Empowering e-fleets for business and private purposes in cities

Programme: STEER

Project number: IEE/12/713/SI2.644746

e-Mobility Fleet Schemes and Market Potentials in Portugal

Date: 03/02/14

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Co-funded by the Intelligent Energy Europe Programme of the European Union

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1. Executive Summary

Electric mobility is a highly promising technology that can help address severe global challenges such as climate change and fossil fuel dependency; it can contribute to cutting local CO_2 emissions and noise pollution coming from transport and enable synergies with smart grids and so favour a greater percentage of renewable energies production.[1]

The large potential of electric vehicles in urban fleets includes (a) improving electric mobility markets through niche development, thus accelerating mass market adoption of electric vehicles; (b) supporting the achievement of energy and climate protection goals; and (c) contributing to tackling global recession by revitalising the industrial fabric and fostering innovation, growth and job creation.

Portuguese gross domestic product (GDP) of 171 billion EUR in 2011 represents 1.35% of EU 27 GDP[2].

With a population of 10.5 million (2012), Portugal represents 9.36% of the total European population (500.35 million)[3] and 86.67% of this population (2011) lives in cities that have between 50,000 and 300,000 inhabitants.

Portuguese modal share (2011) shows that almost half population uses car and/or motorbike.

With 4.7 million vehicles in 2011, Portugal has the 10th European carpool representing 1.9% of the total EU fleet. [4]

The National Energy Strategy 2020 sets a target of 31% of gross final energy consumption coming from renewable sources by 2020, and 10% of the energy consumption in transport coming from these sources. Also, the National Plan for Energy Efficiency has foreseen a reduction in energy consumption in 8.2%% until 2016[5]. This strategy will imply the contribution of several sectors of activity, leaded by the Government, with it's own compromise of reducing 30% of consumption in its activities.

Committed with these objectives, the Portuguese Government launched in 2008 a National Program for Electric Mobility (MOBI.E), aimed at creating an innovative electric mobility model and a charging network with national coverage.

The MOBI.E network is an intelligent charging network available throughout Portugal, and accessible to all users (using a charge card), that will allow in the near future to an optimal exploitation of the electric grid: control the electric vehicles charging process, transferring consumption from peak to low demand periods, re-enter the electricity stored in the EVs into the grid, etc. The developed technology is also a payment system, and allows users to find and select charging locations, plan routes and know the battery level of their vehicles.

This pilot initiative involves 25 of the largest Portuguese municipalities and planned the installation of 1,300 normal charging points and 50 fast charging points, although only about 1,000 have been implemented.

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[1] Council of the European Union. 2010.

[2] Eurostat, (2013a). GDP at current market prices.

[3] Eurostat, (2013b). Population on 1 January.

[4] European Automobile Manufacturers' Association (ACEA). Pocket guide 2013.

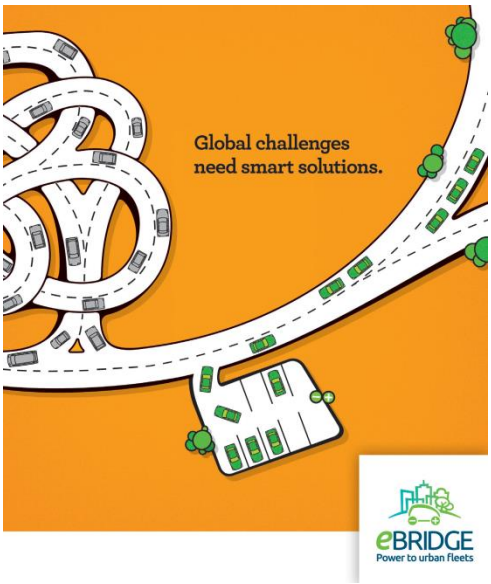
5 National Action Plan for Energy Efficiency (PNAEE 2016).

2. Introduction

2.1 The eBRIDGE Project

eBRIDGE is a co-funded EU project to promote electric fleets for urban travel in European cities. The project aims to bring innovation and new technologies to make today's mobility cleaner, more efficient and sustainable.

During eBRIDGE, alternatives to current mobility patterns will be explored in order to analyze whether electric mobility is a feasible option to make cities cleaner and more sustainable.



Although electric vehicles fulfil all the requirements to be among the most important players in urban transport systems of the near future – they are clean, efficient, silent, and incur low running costs – significant barriers to a wider diffusion and use of electric vehicles remain to be addressed, including low user acceptance and higher purchase costs compared to conventional cars.

On this backdrop, eBRIDGE aims to demonstrate how the introduction of electric vehicles in fleets for business and private urban travel can efficiently contribute to the improvement of market conditions for the electric mobility sector.

Seven case studies with heterogeneous starting conditions assure a broad-spectrum outcome. Berlin (Germany), Milan (Italy), Lisbon (Portugal), Vigo (Spain), Valencia (Spain), a selection of Austrian municipalities and Carmarthen (Wales) are developing actions to optimise operational fleet performance, test and launch solutions to increase the convenience and ease of use of car sharing offers and finally, raise awareness among the target groups and further relevant stakeholders through engaging marketing approaches on the suitability of electric mobility for urban transport and commuting.

The eBRIDGE team involves technical experts, academics, associations, public administrations, mobility providers and public transport and car sharing operators:

- choice GmbH (Coord.), Germany
- DB FuhrparkService GmbH, Germany
- Allmenda Social Business e.G., Austria
- Forschungsgesellschaft Mobilität – Austrian Mobility Research gem. GmbH, Austria
- I Nova Consultores en Excelencia e Innovación Estratégica, S.L., Spain
- Galician Cluster of Automotive Companies, Spain
- Movilidad Urbana Sostenible S.L., Spain
- Comunitat Autònoma de les Illes Balears, Spain
- Fondazione Legambiente Innovazione, Italy
- Azienda Trasporti Milanesi S.p.A, Italy
- Occam, Portugal
- Câmara Municipal de Lisboa, Portugal
- Cardiff University, United Kingdom

2.2 Scope of the report

The goal of the "Work Package 2: Market Analysis", is to analyse the current situation and trends of electric fleets in the eBRIDGE targeted regions by assessing information about all context relevant issues such as market overview, best practice, legal framework, policy, and environmental impacts. The work package will also assess the market potential of electric mobility, mainly for fleets.

The present report "e-Mobility Fleet Schemes and Market Potentials – PORTUGAL", gathered this information for Portugal and particularly Lisbon, the Portuguese case study site.

2.3 Methodology

In the course of this work package, data from Germany, Austria, Spain, Italy, Portugal and United Kingdom have been gathered and analysed for the period 2008-2012.

The overall goal has been to establish the current state of play on electric urban fleets for every participant country. A factsheet on transferability at a European scale will be based on this report series.

Relevant data regarding national carpool such as registrations, power train type, sales figures, car sharing hot spots, main charging operators, as well as main national policy and R&D aspects e.g. incentives and favouring policies have been collected and analysed.

Additionally, a brief assessment of the market potential of electric vehicles including identified national barriers and drivers is provided.

Finally, the assessment of the Lisbon case study facilitates the comparison of the local and national levels, showing to what extent the Portuguese energy and climate targets are on track.

The methodology is based on four steps as shown in Figure 1. First, the relevant aspects of urban mobility and electric fleets were defined in the data collection template. The contents of the report were likewise defined and main timelines drafted. Finally, the results of the data analysis and complementary sources were added, and presented in the present report.

Figure 1 Time Plan Methodology

Source: Own diagram

3. Electric Mobility in Portugal

3.1 Starting point

Under the Directive 2009/28/EC (EC, 2009), Portugal has committed itself to a target of 31% of gross final energy consumption coming from renewable sources by 2020; in its National Energy Strategy 2020 (Portuguese Gov., 2010), it also sets the objectives of having 60% of electricity production and 10% of the energy consumption in transport coming from renewable sources by 2020.

The strategy underlined by these objectives[6], combined with the possibility of making greater use of wind power generation installed capacity (with the potential to drastically cut CO_2 emissions from transport), convinced Portugal to start its electro-mobility initiative in 2008 with the creation of the MOBI.E Program.

The pilot initiative is nationwide and involved 25 of the largest Portuguese municipalities and a number of different stakeholders: from research centres, to energy and IT companies. This program planned the installation of 1,300 normal charging points (CP) in public roads and 50 fast CP in primary roads and highways, although only a total of around 1,000 charging points have been achieved so far.

The number of EVs is expected to reach 200,000 by 2020, in view of wide user adoption fostered by convenience of vehicles for certain categories of users and penetration of new mobility services incentivized by public authorities; the public charging infrastructure may count 25,000 public charging points by that time. So far, only a national total of 294 pure EVs were registered in 2012, a number below the initial expectations, that cannot be set apart from the difficult economic period that the country is living.

3.2 General Aspects of Mobility

DEMOGRAPHY

Portugal recorded a total population of 10.48 million inhabitants in 2012. The median age of population has been increasing in the last decades, from 40.1 in 2008, being 42.3 in 2012 and so the 6th oldest in EU-27.[7]

Figure 2 classifies Portugal's population for the period 2008-2012 in two categories: total population and working population (aged between 18 and 70 years).

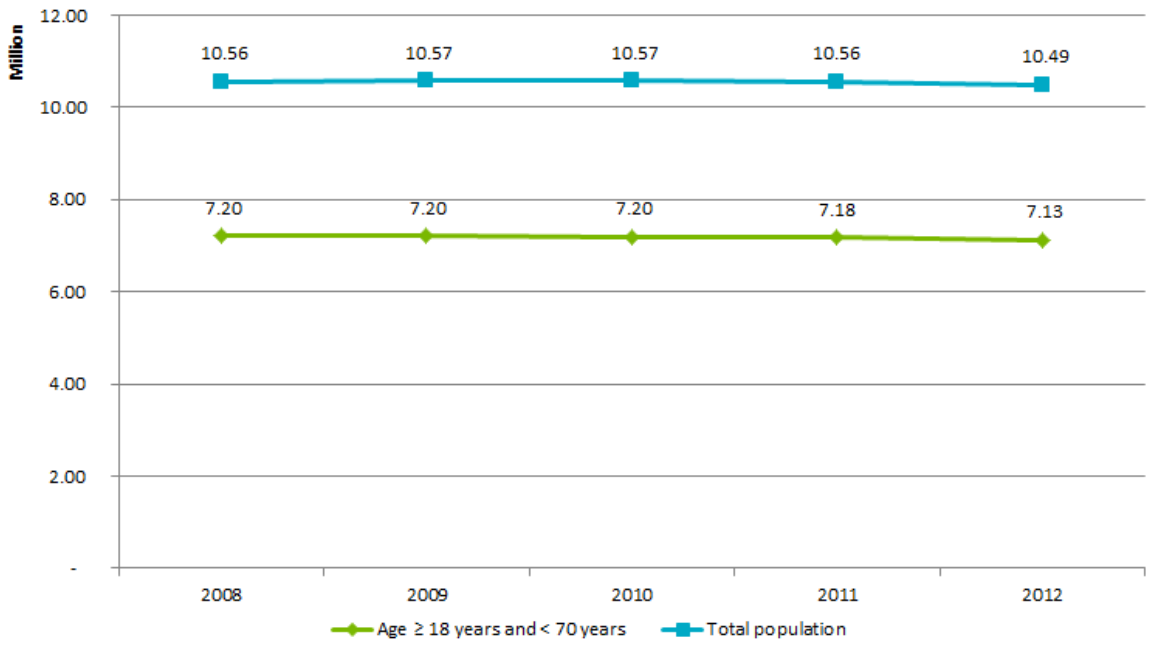
In 2012, more than over a half of the total population was working population (68.01%), able to hold or obtain a driving license.

From 2008 to 2012, total population has decreased a 0.72%, and working population 0.97%.

[6] National Action Plan for Energy Efficiency 2020 (PNAEE); Portugal2020 - National Reform Programme (2011).

[7] Eurostat (2013c) Population structure and Age.

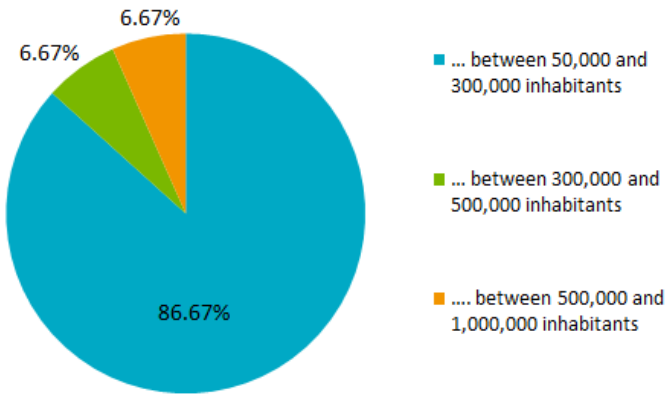
Figure 2 Demographic trends



Source: Own graphic based on Portuguese Statistical Office (INE) (2013)

The country´s population is distributed as shown in Figure 3. In 2011, 86.67% of cities have between 50,000 and 300,000 citizens.

Figure 3 Share of cities by size class

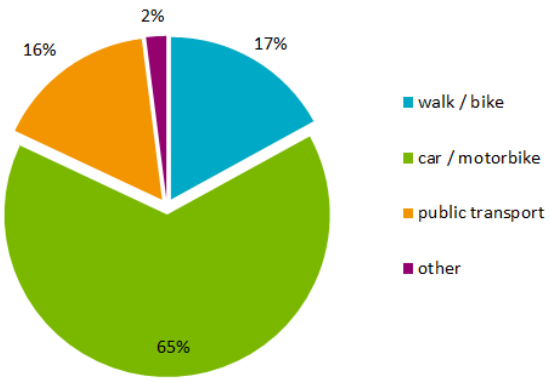


Source: Own graphic based on Portuguese Statistical Office (INE) (2011)

MOBILITY PATTERNS

The Portuguese modal share 2011 showed that most of the trips (65%) were done by individual motorised means (car/motorbike), almost same percentage by public transport (16%) and walked or cycled (17%) and 2% by other means.

Figure 4 Modal share 2011



Source: Own graphic based on National Mobility and Transports Authority (IMT) (2011)

3.3 The Portuguese Carpool

VEHICLE FIGURES

Total vehicles registered

The number of passenger cars and light transport vehicles has increased steadily from 5.60 million in 2008 to 6.03 million in 2011.[8] In this period, the trend of increase is slightly higher in light commercial vehicles (10.14%) than in passenger cars (6.90%).

78.3% of all registered vehicles were passenger cars in this period (2008-2012).

The average age of the vehicles was 10.10 years in 2010 and 10.60 years in 2011.

Figure 5 Total vehicles registered 2008 - 2011

Source: Own graphic based on Automobile Association of Portugal (ACAP) (2008-2009) and Portuguese Statistical Office (INE) (2010-2011)

[8] No data available for 2012.

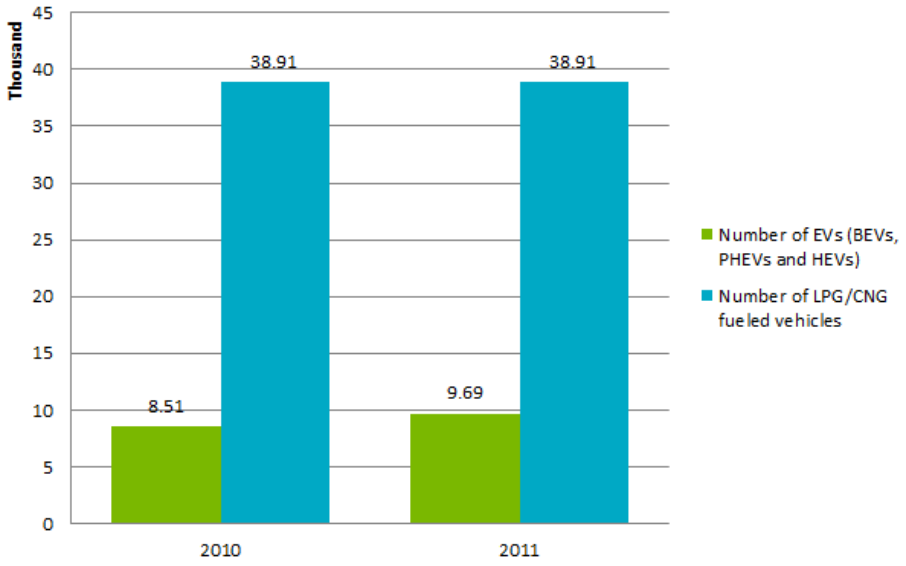
Vehicle powertrain type

In 2011, only 0.81% of the total vehicles registered were alternative fuelled vehicles; being 99.19% conventional fuelled vehicles.

Among the alternative fuelled vehicles a big percentage, 80.06% (0.64% of the total), were liquefied petroleum gas (LPG) or compressed natural gas (CNG) fuelled vehicles and 19.94% (0.16% of the total) was plug-in hybrid electric vehicles (PHEV), hybrid electric vehicles (HEV) and battery electric vehicles (BEV).

LPG and CNG registered vehicles have remain stable in 2010-2011, while in the same period, PHEVs, HEVs and BEVs have increased by 13.90%.

Figure 6 Total vehicles powertrain type 2010 - 2011



Source: Own graphic based on Portuguese Statistical Office (INE) (2013)

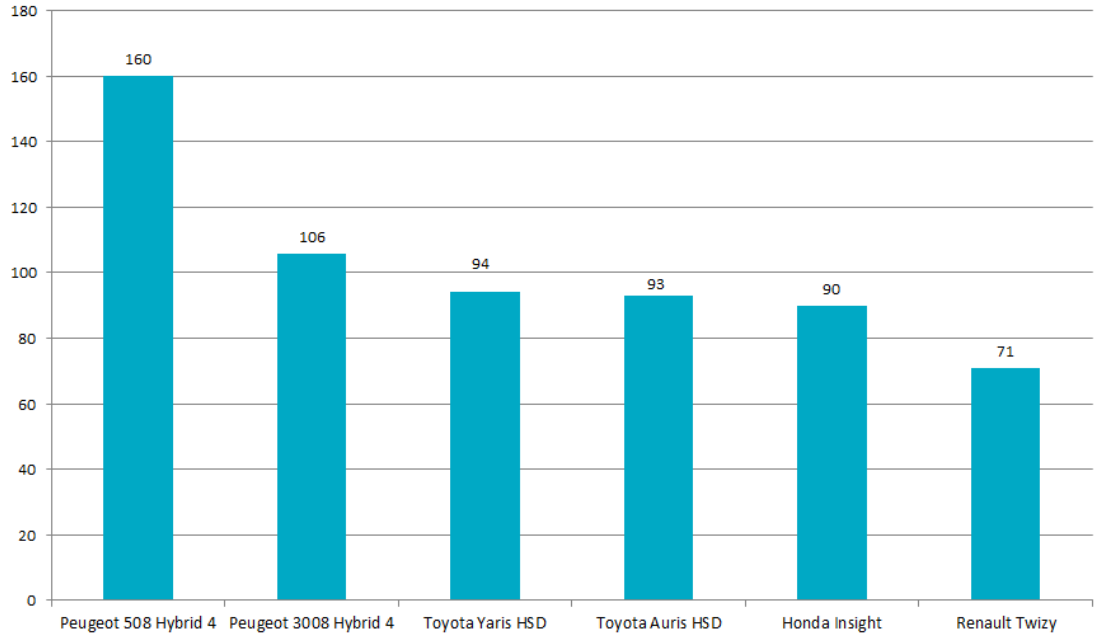
Selection of most sold EVs per supplier & model

Based on the sales of 2012, Figure 11 shows a selection of the most sold EVs with Peugeot leading the market with its models 508 and 3008 (28%)

Toyota follows with the Yaris and Auris models (19.68%)

These four models, together with Honda Insight and Renault Twizy, achieved 64.63% of market share.

Figure 7 Selection of most sold EVs 2012



Source: Own graphic based on Automobile Association of Portugal (ACAP), Toyota Caetano Portugal, Nissan, Renault (2013)

ENVIRONMENT

The EU has called for the need to drastically reduce world greenhouse gas (GHG) emissions, with the goal of limiting climate change below 2ºC. Overall, the EU needs to reduce emissions by 80–95% below 1990 levels by 2050, in the context of the necessary reductions of the developed countries as a group, in order to reach this goal.

European Commission analysis shows that while deeper cuts can be achieved in other sectors of the economy, a reduction of at least 60% of GHGs by 2050 with respect to 1990 levels is required from the transport sector, which is a significant and still growing source of GHGs. By 2030, the goal for transport will be to reduce GHG emissions to around 20% below their 2008 level.

Accordingly, the White Paper on Transport (2011) establishes as first goal to halve the use of conventionally fuelled cars in urban transport by 2030; phase them out in cities by 2050; achieving essentially CO_2-free city logistics in major urban centres by 2030. [9]

Moreover, the European Union's ten-year growth strategy, Europe 2020, established a set of targets including climate, energy and sustainability targets. The EU targets are translated into national targets in each EU country.

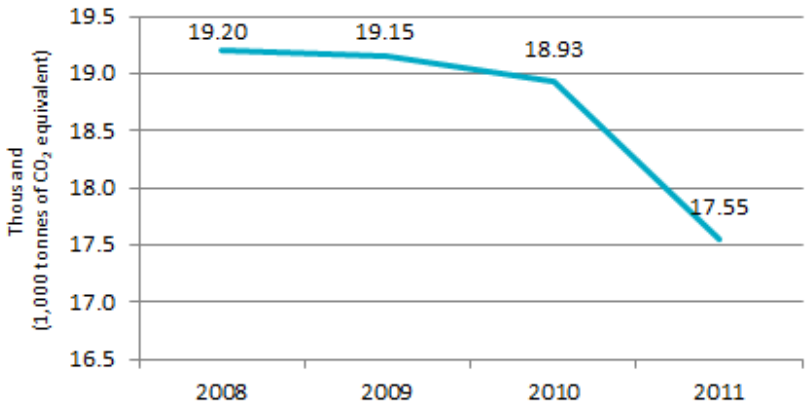
In the specific case of Portugal, the national target related GHG for 2020 is to reduce the GHG 1% with respect to 2005. [10]

[9] European Commission (2011a) WHITE PAPER - Roadmap to a Single European Transport Area: Towards a competitive and resource efficient transport system (2011) COM/2011/0144.

[10] European Commission (2011b) Europe 2020 Targets.

The total GHG emissions transport in MT CO_2 units[11] shows a decreasing trend, being the average drop rate of 8.60% from 2008 to 2011. This downward trend is more evident in 2011, with a drop of 7.29%.

Figure 8 Greenhouse gas emissions from transport 2008 - 2011

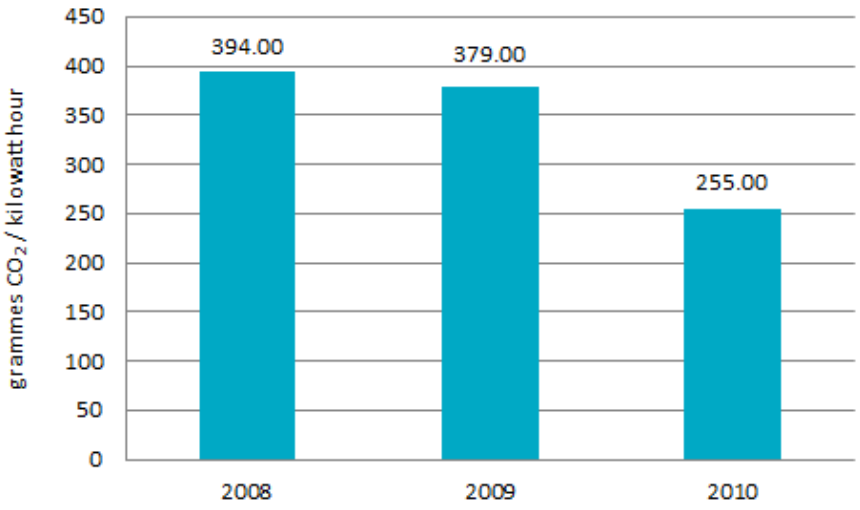


Sources: Own graphic based on Eurostat (2013d) Indicators Theme 6 Climate Change and Energy

Regarding electricity generation, CO_2 emissions per KiloWatt hour, from 2008 to 2010 shows a huge decreasing trend, being the average decline rate of 35.28%.

This positive trend can be considered a driver of electric mobility in Portugal.

Figure 9 CO_2 emissions per kWh from electricity generation 2008 - 2010



Source: Own graphic based on CO_2 Emissions from Fuel Combustion Highlights, IEA (2012)

[11] This indicator shows trends in the emissions from transport (road, rail, inland navigation and domestic aviation) of the greenhouse gases regulated by the Kyoto Protocol.

3.4 Charging Infrastructure

MAIN OPERATORS

In 2012, the recharging infrastructure was owned mainly by private companies with an electric utility or a petroleum company profile. Three main operators installed approximately 430 charging points.

Table 1 Main charging operators

Operator	Charging Points	Fast Charging Points (30')	Profile
EDP MOP	400	0	Electric utility
GALP	0	5	Petroleum company
PRIO.E	22	3	Petroleum company

Source: Own table based on EDP MOP, Galp, Prio.e (2013)

3.5 Portuguese Fleet Hot Spots

MAIN LOCATIONS FOR CAR SHARING

The next table shows the main Portuguese car sharing cities to consider due to the number of car sharing operators, high number of charging points, high number of EVs or other feature:

Table 2 Main locations for car sharing

Number of	Lisbon	Porto
Car sharing operators	1	1
Charging points	500[12]	168[13]
EVs	2 (Hybrid)	-

Source: Own table based on Mob Carsharing, Citizenn, Municipality of Lisbon and Municipality of Porto (2013)

CORPORATE CARSHARING FLEETS

Regarding company fleets, Lisbon's gathers the majority of initiatives, with large predominance in terms of municipal/public initiatives.

Table 2 Main corporate car sharing fleets

Fleets	Type	Number of EVs	Location
Lisbon	Municipality of Lisbon	54	Lisboa
Lisbon	EMEL – Lisbon Municipal Mobility and Parking Company	5	Lisboa

Source: Own table based on data from Municipality of Lisbon (2013), EMEL (2014)

[12] Slow charging points

[13] Slow charging points

BUSINESS CAR SHARING OPERATORS

Table 4 Main business car sharing operators

Operator	Fleet		Technological key aspects				Locations
	Operator private company	Total fleet	Booking	Access	System	Payment	
MOB CARSHARING	Carristur	10	Phone Internet	Smartcard Car key inside	Station-based	Credit card	Lisbon
CITIZENN	Transdev	20	Phone Internet	Smartcard Car key inside	Station-based	Credit card	Porto

Source: Own table based on Mob Carsharing, Citizenn (2013), see links

3.6 Research & Development

The main research focus in Portugal has been on the development of an intelligent and integrated infrastructure to support the deployment and evolution of the MOBI.E network. This is the result of significant investments in research and development (R&D) and engineering by Portuguese companies and R&D organizations from the automotive, electric and electronics systems, ICT, and energy sectors.

KEY RUNNING R&D PROJECTS ON ELECTRIC VEHICLES

Table 3 Key running R&D projects on electric vehicles

Title	Key areas covered	Coordinator	Partners	Budget	Funding
FREVUE Freight Electric Vehicles in Urban Europe	EVs in urban logistics	Westminster City Council (UK)	30	13.8 Million EUR	FP7 European Commission

Source: Own table based on project web page (2013)

DEMONSTRATIVE E-FLEET PROJECTS

Table 6 Demonstrative e-fleet projects

Project	Key areas covered	Years	Nº of EVs	Nº of partners	Coordinator	Budget
MOBI.E Pilot Project	Research project for the full development of a large-scale national demonstrator of the MOBI.E project	2010-2012	-	6	Inteli (Portugal)	6.7 million EUR

MOBI.Europe	Test and evaluate services for real time information on the charging infrastructure, roaming between different electric mobility operators and electricity retailers, smart managing of electric vehicle charging and vehicle sharing.	2012-2015	-	12	Inteli (Portugal)	18.4 million EUR
MOBILES – Mobilidade Eléctrica Sustentada	To create ICT-based solutions to support electric mobility, in particular mobile-based applications with navigation systems for support	2009-2012	-	5	NDrive Sistemas de Navegação, S.A. (Portugal)	1.7 million EUR
MERGE Mobile Energy Resources in Grids of Electricity	Development of a management and control concept that facilitate the actual transition to electric vehicles; adoption of an evaluation suite of tools based on methods and programs enhanced to model, analyze, and optimize electric networks where EV and their charging infrastructures are going to be integrated	2010 - 2011	-	16	Public Power Corporation S.A. (Greece)	2.96 million EUR

Source: Own table based on Hybrid & Electric Vehicle (IA-HEV) Implementing Agreement and projects own page (2013)

3.7 Policy Framework

KEY REGULATIONS REGARDING ELECTRIC VEHICLES

Table 4 Key regulations regarding electric vehicles

Regulation	Key aspects being regulated	Date of release	Public body/ authority
Decreto-Lei nº 39/2010	Creation of the public charging infrastructure and general regulation of electric mobility	26/04/2010	Ministry of Economy, Innovation and Development (National level)
Portaria nº 1201/2010	Technical requirements for licencing the activity of charging points	29/11/2010	Ministry of Economy, Innovation and Development (National level)

Decreto-Lei nº 170/2012	Revises DL 39/2010 on licensing of charging services	01/08/2012	Ministry of Economy, Innovation and Development (National level)

Source: Own table based on Official State Journal (2013)

FINANCIAL INCENTIVES

Table 5 Financial incentives

Sector	Key incentives	Date of release	Public body/ authority
Tax Relief Portaria nº 467/2010	The purchase of an electric vehicle will entitle the buyer to Corporate Tax relief (for companies)	2010	Ministry of Finance and Public Administration (National level)
Tax Exemptions Lei nº 22-A 2007	Electric vehicles are exempt from both ISV - Vehicle Tax - and IUC - Single Circulation Tax	2007	Assembly of the Republic (National level)
Decreto-Lei nº 39/2010	Private customers that buy one of the first five thousand electric cars from 2010 onwards would be entitled to an incentive of 5.000 EUR.	2010/2011	Ministry of Economy, Innovation and Development (National level)
Portaria nº 468/2010	Defined the eligible electric cars that may benefit from the 5.000 EUR incentive previously referred.	2010/2011	Ministry of finance and public administration, economics, innovation and development of public works, transport and communications (National level)
Mobi.e	Development of pilot public charging network	2009/2013	Intelligence in Innovation - Innovation Centre (INTELI) (National level)

Source: Own table based on Official State Journal (2013)

4. Market Potentials

4.1 Main Drivers and Constraints

In general terms and at European level, the main market barriers for the successful integration of electric mobility into European transport systems include technological, infrastructural and cost-related aspects. Finding integrative solutions to overcoming the current challenges concerning battery technology, standardisation of the recharging infrastructure, interaction with electricity generation systems and cost and business case of large scale introduction is crucial for the development of the electric mobility market in the short and long term. The increased demand for EVs, along with the sharing of best practice and extensive public and organisational awareness-raising activities, will help encourage infrastructure and technological investments and reduce costs.

In the specific case of Portugal, the following drivers and constraints have been found:

Table 6 Drivers and Constraints Electric Mobility

Potential Drivers	Constraints
• Available public charging network	• Cost-benefit not sufficiently established (in particular due to the high cost of acquisition) • Uncertainties related to the reliability of the technology • Maladjusted expectations with regard to individual mobility needs (people believe they need a vehicle to address all their potential needs in terms of range, not their actual needs) • Very scarce incentive framework

Source: Own table based on "Toyota's Mobility Consultation", Toyota Caetano Portugal; and educated guess (2012)

Other relevant issues to consider for Portuguese case are:

1) Factual information on BEVs is lacking in the communication campaigns related to BEVs and prejudices and misperceptions create a market barrier to this technology.

2) The national strategy is targeted at individual drivers and not the professional sector, which could contribute to a better public image of BEVs, people would become more and more aware of the technology and its potential.

Sources: "Toyota's Mobility Consultation", Toyota Caetano Portugal; and educated guess (2012)

5. Local Assessment

5.1 Starting Point

The Municipality of Lisbon has been particularly committed to electric mobility in the last 5 years. Lisbon is part of the ambitious National Program for Electric Mobility in Portugal (MOBI.E) that intends to set-up a nation-wide intelligent charging network, and under which almost 500 charging points were installed in the city until the end of 2011. Also, since 2010 that Lisbon City Council (CML), together with the Municipal Public Parking Company for Lisbon - EMEL - has been developing the Local Action Plan for Electric Mobility, a participatory process involving relevant stakeholders for the city that intends to enable electric vehicles to become the preferred mode of choice in urban areas.

Furthermore, the municipality has been developing a comprehensive strategy to improve air quality in the city centre: in 2010 a Reduced Emission Zone ("Zona de Emissões Reduzidas") – ZER – was enforced in the major avenues of the city and has been gradually extended.

As part of its leading by example approach, Lisbon City Council has signed the agreement that at least 20% of all new vehicles purchased should be EVs. Hence, the municipality has been progressively investing in the acquisition of EVs for their own fleet and substituting older vehicles. By 2011 the municipality had already 36 EVs in its fleet (of a total of 880 vehicles): 5 light passenger cars for generic transport activities, 17 light duty vehicles to support municipal urban cleaning operations and 14 quadricycle (Segways and Gems) used by the Municipal Police.

5.2 General aspects of Mobility

DEMOGRAPHY

Lisbon recorded a total population of 524.28 thousand inhabitants in 2012. The median age of population in 2011 was 44.4, quite older than national average age for the same year (41.9) and the EU-27 (41.2). [14]

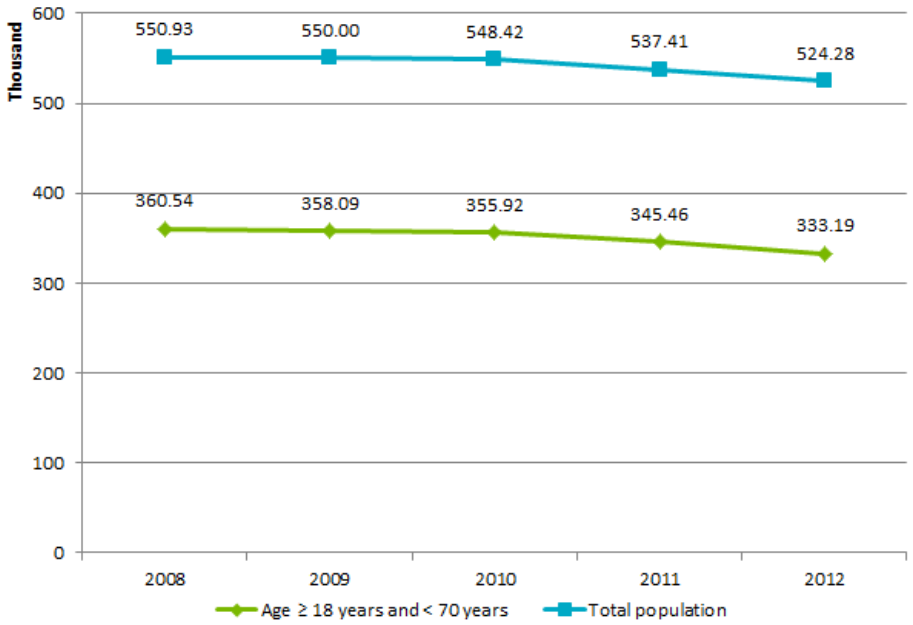
Figure 10 classifies Lisbon's population for 2008-2012 in two categories: total population and population aged between 18 and 70 years (aged between 18 and 70 years).

In 2012, over half of total population was working population (63.55%), able to hold or obtain a driving license. This percentage is similar in previous years, being the average for period 2008-2012 of 64.66%.

From 2008 to 2012, total population has decreased 4.84% and working population 7.59%.

[14] Eurostat (2013c) Population structure and Age.

Figure 10 Demographic trends



Source: Own graphic based on Portuguese Statistical Office (INE) (2013)

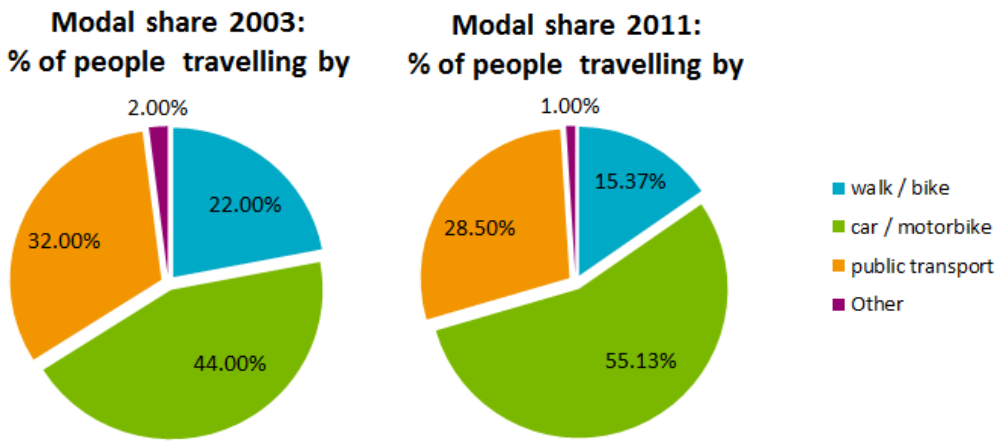
MOBILITY PATTERNS

In 2003 the Lisbon modal share showed that 44% of the total journeys (Monday-Sunday) were done by own vehicle (car/motorbike), 32% used public transport and 22% by walking/cycling.

Compared to the modal share in 2011[15], a trend towards can be observed, with an increase of 11.13% in trips done by own vehicle (car/motorbike), while public transport decreased by 3.50% and walking/cycling by 6.63%.

The travel purpose in 2003 was mainly leisure/other (76%), and the average trips per person and day were 2.33.

Figure 11 Modal share 2003 vs 2011



Source: Own graphic based on "Lisbon: the challenge of mobility" (2005) and Portuguese Statistical Office (INE) (2011)

[15] Data for 2011 is for the Metropolitan Area of Lisbon, that includes Lisbon municipality but also others.

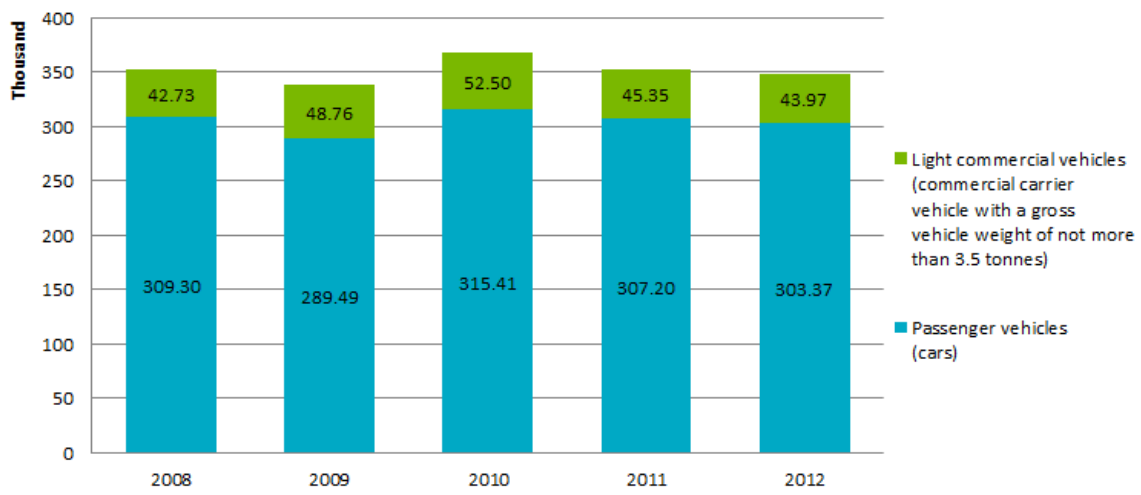
5.3 The Lisbon Carpool

TOTAL VEHICLES

The number of passenger cars and light transport vehicles had a slightly decrease of 1.33%, from 352 thousand in 2008 to 347 thousand in 2012. Passenger cars have decreased 1.92%, however light commercial vehicles have increased 2.89% in this period.

From 2008 to 2012, 86.73% of all registered vehicles were passenger cars.

Figure 12 Total vehicles registered 2008 - 2012



Source: Own graphic based on Insurance Institute of Portugal (ISP) (2013) (figures for LCV are an estimation)

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Co-funded by the Intelligent Energy Europe Programme of the European Union