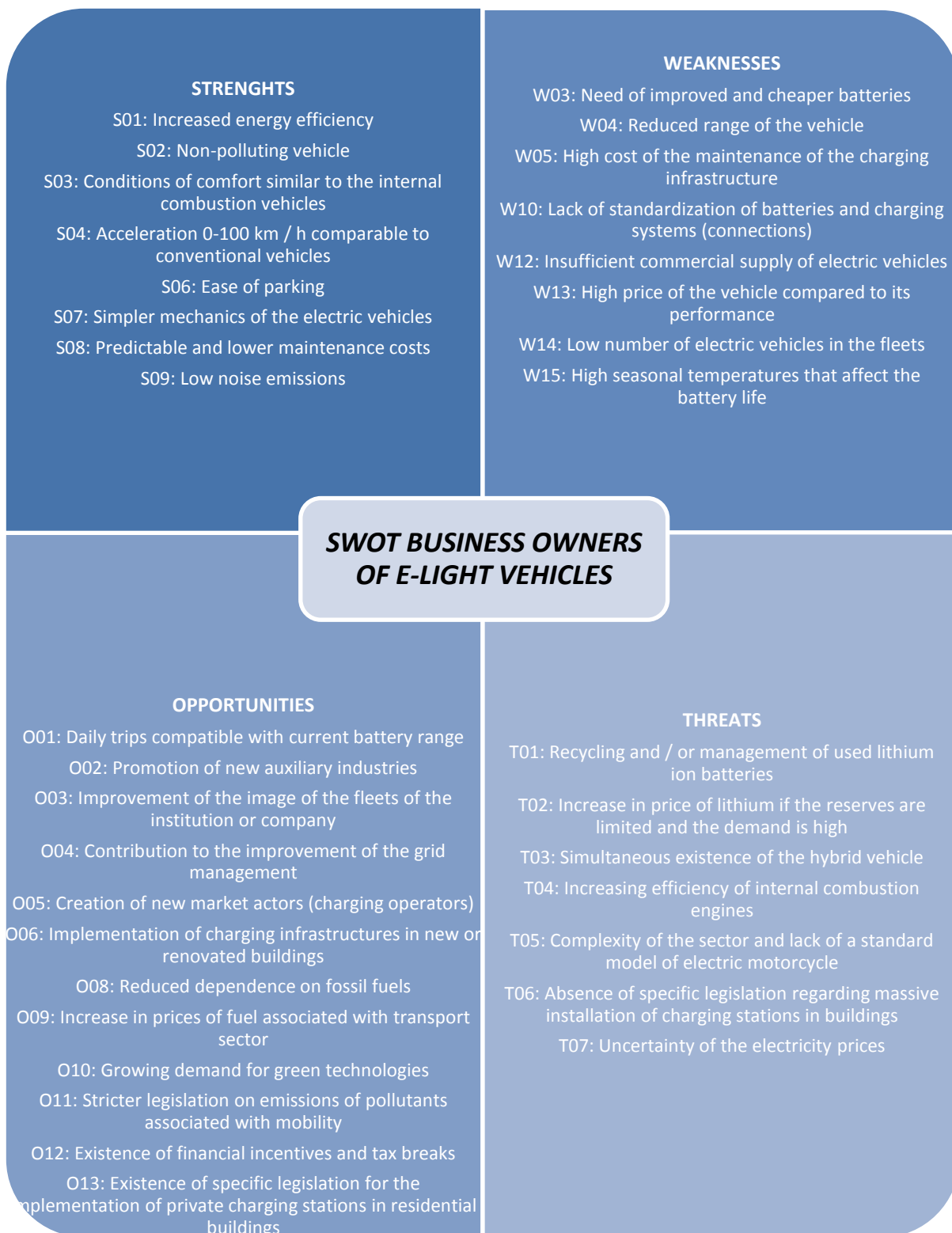
### 2.5. Scooter sharing system



## 2.6. Private owners of e-light vehicles



## 2.7. Business owners of e-light vehicles



### 3. GUIDELINES FOR THE INTRODUCTION OF ELECTRA MODEL

1. Legislative and political support at the national level
  - IDAE
  - MOVELE
  - PIVE
2. Legislative and political support at the local level
  - Covenant of Mayors
  - ALEM
  - Sustainable Urban Mobility Plan
  - Mobility Roundtable of Murcia
3. Other actions for the promotion of electric vehicles in the Municipality
  - Rental system for electric motorcycles
  - Reserved parking spaces
  - Systems of free charging points
  - Green bonuses
  - Seminars, conferences and awareness rising and support activities related to electric vehicles

#### ***3.1. Legislative and political support at the national level***

Currently there are various national policies for the promotion and development of electric vehicles.

##### **The Institute for Energy Diversification and Saving (IDAE)**

The Institute for Energy Diversification and Saving, IDAE, is a part of the Ministry of Industry, Energy and Tourism through the Secretariat of State for Energy, which oversees it structurally.

Contribute to achieving the objectives of Spain in improving energy efficiency, renewable energy and other low carbon technologies is the strategic framework of its activity.

In this sense, the IDAE conducts communication campaigns, dissemination and training activities, technical assistance, program development and funding of specific projects of technological innovation. The international activity of the Institute consists of intense participation in various European programs and cooperation with third countries worldwide.

##### **Urban Electric Mobility Project (MOVELE)**

One of the most relevant projects is the Urban Electric Mobility Project (MOVELE), led by the IDAE.

This project pursues the introduction in urban environment of electric or plug-in vehicles of various categories, performance levels and technologies; used by wide community of companies, institutions



and individuals, as well as installation of charging points for these vehicles.

The main objectives of the project MOVELE are:

- Demonstrate the technical and energy viability of electric mobility in urban environments by adopting a series of measures to soften the existing obstacles to its development, positioning Spain among the few real experiences of demonstration of these technologies.
- Activate, within the local authorities involved, measures driving such mobility, such as development of a public charging infrastructure in the streets, facilitation of the mobility of electric vehicles, reservation of parking spaces, permission of circulation on bus-taxi lanes, reduction of tax burdens, etc.
- Involve private sector in the introduction of electric vehicles: electric companies, insurance and financing companies, energy service companies, etc.
- Provide a basis for the identification and promotion of policy measures promoting this technology: fiscal and economic measures related to the purchase or use of the vehicles, preferential rates of energy supply, modification of rules preventing the development (access to charging points in community housing, on the streets, homologation, security ...), etc.

To achieve these objectives, the promotion of electric vehicles must overcome barriers to their introduction into the market through four lines or areas:

- The boost to demand and promotion of the use of EV.
- The promotion of industrialization and R + D + i specific for EV.
- The development of the charging infrastructure and its energy management.
- A set of horizontal actions bringing together aspects common to several of these strategic lines or not specific to any of them.

### **Subsidies to encourage and promote the purchase of electric vehicles in 2015**

Due to the high relative cost of electric vehicles compared to conventional technology vehicles, it has been found useful to grant subsidies to encourage and promote the purchase of electric vehicles in 2015.

Accordingly, the Ministry of Industry, Energy and Tourism published on the March 18, 2015 the Order IET / 494/2015, with which the Annual Integrated Plan for Subsidies for the Purchase of Electric Vehicles in 2015 is approved.

Some new elements in this call are the following:

- The purchase of the vehicle is associated with the installation of a charging point (dealers will be required to install a charging point for each vehicle sold)



- The maximum price for passenger cars is limited to forty thousand euros.
- These subsidies are declared to be incompatible with other grants from General Government Administration is declared.

### Incentive Program for Efficient Vehicle - PLAN PIVE 8

The renewal of the transport fleet has proven to be one of the most efficient measures to reduce energy consumption, with additional positive effects on road safety and environmental matters.

In this sense, experiences of Incentive Program for Efficient Vehicle (PIVE), with its seven calls to date (Plan PIVE, PIVE-2, PIVE-3, PIVE-4, PIVE-5, PIVE 6 and 7) has the aim to replace a total of 886,000 old vehicles with approximately the same number of new vehicles. The fact that the funds of these programs are exhausted in a much shorter period than initially expected, reflect the success of these programs.

The Plan PIVE 8 aims to promote the removal of about 300,000 vehicles that are over 10 years old, in the case passenger cars, and more than 7 years old, in the case of light commercial vehicles, and modernize the fleets encouraging the purchase of new energy-efficient vehicles.

This plan, with entry into force on May 16, 2015, until exhaustion of the available budget, **has a specific line of financing for the purchase of electric vehicles** as well as plug-in and extended range hybrids.

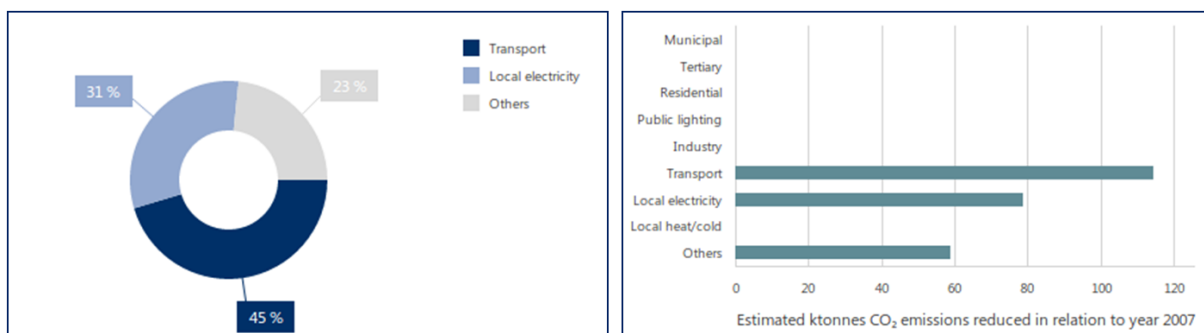
### 3.2. Legislative and political support at the local level

#### Covenant of Mayors

The Covenant of Mayors is a broad initiative of the European Commission has as its point of origin Directorate-General for Energy and Transport. The Covenant brings together the mayors of the most innovative cities in Europe in a permanent network for exchange and implementation of good practices through the framework of Local Administration. The key point of the Covenant are the cities. Its main purpose is to improve energy efficiency in the urban environment.

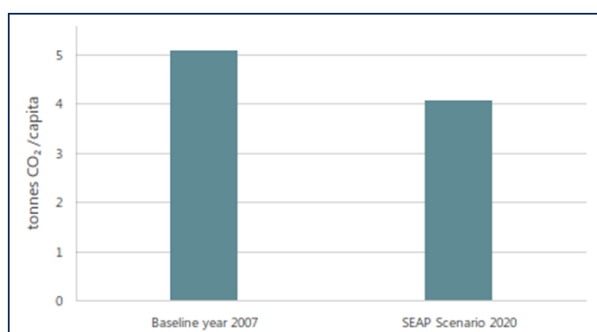
The Covenant of Mayors is an active response by cities which are the most committed to the mitigation of global warming: a formal commitment by them to reduce their CO<sub>2</sub> emissions even beyond the EU target of 20%.

**Graphic 1:** Estimated greenhouse gas emissions reduction per sector in 2020. Murcia.



Source: European Commission, Comitted to local sustainable energy.

**Graphic 2:** Expected evolution in terms of greenhouse gas emissions. Murcia.



Source: European Commission, Comitted to local sustainable energy.

Almost 300 cities throughout Europe have joined the commitments of the Covenant of Mayors, including big capitals, and have expressed their willingness to join this initiative. Murcia was one of the first European cities, and the first in Spain together with Madrid, to express interest in the Covenant of Mayors.

### **Local Energy and Climate Change Agency of Murcia. (ALEM)**

The Intelligent Energy Europe Programme assists the European Commission in its objective of combating climate change and reducing Europe's energy dependence from abroad by promoting self-sufficient energy supply. For that matter, the Municipality of Murcia, due to its unique character, was chosen by the European Commission for the opening and establishment of an Executive Local Agency for Energy Management.

ALEM works to promote alternative energy sources to oil in vehicles of municipal services of Murcia, such as biofuels, natural gas or electricity.

Among the activities of ALEM in cooperation with the European Union, the Agency prepared a **feasibility study of introduction of vehicles powered by alternative energy sources** and energy efficient vehicles in public transportation of the Municipality of Murcia.

A result of this work was a pilot experience of **introduction of biodiesel in public transport fleet of buses** in the Municipality with participation of ALEM, LATBUS and ARGEM. Biodiesel is a diesel fuel replacement made from vegetable oils that can reduce CO2 emissions by around 60%.

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As discussed in paragraph 1 ALEM is working on the **Local Strategy on Electric Vehicle (ELVE)** of the Municipality of Murcia where the fundamental objectives and priority actions of promotion and affirmative actions of electric vehicles will be defined.

Today the city of Murcia has one of the highest proportions of electric and reduced emissions vehicles in its fleet compared to the rest of the Spain. The maintenance of parks and gardens and cleaning services use electric vehicles for their daily work assignments and help to keep our city cleaner by avoiding greenhouse gas emissions and noise generation.



ALEM is also a member of the technical committee set up by the City of Murcia for the preparation of an **ordinance regulating pedestrians and vehicles** with an aim to harmonize the sharing of public roads by pedestrians, bicycles and electric vehicles.

### **Sustainable Urban Mobility Plan**

Murcia has its own **Sustainable Urban Mobility Plan** for the Municipality, called "Muévete" ("Move"). This plan, with the date of the last update December 2013, analyzes and plans how to act in order to increase the role of alternative modes of transport such as electric vehicles, trams, bicycles. This plan contains the designed lines of future action to be followed by the City of Murcia.

In accordance with the document "Spanish Strategy for Sustainable Mobility", the mobility policy of the City of Murcia has the following objectives:

- From the **economic point of view**, to efficiently meet the mobility needs resulting from economic activities, thus promoting the development and competitiveness.
- From **the social point of view**, to provide adequate accessibility of citizens to labor markets, goods and services, promoting social and territorial equity and healthier modes of transport.
- From **the environmental point of view**, to contribute to the protection of the environment and to improve the health of citizens by reducing environmental impacts of transport, contributing to the reduction of emissions of greenhouse gases and optimizing the use of non-renewable resources, particularly energy and prioritizing the use of environmentally sustainable means of transport.

In order to fulfill these goals the city of Murcia intends to develop a sustainable urban mobility policy, which would entail the development of these guidelines or lines of action:

#### **Line 1: Territory, transportation planning and infrastructure.**

- Integrate sustainable mobility in land management and urban planning, developing coordination and cooperation mechanisms, especially in urban areas.
- Integrate general criteria for sustainability in territorial and urban planning and in the development of special plans for infrastructure.
- Promote urban proximity to facilitate the use of alternative means of transport by enhancing the multifunctional public spaces and reducing the current prevalence of use of private vehicles in order to switch to sustainable means of transport.

#### **Line 2: Climate change and reduction of energy dependence.**

- Efficient use of means of transport, promoting the switch towards more sustainable means and development of intermodality.
- New direction of technological innovation, focusing especially on reduction of power, speed and weight of vehicles and the introduction of knowledge in the management of sustainable mobility.



**Line 3: Air quality and noise.**

- Develop and implement action plans on environmental noise.
- Assess the air quality.

**Line 4: Safety and health.**

- Strengthen activities both in terms of operational safety and the development of a zero risk policy.
- Strengthen activities aimed at improving public health.

**Line 5: Demand Management.**

- Encourage more sustainable modes of transport, particularly collective and non-motorized ones through various actions.
- Streamline the number of motorized travel.

**Mobility Roundtable of Murcia**

The Mobility Roundtable of Murcia is a **public forum** where measures are proposed to enhance, among other, electric mobility as alternative transport to the car in the town center. The aim of the Mobility Roundtable of Murcia is to promote the Plan "Muévete".

The Local Energy and Climate Change Agency of Murcia, ALEM, is an active member of this forum, together with other actors, such as public institutions, private associations and citizens.

### 3.3. Other actions for the promotion of electric vehicles in the municipality

#### Rental system for electric motorcycles

The City of Murcia together with two local companies, EMISIONES 00 and MURCIA SOBRE RUEDAS, has promoted an initiative for sustainable mobility consisting in offering to its citizens electric motorcycles for daily urban travel.

The system consists of 150 electric motorcycles, a figure that could increase depending on demand, and offers the rent of electric motorcycle for 145 Euros a month, with maintenance, helmet, lock and insurance included.

#### Free parking spaces for electric motorcycles

Another initiative promoted by the City of Murcia has been the creation of a network of free parking spaces for electric motorcycles.

Currently there are 20 spaces for electric motorcycles located in strategic places of the city, all of which serve a double purpose. On the one hand, they encourage the purchase of these vehicles and secondly, increase the visibility of these vehicles among the citizens of Murcia.



**Image 1:** 10 parking spaces reserved for electric motorcycles in front of the e-scooter dealer "Murcia SobreRuedas"





**Image 2:** 10 parking spaces reserved for electric motorcycles in front of the e-scooter dealer "Emisiones 00"

### Municipal Service for Charging Two-wheeled Electric Vehicles

Since 2011 the City of Murcia has the first two public points for intelligent two-wheeled electric vehicle charging. The system allows simultaneous charging of two motorcycles or two electric bicycles for free for a maximum time of 3 hours. After this time, that day you cannot charge your vehicle any more.

The intelligent management of the charging allows communication between the vehicle and the station, so that the charge is more efficient and safe. The system is very simple and works by subscriber cards which unlock the plug when validated by a reader.

The charging points are easily distinguishable by the users of electric vehicles as the spaces reserved are green and marked with a vertical totem type sign easily recognizable from a distance.



**Image 3:** Charging point for two-wheeled electric vehicles in Paseo Alfonso X

## Green Bonuses

In 2008 The City of Murcia made available to the public so-called "Green Bonuses" in the road tax for electric vehicles. These bonuses reach 30% of the tax for hybrid vehicles (with electric-gasoline, electric-diesel or electric-gas motor) and for electric motors with reduced CO2 emissions of up to 120 g. / Km. This bonus is effective for the year of enrollment and two additional years.

## Inclusion of the requirement to use electric fleets in procurements of the City of Murcia

Years ago the Service ALEM of the City of Murcia asked to include in the public contracts of the administration a mandatory clause to use electric vehicles in those management, maintenance or service contracts in need of vehicles for the implementation of the work of the contract. As a result of this strategy, the City already has numerous electric vehicles, running under the concession of services of maintenance of parks and gardens and cleaning of public roads. The last case was the newly released public bicycle rental service "MUyBICI" in which the company awarded the contract had to purchase an electric van for maintenance and distribution of bicycles between the stations of the system.

## Extension of the network of electric charging points through MUyBICI

Through the above mentioned contract "MUyBICI", the City of Murcia has obligated the concessionaire to install 15 charging points for electric vehicles among the 60 stations of the bicycle rental system. Recharging is free for the users and will cover the entire center of the city. Given the size of Murcia, this system will give electric motorcycle users very important support in the field of public charging.



Image 4: Charging points for electric vehicles.

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

Some of the observed barriers and constraints to implementation and development of the EleCTra project are the following:

- Lack of critical mass and misinformation of the public about the features and benefits offered by the electric motorcycle compared to its conventional version.
- Lack of regulation of financing, incentives / subsidies for the development of electric chargers.
- Lack of strategy to subsidize vehicles with special treatment (public transport, special community vehicles, transport vehicles, cargo company cars, delivery vehicles, etc.).
- Lack of regulation of ECO areas in the city of Murcia, that is, areas designated specifically for the transit of sustainable vehicles.
- Lack of regulation of the use of these vehicles in the cultural events, sports and other areas.
- All segments of society lack education on the opportunities and benefits of the implementation of systems of traffic electrification.
- Currently there are only few establishments specialized in this sector, given the low demand, though a gradual increase is expected as the use of these type of vehicles spread.

### ***3.3 POSSIBLE SOLUTIONS FOR THE CRITICAL ISSUES***

From the limitations listed in the previous section comes a series of guidelines that will help remove the current barriers for the electric motorcycle and its development in the city of Murcia.

- **The boost to demand and promotion of the use of electric vehicle.**

Through such initiatives as the development of incentives for the purchase and use of electric motorcycle, identification of potential demand of urban fleets, development of professional training related to electric motorcycle and development of a benefits / affirmative action for urban users electric mobility.

- **The promotion of industrialization of EV and support to R + D + i.**

It is necessary to support business plans that have as their objective the electric vehicles and support activities for improvement of the performance of the electric motorcycles.

- **The development of the charging infrastructure and its energy management.**

For proper development of electric vehicles in Murcia, there is a need to develop a network of charging points that act as incentive and service to users of electric motorcycle in the municipality.

Similarly, actions of discounts and special offers of energy can be implemented, providing incentives to charge the vehicles in off-peak hours (reduced rate to promote charging at night)

Ultimately, as we have seen in this section and in the analysis of weaknesses and threats to the introduction of the EleCTra in Murcia, there are still barriers to overcome, such as lack of knowledge among the population, as well as short battery life and the lack of development of a network of public charging, but certainly, despite the limitations it is facing, the electric motorcycle is emerging as the most suitable alternative means of transport for our city whose development opportunity is now.

#### 4. SYNTHESIS OF THE POTENTIAL USERS' NEEDS

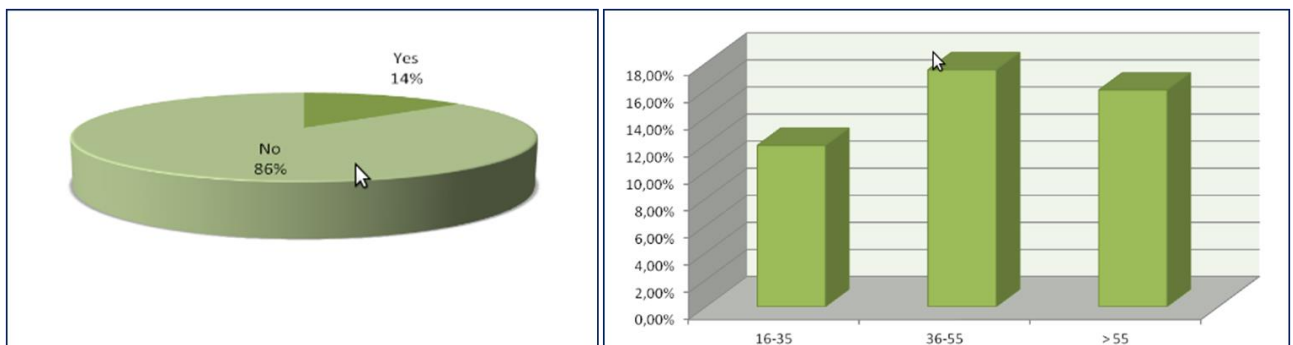
With the aim of establishing a rental system for electric motorcycles for a more sustainable urban mobility, in late 2013 a study on the mobility among the inhabitants of the city of Murcia was performed. The main results obtained are shown below:

##### 1. Use or not use of electric vehicles

89% of the respondent population affirms not having used an electric vehicle, whereas 11% have done it. Among the 11%, 73% have used it "occasionally". 8% of them have done it "daily", "weekly" and "once a month" with the same frequency. Finally, 4% of those who have used it do not answer about the frequency.

Sorted by age groups, those who affirm having used an electric vehicle to a large extent are the individuals under 16 years old (16% of them), followed by the people between 36 and 55 (14%). The individuals from 16 to 35 years old are those who have used it the least (9% of people in that age group).

**Graphic 3:** Use of the electric vehicle by age groups



Source: Mobility Survey Report, EleCTra Project

##### 1.1. Frequency and type of vehicle used

The main type of vehicle used was the "car", with 59% of the cases. 14% had used a "motorcycle/scooter", 6% a "bicycle", and 16% "other type of vehicle". In addition 6% of these individuals did not answer what type of vehicle they had used.

##### 1.2. Willingness to try/purchase an electric vehicle

Among the respondents who had never used an electric vehicle, 71% expressed their willingness to try or purchase one, whereas 29% answered negatively.

##### 2. Valuation of the electric vehicle

Five aspects count for the valuation of the electric vehicle by the side of respondents, *cost*, *speed*, *comfort*, *safety* and *parking*. It should be pointed out that in all aspects there is a predominance of



the option "don't know/no answer", being placed in a range between 35% of the choices for the aspect *parking* and 39% for the aspect *cost*.

**The Cost:** Referring to the *cost* it should be noticed that 28% of respondents assess it with the worst scoring (low). 14% think that the *cost* is "enough", and 11% consider it as "appropriate". As "good" or "excellent" is only assessed, respectively, by 6% and 2% of respondents.

**The speed:** The speed is considered "appropriate" by 25% of respondents, other 25% assess it as "enough" and "low", as 12% see it as "good" and "excellent".

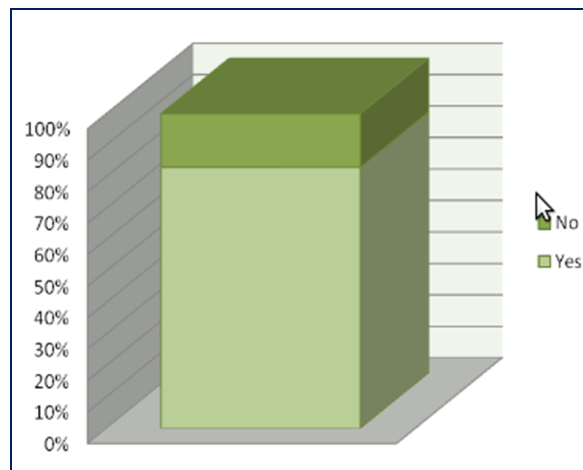
**The comfort:** In relation to the assessment, the comfort obtains "appropriate" by 28%. 11% marks it with "enough" and "low" and 25% considers it "good" and "excellent".

**The safety:** The safety gets practically the same marks than the previous item.

**The parking:** As for the parking 13% consider it "appropriate", 32% mark it below and 20% above.

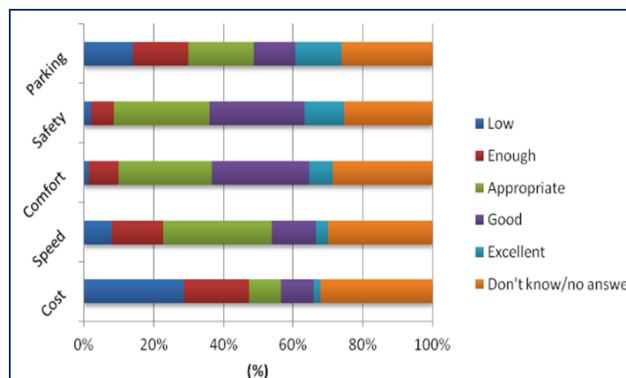
In general terms, the worst assessed aspect is the cost, and the best marks are the safety and the comfort.

**Graphic 4: Willingness to use/purchase an electric vehicle**



Source: Mobility Survey Report, EleCTra Project

**Graphic 5: Electric vehicle assessment**

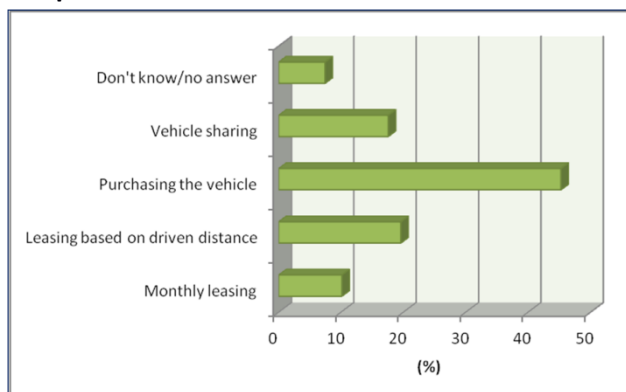


Source: Mobility Survey Report, EleCTra Project

### 3. Mode of use of an electric vehicle service

Facing toward a service for using electric vehicles in the city, the mode of cost that the respondents consider more appropriate is the "purchase of the vehicle", representing 38% of the answers. The "monthly leasing" is chosen by 19%, and the "leasing based on driven distance" and the "shared use with more people in the vehicle" represent each one 12% of the answers. In addition, 17% of respondents do not know or do not answer the question.

**Graphic 6: Mode of use of an electric vehicle service**

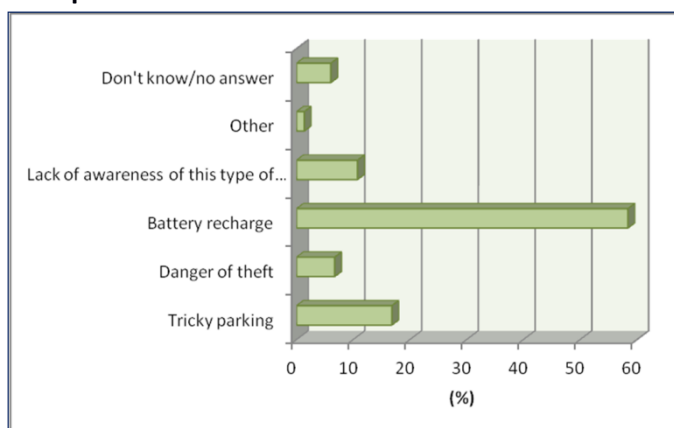


Source: Mobility Survey Report, EleCTra Project

### 4. Annoyances/concerns in relation with the use of electric vehicles

The main concern faced by the respondents in relation with the use of electric vehicles in Murcia is the "battery recharge" with 51% of answers. Far away appears the "tricky parking" with 15%, the "danger of theft" with 13% and the "lack of awareness of this type of vehicles" with 12%. Finally, there are 9% of respondents who choose the option "don't know/no answer".

**Graphic 7: Concerns about the use of electric vehicles**



Source: Mobility Survey Report, EleCTra Project

### 5. Benefits of a rental service for electric vehicles

The main benefit noticed by the respondents in relation with the availability of a rental service for electric vehicles or bicycles in Murcia, is the "reduction of polluting emissions". Thus, 53% of

respondents choose this option. Next, 24% choose "not fuel costs". "Less noise in the city" and "lower road taxes" are chosen each one by 8% of individuals. And 6% remain with the option "don't know or no answer".

## 6. Incentives for using an electric vehicle service for daily journeys

The main incentive to use an electric vehicles service in the respondents' daily journeys in the city is the "**discount to purchase electric vehicles**". 44% of those thought like that. Second, they found inspiring the "**removal of local taxes to owners**" of these vehicles (23%). "**Granting environmental bonuses**" appears the third with 15%, and the option "**remove emissions taxes to owners**" of electric vehicles was 7% over the total of the answers. It should be noticed that 10% of respondents said "not being aware" of any incentive for using this service, or did not answer.

## 7. Interest to use an electric motorbike/scooter rental service

Referring to the willingness of the respondents to use an electric motorbike/scooter rental service in Murcia, the top option was "probably", with 28% of the answers. 23% of the choices were for the option "I would never use the service". The option "not sure" covers 21% of the answers, and the last are "sure" with 16% and "probably not" with 12%. To summarize, the negative answers suppose 35% over the total, and the positive ones 44%, meanwhile the undecided respondents represent 21%.

## CONCLUSIONS

One of the main noteworthy findings of the survey is that only 11% of respondents have used the electric vehicle. This percentage indicates the lack of awareness among the public about this vehicle and its implications for sustainable mobility. On the other hand, it should be pointed out that 71% of citizens who had never tested the electric vehicle, were interested in trying or buying one.

"The gap between the low percentage of users (11%) and willingness to use them (71%) indicates that there is a large group of potential users, demonstrating a need of initiatives for the promotion and use of electric vehicles among the society of Murcia".

As for the characteristics of the electric vehicle and their evaluation by citizens, it should be noted that in general, the aspect with lowest evaluation is the cost and the best rated aspects are security and comfort. Therefore, **efforts to reduce the limitation of the high cost**, like rent to own, subsidies, rent of car batteries etc., are necessary for the development of electric motorcycles in Murcia.

As for the main difficulties / drawbacks highlighted by the studied population, as we have noted above, the "battery recharge" is the biggest problem found, followed by the difficulty of parking and lack of knowledge about these type of vehicles. Therefore, **the development of a network of charging points and parking areas reserved** for these vehicles would be initiatives that could have a positive effect on the introduction of EleCTra project in Murcia.

Therefore, we can conclude that there is a market for the ELECTRA project in Murcia, however, such limitations and barriers as the "cost", "lack of awareness" and "charge of the batteries" have created a situation where only 11% of respondents have used an electric vehicle at least once..

#### ***4.1. Scooter sharing system***

Shared rental system of electric motorcycles is the ideal way how to tackle some of the limitations encountered in Murcia, such as lack of awareness among the users about the benefits of electric motorcycle.

Therefore, information campaigns on the characteristics of electric motorcycles are indispensable for the development of rental system, as well as affirmative actions, such as preferential access to roads in the center of the city or the exclusive use of restricted lanes.

Some of the actions in the field of awareness and public education are the following:

- Conduction of information sessions aimed at specific groups, such as groups of students, both from secondary schools and universities, logistics companies from Murcia, workers of car dealerships and general society.
- Collaboration with local media to disseminate the characteristics of the electric motorcycle.
- Creation of promotional materials for the project and making them available to the electric vehicle providers.
- Edition of booklets with information on the location of public charging points and information on the electric vehicles and specifically motorcycles. These booklets will be distributed at dealerships and information points of public buildings.
- Provision of information through the websites of municipality and ALEM.
- Annual free exhibition and testing of electric vehicles, in which the citizens and businesses can receive information and advice about how to meet their mobility needs with the electric vehicle. Such actions have occurred in recent years during the European Mobility Week, which is celebrated in the city of Murcia only on a small scale. To make further this type of action should be organized on a bigger scale, with involvement of partner agencies at the regional level and looking for the greatest possible media impact

#### ***4.2. Private owners of e-light vehicles***

In addition to the actions of dissemination and promotion of knowledge among the citizens on the advantages of the electric motorcycle detailed in the previous point, and with the information available, we propose the following initiatives aimed at promoting the purchase by private users, such as:

##### **Direct incentives**

Considering the present high cost of electric vehicles when compared to conventional technology vehicles, and to encourage the purchase of these vehicles, it is necessary to implement incentive programs designed to promote their acquisition or make discounts which would reduce costs faced by users of electric vehicle. Some of them may be:

- Direct subsidies for the purchase of electric motorcycles: discounts, VAT deductions...





- Taxes based on differences between vehicles (e.g. depending on CO2 emissions and / or road tax)
- Free parking spaces or discounts for ORA zones (or differentiated parking fees).

### **Indirect incentives**

These incentives do not have a direct monetary value for the consumer, but they would encourage the purchase of electric vehicles. Some of the non-financial incentives might be:

- Affirmative action measures such as preferential access to roads in the city center (low or zero emission zones).
- Exclusive use of restricted lanes.

### ***4.3. Business owners of e-light vehicles***

Undoubtedly, the implementation of electric vehicles is a strategic move by professional fleets, which is already evident in companies both in urban logistics and municipal services and, of course, a private public transport, such as taxi, and collective, such as 100% electric bus, with examples of implementation in several Spanish cities.

Certain incentives to promote electric vehicles in professional fleets would be needed. Among them, we highlight:

### **Direct incentives**

To encourage the purchase of electric vehicles for professional fleets it is necessary to organize incentive programs designed to promote their acquisition or create discounts that reduce the costs faced by the users of electric vehicles (ORA area discounts, tax deductions...).

### **Indirect incentives**

This group of incentives consists of those incentives without a direct monetary value for the consumer, but encouraging the purchase of commercial vehicle fleets. Some of the incentives could be:

- Recognition of "environmentally responsible companies",
- Reserved parking areas,
- Preferential access roads in the city center, free charging points.

## 5. POSSIBLE BUSINESS MODELS FOR THE IMPLEMENTATION OF ELECTRA

### *5.1. Rental system of motorcycles (daily / weekly / monthly)*

This service provides potential customers with electric motorcycles for daily, weekly and monthly rent.

The cost of the rent would also include the following products and services:

- Charger
- Insurance for third parties and driver
- Medical assistance in case of accident
- Roadside Assistance
- Full maintenance
- Change of tires after 15,000 km
- Helmet

As for the potential user of these rental services we can list the following:

- Private users, who occasionally need to rent a small motorcycle for short intercity travel or potential buyers who want to test the motorcycle before making the final decision.
- Domestic and foreign tourists, as it is increasingly more common for both domestic and foreign tourists to rent a car for their travel within the city once they have reached the chosen vacation destination.
- Companies, which either require this service as means to attend frequent meetings, or it is part of their business, such as messaging and delivery.

### *5.2. System Rent-to-own*

This type of long-term rental allows for the rent-to-own, that is, having enjoyed the service for a fixed period of time, users can purchase the motorcycle by paying its residual value, i.e., discounting from the final price the rental fees already paid to the company. Thus, potential users can test the electric motorcycle before the purchase.

- Private users, who occasionally need to rent a small motorcycle for short intercity travel or potential buyers who want to test the motorcycle before making the final decision.
- Companies, which either require this service as means to attend frequent meetings, or it is part of their business, such as messaging and delivery.

### *5.3. Mixed option- purchase of the vehicle and rental of the battery*

To avoid negative externalities, such as the high cost of electric motorcycle, from which the cost of the battery forms an important part, one of the models that could be interesting is the possibility of acquiring only the chassis and rental of the battery.

It is an innovative solution that allows potential customers to own an electric motorcycle in a more



simplified manner. With this method of buying the most reluctant consumers are more peaceful, as the rental contract usually includes a guarantee of the performance and capacity of the battery.

#### ***5.4. Direct Purchase system***

This is the simplest model and the one which after a period of time is expected to develop in the municipality of Murcia. As we have mentioned previously, this model requires an incentive policy for the purchase of these vehicles and the development of awareness among the public about the advantages and additional benefits offered by the electric motorcycle when compared to the conventional one.

#### ***5.5. The most appropriate model for the implementation of EleCTra in our city***

After briefly analyzing the systems available for the implementation of EleCTra in our city, the considerations made by this study and given the specific characteristics of Murcia we think the best system for our city is **long-term rent-to-own**.

As we have observed throughout the study, Murcia has a unique demographic and geographic distribution, which affects the mobility patterns of its habitants. In Murcia there are large population centers annexed to the city and people living in these centers take moderate daily trips for which electric motorcycle is an ideal solution.

According to data from the mobility survey conducted in the city, the main results of which are presented in Section 4, it should be noted, that the vast majority of most frequent daily commutes longer than 5 minutes occur in the center of the city of Murcia. This area represents 36% of all origins and destinations.

Analyzing the origins of the movement, 22% of these are concentrated in the center of the city. Regarding the destinations, Center area is also situated at the top of the list with 49%, more than double than the origins.

Furthermore, it should be noted that although Murcia has a potential users for EleCTra project, there are barriers like the "cost", "lack of awareness" and "charge of batteries". Due to these limitations, as we have noted in Section 4, only 11% of respondents have used an electric vehicles at least once, a figure which would increase with the implementation of this system.

Another reason that makes this system the most appropriate for our city is the fact that it reduces the uncertainty when buying an electric motorcycle, as would give the opportunity to test the vehicle before purchase.

In the next section we detail the main features of this business model and the economic and financial aspects of a case study.



## 6. ECONOMIC AND FINANCIAL ASPECTS OF THE MODEL

As we have previously discussed the most suitable system we envision for the introduction of the electric motorcycle in Murcia is the long-term rent-to-own. In this section we will detail the fundamental aspects of the development of a business model for implementation of a rent-to-own system consisting of 20 electric motorcycles.

This model requires from the company implementing it 10% of the resources of their core business. That is, all expenditure forecasts have been made supposing that the company allocates 10% of its resources to this activity. Therefore, this model may be used by all companies that want to implement the strategy of rent and sale of electric motorcycles in their business model.

As for earnings forecasts, in our scenario we place the level of demand for rent at 80% of motorcycles available per annum. In terms of purchasing demand forecasts, we have set it at 30% of the available motorcycles. As the purchase will take place at different times, the final sales price of each motorcycle is determined by discounting the paid rental fees from the initial price.

### Service and product offered

This service consists of long-term rental of midrange electric motorcycle with 4 kW motor equivalent to an internal combustion motorcycle of 125cc (allowing for travel on highways).

We chose as the proposal the S02 model made by Scutum. It is a Catalan company, which already works with one of the local distributors.

The proposed electric motorcycle has a top speed of 80km / h and an average range of 70 km.

The cost of the monthly rent, in addition to the rent of the motorcycle, would also include the following products and services:

- Charger
- Insurance for third parties and driver
- Medical assistance in case of accident
- Roadside Assistance
- Full maintenance
- Change of tires after 15,000 km
- Helmet

### Initial investment

The initial investment needed to implement the model of rent-to-own is the capital necessary for the acquisition of 20 electric motorcycles. We expect a 25% profit margin on the average market price (4,500 euros), bringing the cost of one electric motorcycle to 3,375 Euros.



After the first year an additional annual investment will be needed for the replacement of 6 motorcycles that will have been sold during the immediately preceding year (sales representing 30% of the offer).

We assume this expense will be covered by own funds so this is not seen as a financial expense

## **EXPENDITURE\***

### **Operating costs**

In this model we have estimated that 10% of the total expenses of the company will be related to the electric motorcycle, therefore personnel costs (we plan a part-time dedication to tasks related to the electric motorcycle of 2 salespersons and a manager), a part of the rented facility, supplies and other operating costs have been calculated on the basis of this criteria.

### **Depreciation costs**

In this section we contemplate the monetary depreciation of the electric motorcycles. We have estimated that its limited duration service life is 5 years, after which it has a residual value of 35% of the acquisition cost.

The amount allocated for depreciation in Year 1 comes from the quota needed to amortize the 20 motorcycles purchased in period 1.

The depreciation costs in subsequent periods will be made up from fees of the vehicles from the previous period and the fee required to amortize 6 motorcycles acquires annually to replenish the ones sold in the previous period.

(\*) We have included an increase of total costs of 1.5% per annum, based on growth forecasts for 2016 and average changes in the CPI.

## **INCOME**

Revenues considered in this model come exclusively from the exploitation of the rental service and sales, with no other income from subsidies.

In the case of long-term rental we have chosen an optimistic scenario, estimating a demand of 80% of the available supply (motorcycles offered for rent initially minus the motorcycles already sold). At the end of Period 1, the company will replace the vehicles sold (6) and will rent them to new users under the same conditions.

Regarding the sales of motorcycles, we plan that annually 30% of users will choose to buy the product, so every year six electric motorcycles will be purchased at specific points in time (the price of the motorcycle is determined by discounting from the total price the monthly fees that the client has already made)

Therefore, as the income from the operation of the service we will consider:



- **Monthly rent:** This service has a price of **170 €**. The service price is set according to various criteria. First, it takes into account prices for monthly rental with set by the leading providers of rental services of electric motorcycle in Spain (around 160 Euros per month). Secondly, we have taken into account the market competitors, i.e. the monthly rental price of similar gasoline motorcycles (around 170 Euros per month).
- **Sale:** As noted earlier, we forecast annual sales of 30% of the rental fleet offer.

**Table 3:** Anticipated income of the model

ANTICIPATED INCOME					
	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
<b>Provision of services</b>	27.744,00 €	27.744,00 €	27.744,00 €	27.744,00 €	27.744,00 €
<b>Product sales</b>	20.880,00 €	20.880,00 €	20.880,00 €	20.880,00 €	20.880,00 €
<b>Subsidies</b>	0,00 €	0,00 €	0,00 €	0,00 €	0,00 €
<b>TOTAL</b>	<b>48.624,00 €</b>	<b>48.624,00 €</b>	<b>48.624,00 €</b>	<b>48.624,00 €</b>	<b>48.624,00 €</b>

Source: Own elaboration

**Table 4:** Forecast expenditure of the model

FORECAST EXPENDITURE					
	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
<b>Personal costs</b>	8.243,04 €	8.366,69 €	8.492,19 €	8.619,57 €	8.748,86 €
<b>Other exploitation costs</b>	1.800,00 €	1.827,00 €	1.854,41 €	1.882,22 €	1.910,45 €
<b>Provision for amortization</b>	13.500,00 €	17.752,50 €	22.068,79 €	26.449,82 €	30.896,57 €
<b>Taxes</b>	0,00 €	0,00 €	0,00 €	0,00 €	0,00 €
<b>Rent</b>	4.800,00 €	4.872,00 €	4.945,08 €	5.019,26 €	5.094,55 €
<b>Supplies</b>	360,00 €	365,40 €	370,88 €	376,44 €	382,09 €
<b>Insurance premiums</b>	1.800,00 €	1.827,00 €	1.854,41 €	1.882,22 €	1.910,45 €
<b>Maintenance</b>	1.800,00 €	1.827,00 €	1.854,41 €	1.882,22 €	1.910,45 €
<b>TOTAL</b>	<b>32.303,04 €</b>	<b>36.837,59 €</b>	<b>41.440,15 €</b>	<b>46.111,75 €</b>	<b>50.853,43 €</b>

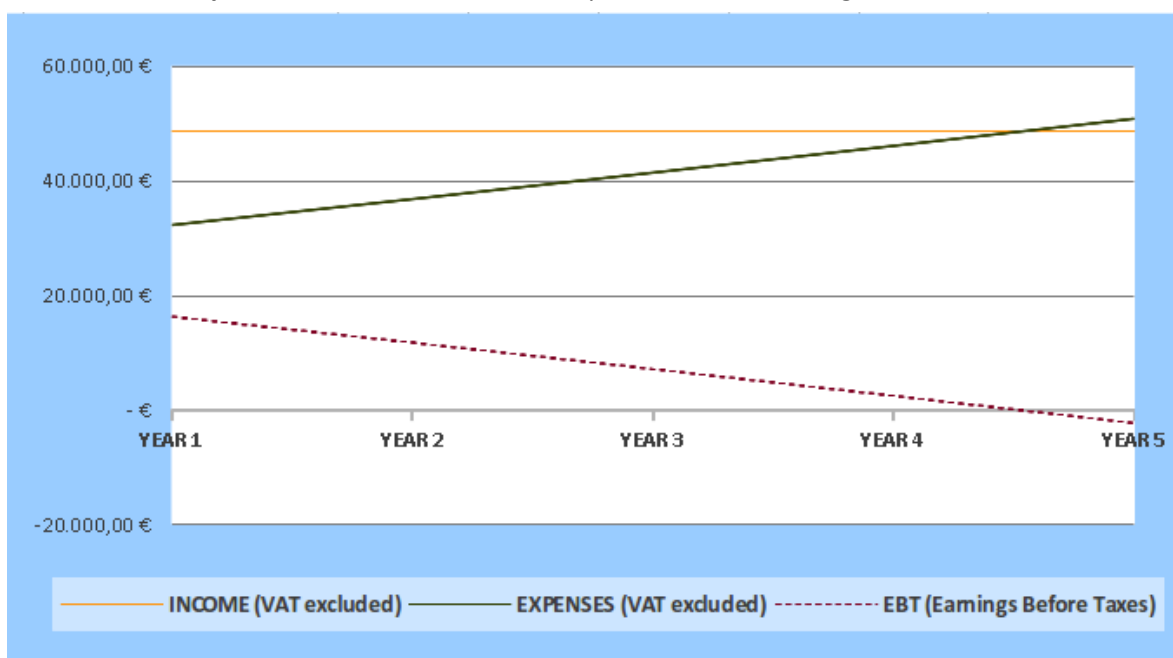
Source: Own elaboration

**Table 5:** Income statement of the model

INCOME STATEMENT					
	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
<b>Income</b>	48.624,00 €	48.624,00 €	48.624,00 €	48.624,00 €	48.624,00 €
<b>Expenditure</b>	32.303,04 €	36.837,59 €	41.440,15 €	46.111,75 €	50.853,43 €
<b>Earnings Before Taxes (EBT)</b>	16.320,96 €	11.786,41 €	7.183,85 €	2.512,25 €	-2.229,43 €

Source: Own elaboration

**Graphic 8:** Forecasts for income, expenditure and Earnings Before Taxes



Source: Own elaboration

In Year 5 the residual value of vehicles not sold (at 35% of the acquisition cost) will be added to the Earnings Before Taxes (EBT).

As we can see, the revenue forecast is stable in this model, while costs increase year after year because of the linear increase of the total costs by 1.5% (based on the mean changes in CPI) and the yearly increase of amortization costs resulting from the replacement of motorcycles sold in the previous period. This difference between constant income and growing expenses causes increase in the gap between the two series and incurs significant losses for the company in year 5, as can be seen from the Graph 8.

Therefore, it can be concluded that under the hypotheses and assumptions made regarding the constant demand, the project of 20 electric motorcycles for rent-to-own is not economically viable.

It should be noted that in the medium term there are likely to be changes in the system, which are not included in this model. These changes would increase the revenues and lower the costs for the company. Some of the expected changes are:

- Increase in the demand.
- Subsidies for the purchase of electric motorcycle.
- Decrease in the cost of the motorcycle.
- Improved productivity and performance of the batteries.
- Increased CSR of the companies, through the promotion of electric mobility.

On the other hand, the "know-how" acquired during the process will allow the company to dedicate fewer resources to maintaining the business model, which will result in economies of scale and therefore additional long-term benefits.

To conclude, we must remember that besides the economic and environmental benefits that this system can bring, some of the medium term transversal objectives of this model should be pointed out:

- Promotes the use and testing of such vehicles among the population.
- Gives visibility of the electric motorcycle in the municipality.
- It can serve as a pilot for all dealers who want to implement this strategy of rental of electric motorcycles. Thus, those automotive companies that are interested can penetrate the market of electric motorcycles, which will contribute to the development of greater commercial offer (as currently in city of Murcia it is very small).



## 7. THE APPROPRIATE TECHNOLOGY AND INFRASTRUCTURE

When discussing the technology and infrastructure needed to operate the project, we must address three key points:

- Electric Motorcycle
- Origin of electricity
- Charging points

### Electric Motorcycle

As detailed in the previous point, for the development of this system of electric motorcycles rent with purchase option we have chosen the model S02 by Scutum. It is a Catalan company, currently working with the Murcian company Emissiones 00. Its main technical features are:

- |   |   |
|---|---|
| - Engine: brushless (HUB) of 4 kW (5 CV)          | - Charging cycles: 900                                |
| - Maximum torque: 140 Nm                          | - Length: 1910 mm                                     |
| - Maximum speed: 80 km/h                          | - Width 710 mm  |
| - Weight without battery: 85 kg                   | - Height: 1260 mm                                     |
| - Range in city: 75 km                            | - Maximum payload: 175 kg                             |
| - Rear-wheel drive.                               | - Boot capacity: 180 l                                |
| - Battery: LiFePO4, of 4,5 kWh, detachable        | - Regenerative braking, engine brake and reverse gear |
| - Charger: external 600 W, standard plug of 230 V |   |



(Electric motorcycle produced by Scutum, model S02)

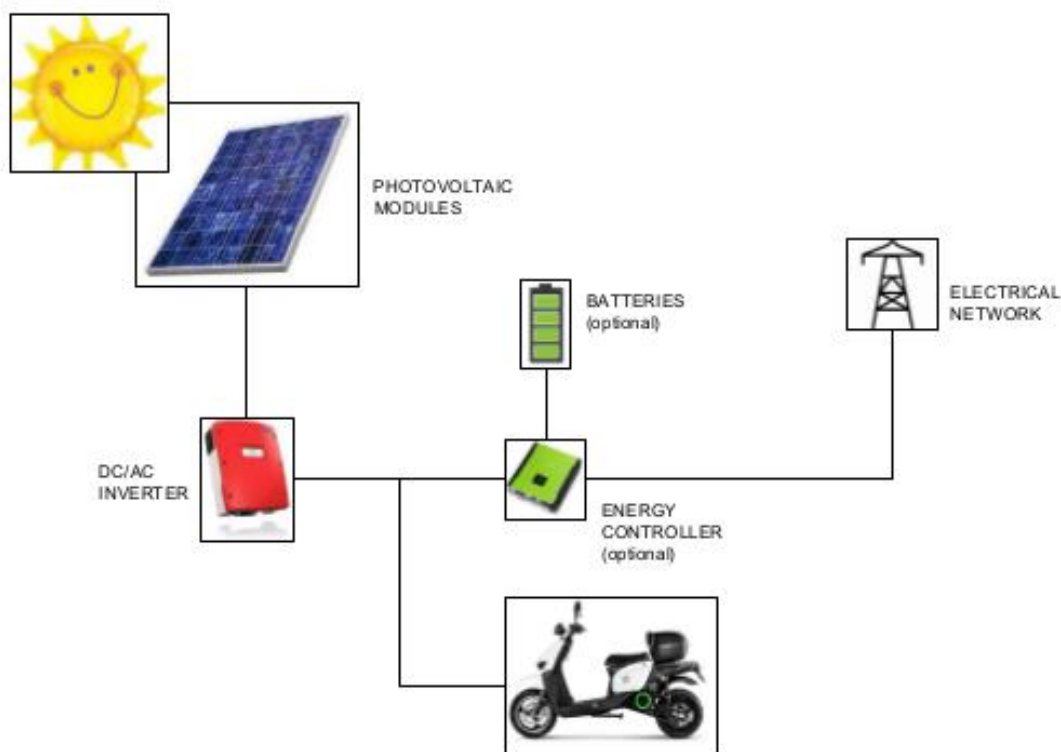
### Origin of electricity

Currently the main source of energy for battery charging is the electricity grid.

However, given the enormous potential of the city of Murcia to produce electricity by photovoltaic panels, we set out below a combined model of solar and electric energy, which is much more favorable from an environmental point of view. In this way, renewable energy would be used to meet the transportation needs (which are precisely the sector most dependent on fossil fuels).

In Figure 1 we show a scheme of a photovoltaic system ready to use all the solar energy. If consumption (battery charging) occurs during daylight hours, the PV output is used directly to power the electric motorcycle battery. If the consumption does not coincide with the hours of sunshine, photovoltaic production fills in stationary batteries to be used when needed. In addition, the system is connected to the grid; to ensure that at all times you can use the maximum load of the charging point.

**Figure 1:** Production scheme of photovoltaic power supply



Source: Own elaboration

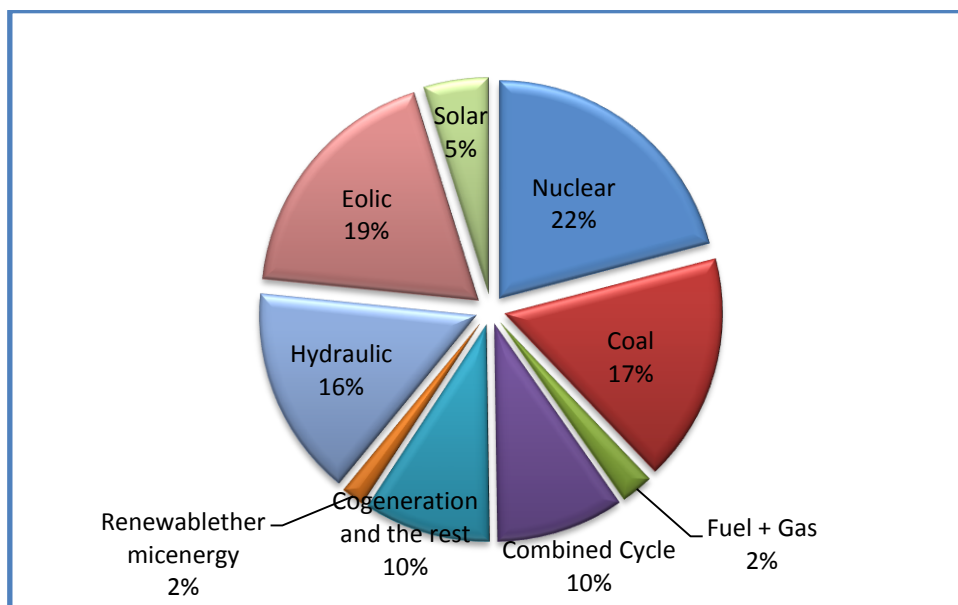
Moreover, as reflected in Table 6 and Graphic 9, the energy from the power grid requires the consumption of fossil fuels. Despite having 42% of renewable energy (wind, hydro, solar) of 42%, other sources include nuclear (22%) and coal (17%), among others

**Table 6:** Annual energy balance of Spain. Year 2014

ANUAL ENERGY BALANCE OF SPAIN. 2014		
<b>Nuclear</b>	57.376	22%
<b>Coal</b>	46.480	17%
<b>Fuel + Gas</b>	6.663	2%
<b>Combined Cycle</b>	25.919	10%
<b>Cogeneration and the rest</b>	25.887	10%
<b>Renewable thermic energy</b>	4.729	2%
<b>Hydraulic</b>	42.931	16%
<b>Eolic</b>	51.026	19%
<b>Solar</b>	13.158	5%
<b>Net generation</b>	266.853	100%

Source: Own elaboration based on the data from Spanish Electricity Network (REE)

**Graphic 9:** Primary energy sources in electricity generation in Spain



Source: Own elaboration based on the data from Spanish Electricity Network (REE)

By using photovoltaic charging, with the support of recharging from the electricity grid, we would significantly improve the ecological footprint of the users. Even in long-term, some facilities may reach to use only photovoltaic energy to recharge the batteries of electric motorcycles. This will not only reduce emissions and distance them from population centers, but will also greatly reduce air pollution.

## Charging points

The recharge can take place in three different points: in the point of origin (e.g. in the garage at home), at destination (for example, in the garage of the workplace) and in a public space (e.g. in a supermarket, electricity station for electric vehicles or in a public parking).

Regarding the number of charging points to be developed, it should be noted that **the related infrastructure should be similar to the registered electric vehicles**, given that in the case of fleets (Business) one charging point can supply power to several electric vehicles. Also, the following criteria must be taken into account when installing new charging points on public roads:

- They must be distributed throughout the city and located in areas of large flow of vehicles.
- They must be placed without removal of parking spaces and next to a control center in order to facilitate connection to the electricity grid.
- They must be visible, thus increasing the knowledge of potential users.

Currently there are 9 public charging points for electric motorcycles distributed in the city of Murcia. To implement this model, it would be necessary to expand this network to accommodate new energy needs created by daily use of the proposed fleet.

As a consideration to take into account for the expansion of the network of charging points, it would be advisable **to use existing buildings and include the new charging points in them**. Thus the cost of wiring is greatly reduced, as in this case it is not necessary to make a new connection or a new electricity contract. In particular, it would be advisable to install preferably slow charging points (since their installation is simple and economical) in study/work centers, shopping and leisure/cultural centers (libraries, universities, companies, restaurants, cinemas, concert halls, museums, etc.) with high electrical capacity hired. From the point of view of the owner of the infrastructure, service for recharge of electric motorcycles would be a benefit, because it is a competitive advantage. The installation cost would be very small in this case, and it could serve to attract and / or retain users of electric vehicles.

Besides these areas, there are other places that would be good candidates for introduction of charging points. Specifically, parking spaces for electric vehicles in various parts of the city center and park and ride stations near stops of bus, tram, train, etc., which facilitate the intermodality between the use of the electric motorcycle and public transport, thus reducing the maximum energy consumption and mobility related contamination. In this case, we would ask the help of electricity distributors to locate the most suitable sites with the lowest possible investment necessary. To do this, we would look for low load substations and lines, so that it would be viable to install new charging points without the need to upgrade the power.

Finally, users could devote any of their home plugs for the recharge of the battery, as the vehicle battery is detachable. It would be advisable to make these recharges overnight, taking advantage of lower electricity prices during **periods of off-peak**.



## 8. THE IMPACT OF THE SUGGESTED SCENARIOS ON THE ENVIRONMENT

In order to study the environmental impact of the implementation of the project EleCTra, we study how this project affects the environment, understanding it from different perspectives, according to the definition of "environment" by Gomez Orea:

*Living environment is the set of physical, biological, social, cultural, economic and aesthetic factors interacting with the individual and the community in which he/she lives, determining the form, characteristics, relationships and survival of both.*

*Gómez Orea, 1988*

For the implementation of any project it is necessary to assess its impact on the environment and thus ensure the anticipation and undertaking of all necessary measures to minimize negative impacts and maximize the positive measures. Only then the project will be sustainable.

The electric motorcycle has, among others, the following **positive impacts** on the environment:

- Reduced emissions
- Reduced energy consumption
- Lower dependence on foreign energy
- Lower maintenance costs
- Boost to the local economy

As for the **negative impacts**, they are reduced to the phases of construction and decommissioning of the infrastructure and vehicles. It is worth noting that although the EleCTra project aims to introduce a new technology, this introduction does not increase the consumption of resources, as the fleet of electric vehicles is not added to the existing one, but partly replaces it.

All impacts to which we refer in this section take place if the program is successful, i.e. electric motorcycles replace their external combustion analog. Similarly, the average use of the motorcycle of the EleCTra program is assumed to be the same, and we estimate it at about 15,000 km per year.

In the Table 7 we present the summary of results of the environmental impact assessment. Afterwards each point is developed in greater detail.

**Table 7:** Environmental impact assessment of the electric motorcycle.

Index	Environmental impact	
New points for charging batteries	negative	low
Manufacture of electric vehicles	negative	medium
Transmission of electricity	positive	medium
Energy efficiency	positive	high
Ecological footprint	positive	high
CO2 emissions	positive	high
Dependence on foreign energy	positive	high
Noise and smells	positive	high
Maintenance of the fleet vehicles	positive	medium
Impact on the electricity grid	positive	medium
Industrial development of the municipality	positive	medium-low

Source: Own elaboration

**Negative impacts**

The introduction of new charging points will have a negative impact, but it will be very limited, especially if the introduction will be carried out in existing infrastructures.

Likewise, the manufacture of the vehicles themselves has a negative impact of relative importance due to the consumption of resources and energy used by both the automotive industry and the manufactures of the batteries. The production of batteries and electric motors requires a higher consumption of toxic materials and pollutants than production of conventional vehicles. Therefore, this is the main negative impact, but it will not be very high, if we take into account that we must subtract the energy and environmental cost of producing internal combustion vehicles as they are replaced by their electrical alternatives.

As for the transport of the energy source, we can say that the road transport of fluid fuel leads to more pollution and requires greater infrastructure than the transportation of electricity, so this impact from turns from negative into positive light, if we take into account that the use of an electric motorcycle involves the nonuse of a motorcycle (or other vehicle) with internal combustion engine.

To conclude, if we consider the environmental impact related to the proportional decrease in the activities replaced by the processes mentioned above, respectively, the supply of gasoline/diesel at service stations, and the manufacture of internal combustion vehicles, we can assert that the negative impacts are significantly reduced.

**Positive impacts**

In 2009, the transportation sector accounted for about 40% of final energy consumption in Spain. Road transport accounted for 80% of energy consumption in the sector (98% oil products).



In this sense, when comparing similar performance vehicles, **electric motors are more efficient** than traditional combustion engines. Specifically, under normal conditions of use the energy efficiency of internal combustion vehicles stands at under 22% for diesel and around 18% for gasoline engines. However, for of electric vehicles with lithium battery the efficiency ratio is approximately 72%. Therefore, we can say that the energy efficiency of electric vehicles is about four times higher than that of the internal combustion engine vehicle.

**The ecological footprint of the average annual displacement** (15,000 km) is equivalent to an energy consumption of 3.665 kWh in case of a gasoline motorcycle and 900 kWh for an electric motorcycle. Given that the primary energy source is different for the two cases, we have calculated the equivalent kilos of oil for both: a conventional motorcycle has an ecological footprint of about 315 kep, while the one of proposed electric motorcycle will be between 0 kep, if all energy comes from renewable sources, and 45 kep, if all the electricity used comes from the electric grid (with the proportion of renewable energy, as cited above, of 42%).

By using electric vehicles instead of conventional **residues and emissions** in the city are reduced to zero. We go from using a vehicle that emits heat and pollutant gasses to using vehicle that emits zero emissions at the point of use (although it produces emissions, in a much smaller amount than the traditional motorcycle, in the thermal power plants that produce the energy needed to charge the batteries). Therefore, the use of electric vehicles improves air quality in cities, and helps achieving the objectives of the Kyoto Protocol, European Union climate and energy package and Sustainable Development Goals of the UN.

We can take for example the use of a motorcycle chosen by the model for a year. The distance calculated is approximately 15,000 km. A fuel using motorcycle emits 1,455 kg of CO<sub>2</sub>, while the electric motorcycle emits only 222 kg CO<sub>2</sub>, if all electricity used comes from the electric grid (estimated emissions of 0.24643 kgCO<sub>2</sub>/ kWh), and can drop to zero if electricity comes only from renewable energies.

Table 8 is a summary of the quantitative results already presented regarding the decrease in energy consumption and emissions:

**Table 8:** Energy consumption and pollutant emissions.

**Gasoline motorcycle vs. Electric motorcycle**

Use: 15.000 km/year	Gasoline motorcycle	Electric motorcycle	
		Charged from the electric grid	Charged from PV panels
Energy efficiency (%)	18%	72%	
Carbon footprint (kep/	315	45	0
CO <sub>2</sub> emissions(kg/year)	1.455	222	0

Source: Own elaboration



As for the **reduction of energy dependence** from abroad, with the use of electric motorcycles for transport the use of fossil fuels it is reduced, reducing the energy dependence on other countries.

Another advantage of the electric motors over the internal combustion ones is **the total absence both noise and odor**. The introduction of electric motorcycles reduces the levels of noise, vibration and odors in public. Therefore, we must add the positive environmental and social impact of improved quality of life, especially in the city center, where the streets are very narrow and there is a high population and traffic density.

Regarding the **maintenance**, it is worth noting that electric motorcycles require much smaller and less resource intensive maintenance than conventional motorcycles. There is no need to change filters, oil, belts, etc., only a periodic review of the correct operation of the electric motor. In addition, according to statistics, breakdowns in the electric bikes are 40% less frequent.

Another positive aspect to consider is the **increase in electricity consumption at night**, avoiding the need to limit the production of energy from free and unlimited sources at this time. If the batteries are charged during the off-peak hours in the grid, that is, at night, the impact on the grid would be positive because it would increase the demand in times when it is smaller.

A positive cross-effect of the use of electric vehicles is that **users become more aware** of their energy consumption. The electric motorcycle thus promotes a change in the awareness in the user, and sensitizes them on the use of resources necessary to meet their needs.

Similarly, the introduction of electric vehicles would have **positive cross effects on local economic development of the municipality**, creating jobs for managing the introduction, as well as the construction and maintenance of infrastructure. It is especially valuable opportunity in a region like Murcia, hit by the crisis and with one of the highest unemployment rates in Spain. Therefore, the electric vehicle represents an opportunity for the generation of industrial structure and services. Among the sectors that could benefit from the development of electric mobility in the city we can include the following:

- Sector of components: motors, batteries, charging infrastructure, other
- Assembly
- Sales: distributors, dealers
- Services: recharging infrastructure, charging network operator, battery recycling, repair shops.

Therefore, the implementation of such project as EleCTra in the city of Murcia would be a model with many positive environmental impacts and good practices for citizens (such as awareness and dissemination of energy efficiency and energy saving). It is as well a great opportunity for the local economy through the generation of industrial structure and auxiliary services.

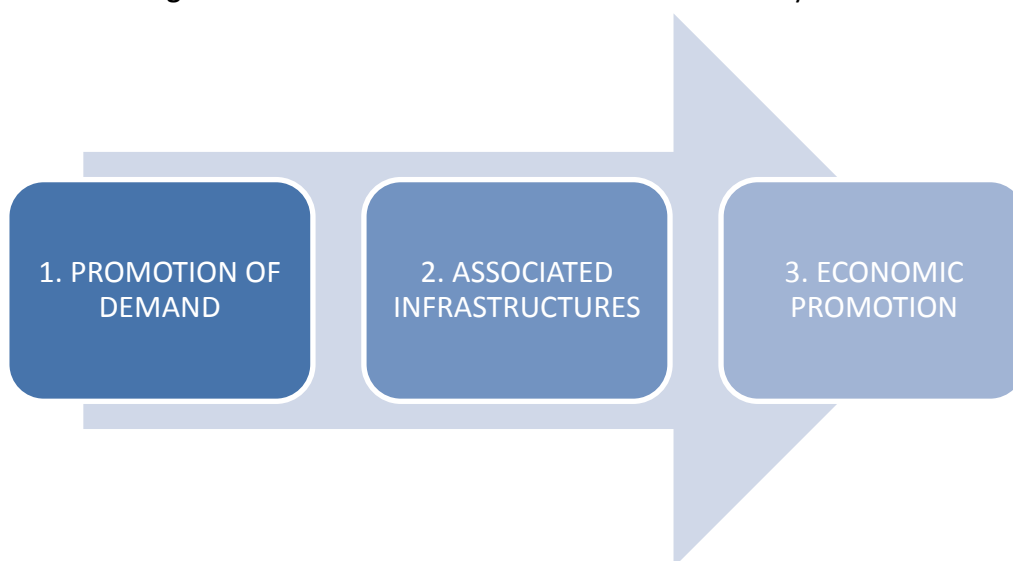




## 9. PLANNED ACTIVITIES FOR THE INTRODUCTION OF E-LIGHT VEHICLE SHARING SYSTEM

Regarding the actions planned for the introduction of electric motorcycles rental system in Murcia, we are considering three areas of priority action (demand, infrastructure and economic promotion). These lines of action are consistent with the guidelines set by the Local Strategy for Electric Vehicle, which is being developed.

**Drawing 1:** Areas for the introduction of the electric motorcycle in Murcia



Source: Own elaboration

### AREA 1: PROMOTION OF DEMAND

#### Communication and Sensitization

Through the promotion of the use of electric mobility it is expected that citizens and private enterprises will assimilate the benefits of the electric vehicle over conventional vehicle, and thus there will be a sustained increase in demand for electric cars and motorcycles, similar to which have been experienced in recent years in other European countries like Britain, Norway and France.

Therefore, the acceptance and feasibility of this project by citizens depends on the design of a communication campaign and adequate sensitization.

As we have noted, the electric motorcycle increases the user satisfaction by offering higher quality components, increased safety, better maneuverability, more power, more technology, lower maintenance costs and improved image of the companies that use it.

According to information from the two current providers of electric motorcycle in Murcia, these features are the main reasons that encourage potential users to purchase electric motorcycle.

Therefore, information campaigns about the characteristics of electric motorcycles are indispensable for the development of the project EleCTra in the municipality.

Thus, for the introduction of the system EleCTra the possible actions in the field of awareness and social sensitization include the following:

- Conduction of information sessions aimed at specific groups, such as groups of students, both from secondary schools and universities, logistics companies from Murcia, workers of car dealerships and general society.
- Collaboration with local media to disseminate the characteristics of the electric motorcycle.
- Creation of promotional materials for the project and making them available to the electric vehicle providers.
- Edition of booklets with information on the location of public charging points and information on the electric vehicles and specifically motorcycles. These booklets will be distributed at dealerships and information points of public buildings.
- Provision of information through the websites of municipality and ALEM.
- An annual exhibition of electric vehicles and information stand, as it is being done in the European Mobility Week in Murcia.

### **Test drives of the vehicles**

According to the results of the survey, as discussed in section 4 of this report, we see the need on the part of potential users to investigate and test the electric motorcycle before the purchase.

Similarly, one of the major constraints faced by potential users was the "battery recharge", so for familiarizing citizens with all the dimensions of the electric motorcycle, they need to test not only the vehicles but also their charging systems. As we noted in paragraph 7, the current charging systems allow recharging the battery very easily in any electricity connection, whether it is located in the house of the individual or elsewhere. Also, the battery charger is included in with the motorcycle, and it is very easy transportable and can be used with any outlet with power.

## **AREA 2: ASSOCIATED INFRASTRUCTURES**

### **Promotion of private charging points**

The charging points in private spaces include such places as commercial spaces, collective garages, individual garages, parking lots of companies etc. In order to encourage the installations in these spaces, local government should simplify the administrative procedures that are within their competence.

### **Installation of more charging points in streets**

It is important to install more chargers in the streets, due to the expected increase in the demand of vehicle. Murcia should provide a network of charging points according to the needs of a city of 440,000 inhabitants. In this sense, the challenge of installing fast and semi-fast charging points at



strategic points of the city will be addressed at the same time as many of the municipal buildings will receive charging points, so that the fleet of municipal vehicles can grow and municipal officials have the support needed to buy an electric car or electric motorcycle to go to their jobs.

The new charging points on public roads must fulfill the following criteria:

- They must be distributed throughout the city and located in areas of large flow of vehicles.
- They must be placed without removal of parking spaces and next to a control center in order to facilitate connection to the electricity grid.
- They must be visible, thus increasing the knowledge of potential users.

### AREA 3: ECONOMIC PROMOTION

This area includes those actions aimed at R+D+i, entrepreneurship, business cooperation and training relates to the electric vehicle. Similarly, expansion of incentives and tax advantages for electric vehicle should be a priority for the economic promotion.

On the one hand, it is necessary **to overcome the regulatory, legal and standardization barriers** that might impede the development of electric vehicles by creating a framework to facilitate its viability. In order to do it, all the possible barriers and necessary regulatory and homologation developments for both the vehicle itself, as well as for its components and charging infrastructure, taking into account all their specific conditions, must be identified:

- Legal barriers regarding the use of electric vehicles throughout their life cycle (homologation, registration, circulation and end of life)
- Legal barriers regarding the recharge (electrical safety and protection, communication protocols, plugs, provision of charging services, etc.)
- Legal barriers regarding the battery (hazardous waste, recycling)

On the other hand, the **incentives and tax advantages** for electric vehicles should be expanded, so that there are sufficient guarantees that the energy cost for electric vehicles is significantly lower than the energy cost for internal combustion engine. It is this economy of use which, along with incentives to buying the electric motorcycles, will facilitate the introduction of this propulsion technology in the market.

Therefore, in the ideal scenario, the use and acquisition of the electric motorcycle, both for fleets and for personal mobility, will be financially supported through direct aid for the purchase of vehicles, and providing some tax advantages, following criteria which will compensate for the efforts made by these early users of electric vehicle, both economically (high acquisition prices), and psychologically (the uncertainty that involves the use of new technology).

## 10. GENERAL CONCLUSIONS OF THE STUDY

Murcia, one of 11 partners from 8 countries participating in the Project EleCTra, presents demographic particularities and a specific geographical distribution, where there are large population centers that perform moderate daily movements to and from the center of the city, which warrant and require initiatives to promote sustainable and electric mobility.

Being aware of the new challenges of the electric energy for mobility in cities, both on European and local levels, there have been created many plans, programs and incentive systems aimed at boosting the electric vehicle.

The electric motorcycle is in the phase of development in the city of Murcia, where a supply consists of two companies: Emisiones00 and Murcia SobreRuedas. Similarly, regarding the network of charging points, Murcia has 9 points distributed throughout the city and situates in visible places to promote knowledge among the potential users.

Among the main weaknesses identified in this analysis we can highlight the "misinformation of the public" about the benefits of electric vehicles, a "low supply of auxiliary services related to the electric vehicle" and "insufficient charging infrastructures".

On the demand side, it should be noted that the "cost and maintenance of batteries" is the main barrier named by citizens. Therefore, active policies for the promotion of electric vehicles and their use by the citizens are essential for Murcia in order to experience a development of electric mobility in every respect, as it has been seen in other European countries like United Kingdom, Norway and France.

As for the business systems for the implementation of the electric motorcycle, we observe that the most suitable system for the city is rent-to-own, as with this system the limitations outlined above, cost and uncertainty regarding the charging systems, could be reduced.

The pilot model of rent-to-own of 20 electric motorcycles, under the hypotheses and assumptions of constant demand, is not economically profitable. In the medium term there are likely to be changes in the system, such as increased demand, purchase subsidies, lower cost of purchase and improved productivity and performance of batteries, among others. These changes will have an impact and bring higher revenues and lower costs for the company.

Regarding the environmental sustainability, we noted the many benefits of the electric motorcycle, such as reduction of emissions; lower energy consumption and decrease in foreign energy dependence; as well as lower maintenance costs. On the other hand, there are cross-cutting benefits as well, such as the development of public awareness and promotion of the local economy.

After pointing out the great advantages and opportunities that the development of electric motorcycle can bring to Murcia, we mention a series of actions necessary to ensure the introduction



and development of electric mobility in the city of Murcia, such as stimulation of demand, development of charging infrastructure system and economic promotion (through incentives and tax benefits).

Undoubtedly, electric mobility represents a challenge for the city and requires constant efforts by the local government to reduce the limitations, such as lack awareness among citizens and develop infrastructure of fast and semi-fast charging points in strategic areas of the city. With the help of these actions, in the medium term Murcia will be designed as a city with integrated sustainable urban mobility through the development of, among others, electric means of transportation, which will offer its citizens the opportunity to interact with the city in respectful and healthy way.



## 11. REFERENCES FOR ELECTRIC MOTORCYCLE. MURCIA

### EUROPE

- **Electric City Transport (Ele.C.Tra.)**  
<http://www.electraproject.eu/>
- **Covenant of Mayors**  
[www.pactodelosalcaldes.eu/](http://www.pactodelosalcaldes.eu/)

### SPAIN

- **The Institute for Energy Diversification and Saving (IDAE)**  
<http://www.idae.es>
- **Urban Electric Mobility Project (MOVELE)**  
[www.movele.es](http://www.movele.es)

### MURCIA

- **Local Energy Agency Murcia (ALEM)**  
<http://www.energiamurcia.es/>
- **Emisiones00**  
[www.emisiones00.com](http://www.emisiones00.com)
- **Murcia sobre Ruedas**  
[www.murciasobreruedas.es](http://www.murciasobreruedas.es)

