

# Electric mobility in Portugal – Municipal plans for its promotion

PAULO RIBEIRO, JOSÉ F. G. MENDES, RUI A. R. RAMOS

Department of Civil Engineering – School of Engineering

University of Minho

Campus de Gualtar, Braga

PORTUGAL

pauloribeiro@civil.uminho.pt; jfgmendes@civil.uminho.pt, rramos@civil.uminho.pt

*Abstract:* The electric mobility program in Portugal is based on four strategic areas, namely the business model, infrastructure, incentives and communication, also supported by a completely adjusted legislation, which is subjacent to the priorities defined in the Portuguese Program for Electric Mobility. A Model for Electric Mobility was also defined, supported by four main components: the value chain, actors, charging network and operation of the pilot-phase. In this work the different phases of implementation of this Program will be identified, with particular emphasis to the measures and incentives in the pilot-phase to promote the use of electric vehicles, such as the development of 25 municipal plans to promote the electric mobility at a local level, covering the principal municipalities of the country to generate a coherent and logical charging network. This paper presents the first steps in electric mobility planning in Portugal in order to justify the decisions taken by the municipalities in this very early stage of its implementation. As an example, the results for the municipality of Beja, located in South of Portugal, will be presented.

*Key-Words:* - electric mobility, sustainable mobility, electric vehicles, mobi.e

## 1 Introduction

Among other solutions currently being applied to minimize the impacts of the actual patterns of urban mobility, this paper will address the promotion of electric mobility at the local level of the municipalities.

An electric vehicle is characterized for not generating local emissions, which could be helpful to reduce the level of pollutant emissions and concentrations in urban areas, where vehicles, pedestrians and bicyclists could cohabit in a quieter environment with a high level of air quality, that is, in a healthier environment.

With the technological improvement of the batteries and the full systems of electric cars, as well as with the increase in vehicle production, it is expected that the prices of electric cars will reduce and become more competitive and accessible to all citizens. In Portugal a national project for electric mobility has been developed, named Mobi.E that contemplates a national public network of charging points for electric vehicles, which includes the coverage of the principal municipalities of the country in a total of 25. At this local level, specific Municipal Plans for Electric Mobility were developed by each municipality with the supervision and technical support of the University of Minho, that contributed to a more harmonised and coherent

set of plans ready to be implemented, especially in the pilot-phase of the program.

This paper aims to address the main questions related to the production of the Municipal Plans for Electric Mobility (MPEM) in Portugal. For this, a summary of the main four strategic areas of the electric mobility program in Portugal will be presented, such as the business model, infrastructure, incentives and communication. On the other hand, the current legislation will be succinctly described, as well as the priorities defined in the Program for Electric Mobility as part of all MPEM. The different phases of a MPEM will be identified, with particular emphasis to the national and municipal vision for this programme, to the criteria to define the municipal charging network, the implementation plan, the local measures and the incentives to promote electric mobility, the main characteristics of an exclusive and targeted communication plan, and finally the main aspects of the local monitoring plan.

## 2 Electric Mobility Program in Portugal

### 2.1 Structure and planning

It is intended that Portugal becomes a pioneer in adopting new environmentally sustainable models for mobility, capable of exploring the relationship

with the electric network and its integration with the cities. Thus, it is necessary to promote the acquisition and modal shifting for the electric vehicle, based on an adequate electrical support infrastructure, through the development of models of services and businesses that allow citizens and organizations to access any electric mobility solutions. For this, it was necessary to set the appropriate legal and regulatory framework, as well as to develop technical solutions for the charging network and its management.

Within the legal and regulatory framework, the Program for Electric Mobility in Portugal was created, headed by an office within the Ministry of Economy and Innovation, whose mission embodied the following key objectives from its full implementation [1]: definition of the model of service, business and implementation; definition of the pilot network and its industrial components; definition of management and coordination of the implementation of the Program for Electric Mobility in Portugal; definition of forms of financing; and development of technical solutions for the implementation of the network and management system of charging points for electric vehicles. Furthermore, the definition of the work plan, activities and timelines, involved players and responsibilities, and the implementation of the communication plan in Portugal and abroad and the promotion near to potential investors.

In 2009, the Portuguese Government decided to establish the strategic objectives of the Program for Electric Mobility: define the fundamental underlying principles; approve the electric mobility model; establish the phases of the Program; set measures to encourage the adoption of electric mobility; and, promote the widespread use of the electric vehicle [2]. The following priorities were established: accelerate the adoption of electric vehicles, mainly in fleets; encourage the creation of attractive conditions for investment, in Portugal, related to the electric mobility; ensure its contribution to the fulfillment of the objectives of Kyoto's Protocol, by encouraging the use of renewable energy in mobility.

Three fundamental principles underlying the program were defined, such as: the model of electric mobility will be focused on the user, assuring equity and universality in the access to the charging network; the market for electric mobility should ensure free competition through the guarantee of attractive conditions for the operation of several

companies; and, the use of renewable sources of energy will be emphasized, anticipating the integration with smart grids in the logic of bidirectionality [2].

The Program for Electric Mobility in Portugal was thought to be developed in three phases, namely the pilot-phase, the growth-phase and the consolidation-phase. The 'pilot-phase', which is ongoing, includes the construction of a minimal experimental infrastructure for electric mobility at the national level, covering 25 municipalities and the country's major roads, which will allow testing the charging solutions. The 'growth-phase' will involve the extension of the experimental infrastructure, with the adoption of the successfully tested solutions of the previous phase. The 'consolidation phase' will begin as early as the demand for electric vehicles reaches a sustained level, and simultaneously when the conditions for the introduction of a bidirectional charging system are created.

At the governmental level, the main measures to encourage the Program for Electric Mobility in the pilot phase and to promote the widespread use of the electric vehicles consisted mainly of subsidies for the acquisition and replacement of existing vehicles and fleets, and the creation of a national electric charging infrastructure.

Finally, in 2010, the Portuguese government established the organization, access and implementation of the activities related with electric mobility in Portugal [3].

## 2.2 The model

Regarding the business model, the aim resided on the definition and integration of several fields of electric mobility, which corresponded to different actors at various levels, each of them adding a specific value. The model was based on its main components, chain of value, players, charging network and in the first stage to the operation of the pilot-phase.

The model provides and integrates the following components: vehicles, batteries, charging points or stations, suppliers or electricity retailers, operators of the charging network, and management system.

The charging points or stations are the infrastructure that enables the interface between vehicles and the electricity network in order to charge their batteries; the supplier or electricity retailers for electric mobility are the legally authorized agents to do so; and, the operators and services (beyond the basic charging service) are

associated with the potential services, such as parking, financing solutions, lease of vehicles and batteries. Finally, the management system authority is responsible for the management of the various flows (information, energy and financial) associated with the charging of vehicles, ensuring technological compatibility among the various infrastructures and services of electric mobility and ensuring a national charging network accessible to any user of electric vehicles.

The model known as MOBI.E is based on an innovative information system enabling the interaction of power suppliers, operators and users of the charging areas of electric vehicles, in addition to the managing entity of the entire system [4]. The flowchart in Fig. 1 presents the architecture of the Portuguese Electric Mobility Model.

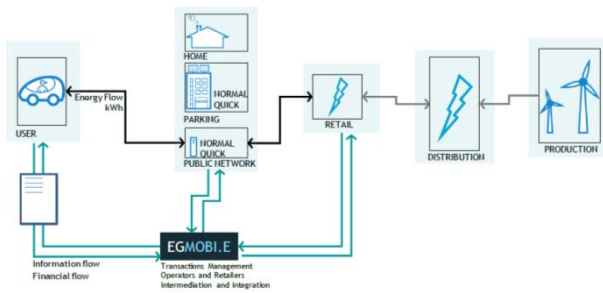


Fig. 1: Portuguese Electric Mobility Model [5]

The MOBI.E model is innovative and unique as it was conceived with an open-access and market-oriented philosophy, with the goal of attracting private investors and benefiting the users. As the first nationwide recharging network operating in the world, this model grants [5]:

- universal access to any car and battery manufacturers, electricity retailers for electric mobility, and recharging network operators;
- full interoperability and integration of all stakeholders;
- integration of information, energy and financial flows through the Managing Authority;
- low initial investment costs.

The chain of value related with electric mobility corresponds to the installation and maintenance of the charging network, the charging service and the commerce and retail of electricity and, lastly the provision of other services associated with the electric mobility, such as parking, financing solutions, lease of vehicles and batteries, among others [4].

The players in the market for electric mobility are mainly the operators of charging points, retailers of electricity for electric mobility and the manager of operations of the electric mobility network, which manages the information, energy and financial flows associated with vehicle charging.

One of the main items of the model for Portuguese electric mobility was the charging network (Figure 2) that has two different charging types of stations: slow and fast charging.

The slow charging points (SCP) are usually located in public spaces, such as roads and public or private parking areas with public access, other than those located in households and companies, allowing to fully charge a battery in about eight hours. The fast charging points (FCP) are usually located at service stations along major highways and other strategic locations that allow charging in about twenty to thirty minutes.

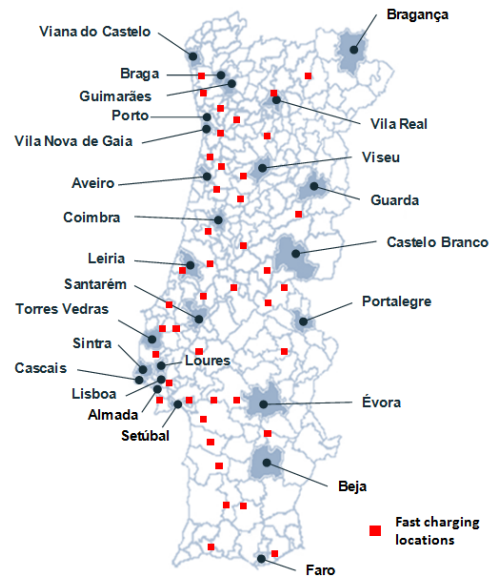


Fig. 2: The pilot charging network [4]

According to Mendes & Ribeiro [4] the charging infrastructure for electric vehicles should include three typologies of locations in terms of accessibility, namely public spaces of public access, private spaces of public access and private spaces of private access, giving a widespread spatial coverage of all territory.

Lastly, the model for electric mobility clearly defined two phases, the pilot and growth phase, where the pilot-phase assumes an extremely important role in the kick-off and promotion of this more sustainable type of mobility.

### 3 Municipal plans for electric mobility

The operation of the pilot-phase represents the implementation of the charging stations network by 2010 to 2012, which is called the Mobi.E network. In this phase, it was predicted the installation of 1350 slow (SCP) and 50 fast (FCP) charging points.

The SCP were proposed to create the 25 local charging networks, consisting of the principal municipalities of the country identified in Fig. 1. The 50 FCP were defined in order to promote the inter-municipality mobility and were strategically located to form a national charging network in the main national roads and motorways.

Given the pioneer nature of the Mobi.E network, demand-supply logic is not yet central, as well as the location of the charging areas. Therefore, an international pilot initiative was selected, the EVProject of the ECotality in the USA, from which coverage ratios for charging points were adopted, with some adaptations, particularly taking into account the Portuguese rates of motorization, resulting in the charging points distribution presented in Figure 3. According to Mendes & Ribeiro [4] the calculated ratio in the pilot-phase is of about 1.15 SCP/1000 inhabitants, from which a relationship of 1 FCP per 24 SCP was derived. Residential points were not considered.

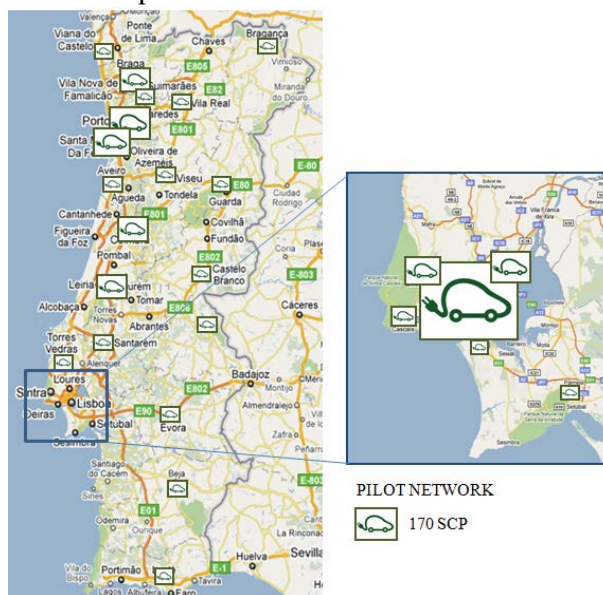


Fig. 3: The SCP distribution for the pilot-phase of Mobi.E in 2015

The planning and execution of the experimental infrastructure of electric mobility, to be established in the Pilot-phase, required the development of Municipal Plans for Electric Mobility (MPEM).

The general objective of the MPEM was to create conditions for the implementation of a network of charging points, as well as to accelerate the adoption of electric vehicles, by creating attractive conditions for their use and promotion and by demonstrating and disseminating the benefits of its use and adoption[4].

It is important to clarify that the MPEM is not a conventional mobility plan. It is, rather, a plan for the promotion and incentive of electric mobility and it must necessarily be related with the plans and mobility practices in the municipality.

The contents of MPEM include the view of the national model for electric mobility, the vision at a municipal and national level, the charging network, the implementation plan, the incentives, the communication plan and the monitoring plan.

The Portuguese government decided to do all twenty five plans at once in order to get a common conceptual framework, coherent visions, principles, schedules, incentives, communication and monitoring, based on a strong commitment from city mayors and through the scientific co-ordination of the University of Minho.

### 4 Practical application

In this paper and as an example, the main issues related with the design and location of a charging network for the city of Beja, located in South of Portugal, will be presented for the pilot-phase, according to its MPEM.

#### 4.1 Vision

At the level of the municipality of Beja, the cities aspire to be, and to be recognized as, more sustainable urban areas, less noisy and polluted, where individuals, families and businesses benefit from a lower mobility bill that arises from the possibility of adopting the electric alternative.

The stated vision is consistent with the established national policies, namely the: National Energy Strategy and National Action Plan for Energy Efficiency, National Plan for Climate Change, National Strategy for Sustainable Development; National Policy Planning and the Strategic Plan for Transports.

#### 4.2 Local measures and incentives

Beyond the central government incentives, municipalities also have an important role on the promotion of electric mobility in its territory. For

that, the municipality of Beja has chosen, from a package of measures and incentives, the following:

- total or partial exemption from parking fee;
- programs of fleet renewal with electric vehicles;
- microgeneration of energy near charging areas;
- margin businesses related to charging areas.

However, other measures could have been chosen such as dedicated parking for electric vehicles; promotion of car-sharing clubs, creation or access to low emission areas and the circulation in priority urban roads (bus lanes) for electric vehicles.

### 4.3 Communication plan

One of the main important components of MPEM is the communication, especially since the core issue is the promotion of a service. The main objectives of a communication plan are the visibility, information, and that the user passes from interest to the adoption of the electric mobility. For this, all municipalities developed a plan based on target segmentation of the audience, namely in citizens (private), professionals (businesses), students (schools) and the trend-setters. In so, three phases were defined: pre-campaign (teaser), launching and communication reinforcement, each of these properly scheduled.

The municipality of Beja decided to apply the following communication action on pre-campaign: teaser campaigns for private users; presentation of Mobie.E through mailings to the business community and cabbies; meetings with business community; viral action on social networks for media; presentation of the first Mobi.E's for media.

In the launch campaign, the following actions were chosen: offline and online launch; street action: Mobi.E arrived!; promotion via municipality facilities; promotion via partnerships; 'guerrilla' action; quiz and test drive; mailing and emailing to reinforce the campaign on business community and cabbies; eco-test drives for the media; and, mobility forum for media and trend setters.

### 4.4 Location of a charging network on the pilot-phase from 2010 to 2012

The key issue of all MPEM was the areas where charging points should be located in the municipalities. Thus, two levels of location were defined, the macro and micro levels, supported by different objectives and location criteria.

The Office for Electric Mobility (GAMEP) defined the total number of SCP for all municipalities of the Mobi.E network, which will be the first of the total projected points for 2015. Considering its population and motorization rates, it was calculated that Beja should have 10 charging points, which means a maximum of 5 locations, since each charging station have a minimum of two points.

The first level of decision about the SCP location was the macro level, with the purpose of allocating the number of charging points (2012 and 2015 horizons) within the municipal area, considering zones, neighborhoods, districts and agglomerates. At this level, the following criteria were respected: political and strategic interest, road infrastructure and dynamics of circulation and parking; traffic generators, presence of central local areas associated with equipments, services or businesses. In the case of Beja for 2012 it was decided that all SCP should be located within the city, as can be seen in Fig. 4



Fig. 4: Public charging network 2010-12 (macro)

The second level of decision refers to the micro level location, where the objective is the specific location of the charging areas of the pilot phase (until 2012) within the zones, districts or agglomerates. At this level, the following criteria were considered: main central streets, parking areas with public access, residential areas where private parking is scarce, commercial areas, services and leisure, and business areas. In case of Beja it is possible to observe in Figure 5 the location of five charging stations



around the city, mainly in centre, Hospital, University and municipality service facilities.

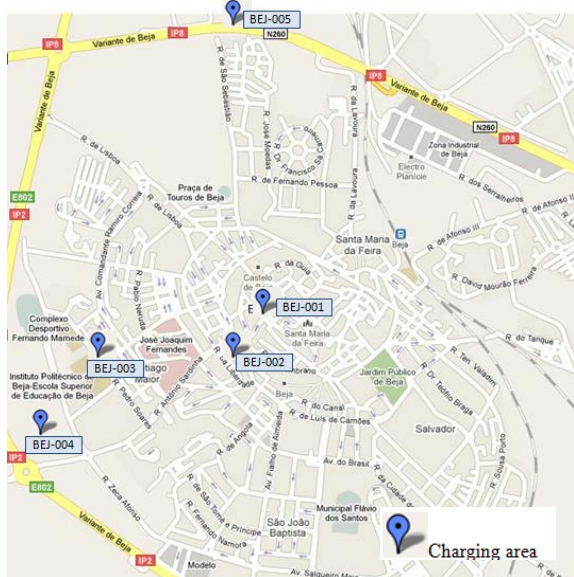


Fig. 4: Public charging network 2010-12 (micro)

In order to test and validate the solutions for electric mobility, creating a dynamic experimenting laboratory for solutions on a national level, the Mobi.E network was the immediate launch between 2010 and 2012 however this phase will only be completed by 2015. Thus, the design of the pilot charging network was made for 2015, based on population projections for each of the 25 municipalities, in which the ratio of 1.15SCP/1000inhabitants was applied, adjusted according to the motorization rate. For Beja, this resulted in 29 SCP and 1 FCP spread around the municipality (Fig. 6).

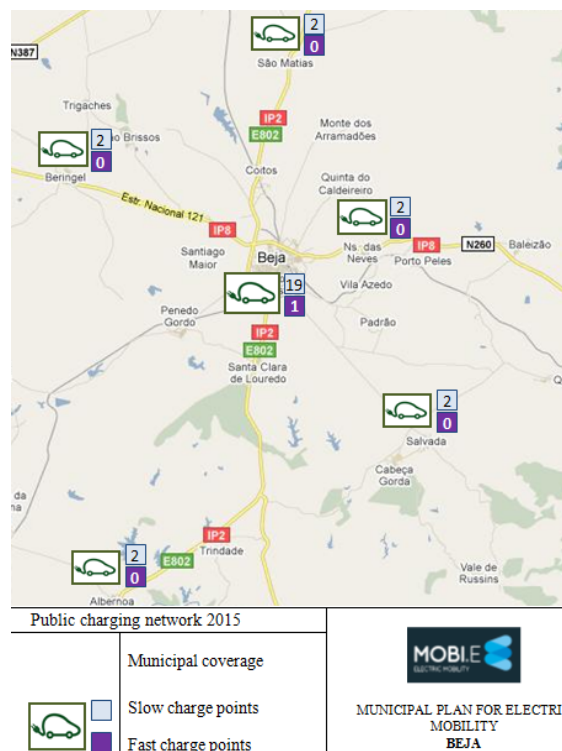


Fig. 6: Public charging network 2010-15 (macro)

## 6 Conclusions

In Portugal, Municipal Plans for Electric Mobility – MPEM -were elaborated for 25 municipalities that joined the pilot phase of the Mobi.E program for electric mobility. These plans were made simultaneously in all municipalities, under the orientation of GAMEP and the supporting research group of the University of Minho. Considering the experience of working with municipalities, in this paper, the structure, the main issues and contents of a MPEM were presented, with special attention to the definition of the charging network for the pilot-phase, which includes the initial Mobie.E network and its growth until 2015.

It was also presented a summary of the model and programme for Portuguese electric mobility, mainly in terms of the most relevant legislation that underlies the electric mobility, and the presentation of the main components of the model, namely the chain of value, players, the design of the charging network and the operation of the pilot phase.

This paper presented the main components of MPEM, regarding the vision on this issue, the principal local measures and incentives to promote electric mobility, the communication plan and finally the main guidelines used to design and locate the local slow charging network, with examples of its application to a municipality.

The common strategy for electric mobility in Portugal was applied in all 25 municipalities, resulting on a successful implementation of the charging network countrywide.

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