ISCTE Business School
Instituto Universitário de Lisboa

MOBI.E: THE CASE OF A DISRUPTIVE TECHNOLOGICAL INNOVATION THAT HAS CONQUERED WORLDWIDE LEADERSHIP

Ana Isabel Gonçalves Pinheiro Cardoso

Thesis submitted as partial requirement to obtain a Master's degree in Management

Advisor:
Professor Doctor Renato Pereira
ISCTE Business School
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Ana Isabel Cardoso

-Lombada-

THANKS

The completion of this thesis is a very important milestone, not only due to the hours devoted to it but also because it marks the end of a long journey, with many sacrifices but also many successes that fulfilled me and still fill my heart with joy. However, nobody reaches anything alone and, like everyone else, I did not do it either.

The first big debt is, without a doubt, towards my family. Yes, I say family and not parents or siblings. This is because, in fact, I do not have what may be called the "traditional and perfect family." But we have always given and continue to give our best to one another and it was this upbringing and this love that allowed me to conquer everything which I have conquered until now, without ever lacking anything. To all of you, with deep emotion, my most sincere thank you. I love you very much.

Also, a special thank you to all my friends who have been by my side throughout our lives. Thank you for believing in me, for your pride, affection and eternal friendship.

I would also like to thank my counsellor, Professor Dr. Renato Pereira, for having believed in my abilities, for having accompanied and supported me throughout this project, and also for sharing his knowledge with me.

Last but not least, I would like to thank Dr. Alexandre Videira, President of MOBI.E, SA, for having been available with his contribution, his kindness and his sharing of knowledge, without which it would never have been possible to complete this case study.

To all of you,
My most sincere THANK YOU!

MOBI.E: O CASO DE UMA INOVAÇÃO TECNOLÓGIA DISRUPTIVA QUE OBTEVE LIDERANÇA MUNDIAL

RESUMO ANALÍTICO

As preocupações de todos com as questões ambientais e a procura de alternativas limpas, sustentáveis e que não desapareçam ao longo do tempo são questões que têm ganho relevância a nível mundial ao longo dos últimos anos. O objetivo prende-se com a pretensão de garantir a qualidade do ambiente atual, a sustentabilidade e qualidade de vida das gerações vindouras.

Tendo isto em consideração, observa-se uma evolução do mercado neste sentido. Jovens inovadores e empreendedores surgem com ideias e novos projetos de negócio todos os dias. Muitas indústrias já se adaptaram a esta realidade e já surgiram muitas novas. Assim, como não poderia deixar de ser, pelo seu impacto, a indústria automóvel é o mercado que dedica a sua atividade à mobilidade, com alguns exemplos evidentes de empreendedorismo.

Assim, este estudo de caso pretende apresentar, compreender e analisar o mercado da mobilidade elétrica em Portugal, de forma a perceber as razões para o seu crescimento e quais foram e são os seus agentes mobilizadores. Para o efeito estuda-se o exemplo concreto da estratégia empresarial da empresa MOBI.E, a atual gestora da rede de mobilidade elétrica no país.

Palavras-Chave: Empreendedorismo; Estratégia Empresarial; Mobilidade Elétrica; MOBI.E.

MOBI.E: THE CASE OF A DISRUPTIVE TECHNOLOGICAL INNOVATION THAT HAS CONQUERED WORLDWIDE LEADERSHIP

ABSTRACT

The general concern with environmental issues and the search for clean, sustainable and long-lasting alternatives have become issues of global relevance over the past years. The objective is to ensure the quality of current environment, as well as the sustainability and quality of life of future generations.

Bearing this in mind, one can see a change in the market in this respect. Young innovators and entrepreneurs come up with ideas and new business projects every day. Many industries have already adapted to this reality and many new ones have also emerged. Therefore, as it was bound to happen and due to its impact, the automobile industry is the market that dedicates its activity to mobility, with some clear examples of entrepreneurship.

Thus, this case study intends to present, understand and analyse the electric mobility in Portugal, in order to understand the reasons for its growth and also to know who are its past and current driving agents. For this purpose, we study the specific example of the business strategy of MOBI.E, the company which currently manages the electric mobility network in Portugal**.**

Keywords: Entrepreneurship; Business strategy; Electrical Mobility; MOBI.E.

EXECUTIVE SUMMARY

The main objective of this case study is to understand the reasons that led Portugal to excel in the electric mobility market. This is a market that is highly dependent on technology and its development, and the fact that the country is a benchmark in a market with these features is something new which deserves to be highlighted, analysed and understood.

As shown by the available statistics and data, the use and development of technologies seeking to take advantage of renewable energy is increasing. Portugal is no exception and its geographical position makes this a very interesting sector for the country. This is the reason why electric mobility becomes relevant in the Portuguese context.

Industries are increasingly complex and constantly evolving. Only good strategic planning based on innovation and entrepreneurship, with well defined and detailed indicators for short- and long-term actions, can lead to a good positioning of a company in the market and to the achievement of the desired results.

Having said that, with MOBI.E being the entity that currently manages electric mobility in Portugal, the analysis of its history and of its activities makes perfect sense in order to better understand this market. For that purpose, this case study will collect detailed qualitative information. Intensive documentary research and interviews will be carried out to obtain a realistic, complete and reliable perspective of this market.

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FIGURES

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MAIN ABBREVIATIONS USED

ACAP – Portuguese Automobile Trade Association
ACEA – European Association of Automobile Manufacturers
BEV – Batteries of electric vehicles
CPO – Charging Point Operator
CPOw – The Charge Point Owner
CO2 – Carbon Dioxide
DSO – Days Sales Outstanding
EMEL – Empresa Municipal de Mobilidade e Estacionamento de Lisboa
GEM – Global Entrepreneurship Monitor
EV – Electric Vehicle
EVS – Electric Vehicle Symposium
EVSE – Electric Vehicle Supply Equipment
EVSP – Electric Vehicles Standards Panel
IRC – Imposto sobre o Rendimento das Pessoas Coletivas
Km – Kilometre
Kw – Kilowatt
Kwh – Kilowatt hora
PCR – Postos de carregamento rápido
PCUR – Postos de carregamento ultra rápido
PHEV – Hybrid Electric Vehicle Plug-in
PNAEE – National Action Plan for Energy Efficiency
OEM – Original Equipment Manufactured
R&D – Research and Development
RENER – Renewable Energy
RENER – Portuguese Network of Intelligent Cities
Living Lab
RFID – Radio Frequency Identification
SE4ALL – Sustainable Energy for All
UVE – Associations of Electric Vehicles Users
V2G – Vehicle-to-Gird

INTRODUCTION

A. General Framework

RENEWABLE ENERGIES

Recent and growing concerns about environmental issues and the consequences of gaseous pollutants have gained prominence worldwide. In addition to being an expanding sector, the focus on renewable energy has brought opportunities for business and consumers. For the former it can represent investments and opportunity for growth, while for the latter it can generate cost reduction. All this makes this a very relevant topic today which should be taken into consideration by all companies that want to be sustainable.

It is time to innovate processes, products and services and go even further. There is a need to improve efficiency in the use of resources, to reduce dependency on energy from foreign sources and to induce more sustainable production and consumption patterns, strengthening the responsibility of citizens and businesses.

Portugal's Evolution

Portugal is one of the European countries which is more committed to the integration of renewable energies and the consequent reduction of emissions of gaseous pollutants. Concretely, there are undeniable efforts regarding electricity production and there are figures to prove it. In recent years, the country has met established goals and has achieved extraordinary results. In 2005, it was able to reduce the country's energy consumption by more than 85%, reaching the climatic targets in 2012 and obtaining more than 60% of its energy from renewable sources. In 2013, it was classified by the Climate Change Performance Index (CCPI) as the third best country in the world in climate policy. On that year, the value of 29,2% of renewable energies in the final consumption of energy was reached and, in 2014, 61% were gained in the electricity sector. Simultaneously, these results

have made it possible to create a cluster in wind energy. A significant part of the production is exported, allowing some compensation of the costs associated with fossil fuels.

Having said that, despite the fact that imports of fossil fuels are still very high and that the associated costs are also high, the efforts are an undeniable fact. One should highlight the progress Portugal has made in reducing its dependency on foreign energy, which, although still high, has reached the lowest levels of the last two decades. Achieving all these goals puts the country in a good position to meet the CO2 reduction targets defined for 2020.

A decarbonization trajectory of the national economy has been consolidated, creating several opportunities for national companies. In addition, due to its abundance of renewable resources, Portugal is seen as a good European partner for reaching climate policy goals.

Electric mobility is an important contribution to sustainable mobility and to the increase of energy efficiency in transport. The application of the concept of sustainability to the mobility of electricity interconnected four areas: Environment, Energy, Mobility and Industry.

The paradigm of electric mobility goes far beyond the technology of the electric vehicle, having the potential to become one of the main strategic responses to the trend of increasing urbanisation of the world population and to the consequent pressure on the environment, namely in terms of pollution and overcrowding.

Benefits

The first advantage of electric mobility is, of course, the fact that it uses a clean alternative, that is, an energy that does not generate exhausts and does not have a negative impact on the environment. Electric vehicles have a zero level of noise emissions, greenhouse gas emissions and polluting gases.

In addition, the vehicles have a more efficient engine with an average consumption of approximately 0.1 to 0.23 kw / h per kilometre. A vehicle running on gasoline consumes about 0.98 kw / hr per kilometre, therefore being much less efficient. Also, there are lower costs associated with driving electric vehicles, both for maintenance costs, as well as associated taxe incentives, among others.

Disadvantages

By contrast, as in many other businesses, it also has some drawbacks. The weight of the batteries is one of them, since it has a range that is still limited when compared to a combustion engine.

Likewise, recharge time is still a strong disadvantage together with the high acquisition cost, because these vehicles are produced in small series and, therefore, for many people, the subsequent additional savings are not yet fully rewarding.

ELECTRIC VEHICLE	COMMON VEHICLE
Zero-Emissions	Prognosis/Gases Greenhouse Effect
Electrical Network	OPEC
Autonomy +/- 160Km	Autonomy + of 600Km
High Charging Time	Reduced Charging Time
Reduced Cost/Km	High Cost/Km

Table 1- Comparison of features of electric vehicles with features of traditional vehicles

Source: Our elaboration

As a pioneer country in renewable energies, the development of electric mobility was a natural step that places Portugal in a prominent position, since it takes advantage of the strong renewable component in the country.

This requires electrification of transport, both at the level of networks and individual mobility. In 2010, there was the introduction of a small number of electric vehicles on the market, with very limited use of the infrastructure. However, the pilot phase allowed technological solutions and an innovative mobility model to be developed and tested.

MOBI.E

MOBI.E is the managing entity of the electric mobility network in Portugal. It holds charging stations for electric vehicles mainly located in public access spaces. These stations allow the charging of the batteries of electric vehicles, which can be normal charging or fast charging. According to its executive director, this company is the entity with greater knowledge and experience necessary to successfully achieve the most significant development of electric mobility.

In the context of "evolution", MOBI.E is the managing body of the electric mobility network until 12 June 2018. It is present in more than 50 municipalities of Mainland Portugal and the Autonomous Region of Madeira and has more than 1,250 charging stations.

The initial MOBI.E program was developed in 3 phases. The first, "Pilot Phase", completed at the end of 2011, covered 25 municipalities and the main roadways. The "Growth Phase", which began in 2012, involved the extension of the experimental infrastructure, with the adoption of the solutions successfully tested in the "Pilot Phase", specially in the field of the charging network.

Finally, there was the "Consolidation Phase." In 2015, the Government decided, by order of the Ministry of the Environment, Spatial Planning and Energy, that until 2018 the management of the electric mobility network would remain the responsibility of MOBI.E.

B. Research Problem

The diffusion of electric mobility has had a great development all over the world and in Portugal. Over the last decade, millions of electric and hybrid vehicles have been sold and currently there are demonstration projects of electric vehicles with charging infrastructure across all major and medium-sized cities in Europe.

Several models of electric vehicles are currently on the market created by major brands and start-up companies. At different levels, public policies have been devoted to electric mobility.

At local level, many cities have shown great interest and commitment in the implementation of electric mobility, by facilitating the acceptance process. Thus, although still somewhat immature, electric mobility has become an important emerging industry, increasingly comprehensive and influential.

From its initial phase, Portugal has been a pioneer in the adoption of new models of mobility that are environmentally sustainable and that optimise the rational use of electric energy.

Thus, with this case study it will be possible to understand: (a) What innovations were the basis for this disruptive network; (b) What decisions strengthened Portugal's international competitive leadership in this project; (c) What are the main steps that have led to the development of this network.

Therefore, it will be possible to perceive the main interest of Portugal in the project and, likewise, what is the main interest of the partners in this small European country, reasons that led to the beginning of all decisions, which culminated in a successful project.

C. Main Objectives

The main objective of this work is to create a thesis, namely, a case study, in order to allow an in-depth knowledge of entrepreneurship and, more specifically, to help understand how investment in technology and innovation can influence the course of a business. organisation. To make this possible, a practical case is applied using all these management instruments in the context of the MOBI.E company.

Bearing this in mind, the following objectives may be highlighted: (a) Describe the evolutionary process of the MOBI.E network in order to demonstrate the fundamental elements for the success of this innovative project; (b) Analyse and integrate MOBI.E in the global context of the electric mobility network; (c) Identify the innovative aspects that have fuelled the evolution of this network; (d) Identify the key strategic decisions that led to the competitive success of the network; (e) Identify the players of this project and describe the role each one had during the project; (f) Underpin this project as a governmental entrepreneurship initiative (g) Describe the role of the government as a driving force for the project.

D. Structure

This case study is composed of this introduction, the body of text, the pedagogical note and the bibliography, being formally divided as follows:

• Part I is divided into four chapters (Chapters 1, 2, 3 and 4), and presents the theoretical and methodological framework of the study. The first chapter includes the general framework of the theme of entrepreneurship, together with its relationship and the strategic approach. This concept is also interconnected with innovation due to their complementarity. In the next chapter, we try to present the concept of renewable energies, a theme that establishes a direct connection with Chapter 3, the one on electric mobility. In this sense, we start by defining the concept and by understanding its stakeholders and, afterwards, we try to find out from a theoretical point of view how this market has evolved in Portugal. In the last phase of part I, Chapter 4, the methodology of the case study is presented and the qualitative method for data collection will also be addressed. In this chapter, the origins, features, concepts and main advantages and limitations of the technique will also be presented.

Qualitative research is a method of scientific investigation that focuses on the subjective character of the analysed object. In this method of research, contrary to what

happens with the qualitative approach, the respondents have greater freedom to present their points of view on certain subjects that are related to the object of study.

• Part II, THE ELECTRONIC MOBILITY HSTORY, ITS AGENTS AND MOBI.E, is divided into two chapters (Chapters 5 and 6). The first describes the case study itself, together with the results gathered with the research methodology used. Finally, the thesis ends with the respective pedagogical note presented on Chapter 6.

E. Main Results Expected

The present case study seeks to analyse and understand the evolution of the market of electric mobility in Portugal, focusing particularly on the evolution of the MOBI.E company. Thus, it is expected that the qualitative method for collecting data, namely interviews and internal and external documentary analysis, will enable the obtention of reliable, complete and detailed information about this case. Therefore, it is our goal to understand the reasons that led to the success, but later stagnation, of the Portuguese network. Subsequently, it is important to know what is the current situation and what can be expected in the future. To that end, it is important to analyse the entire environment of this market, as well as all the parties involved.

After the conclusion of the study, it is expected that it can be presented to the scientific community as a publication of the results achieved.

PART I

FRAMEWORK OF THE TOPIC AND APPROACH

CHAPTER 1 – ENTREPRENEURSHIP

The concept of entrepreneurship was first used by the economist Joseph Schumpeter in 1950. Entrepreneurship is a term widely used in business and often relates to problem solving, start-ups or new products. A matter to be approached, as well as a problem or a complex situation to be solved. Widely used in business situations, this term also refers to adding value and to the ability to identify opportunities and turn them into a profitable business. It is through entrepreneurship that companies transform ideas and knowledge into new products, and that is why the complementarity of this concept with innovation is essential for the development of society.

Corporate entrepreneurship refers to the act of adopting an entrepreneurial attitude in a company. By doing this, entrepreneurs allow the growth of a company, the development of society and therefore of the world.

1.1 Basic Concepts

There are several definitions of entrepreneurship, of which none is equally accepted by all, although they are not exact opposites either. In fact, the existing spectrum of definitions has some common aspects and they are all convergent. One common idea is that entrepreneurship is an activity that creates value and culminates in the generation, creation and promotion of wealth (Warnecke, 2013).

Having said that, entrepreneurship has been a prominent topic for some time now. Today, this concept is not associated with bad practices, which was often the case. Entrepreneurship has been pointed out as one of the great factors of the economic and social growth of societies, and is now being identified as the solution for different issues such as sustainability (Wyness et al., 2015).

In this way, entrepreneurship must be supported, fostered and strengthened. In Europe, the importance of entrepreneurship for economic growth is defended, emphasised and enhanced. Moreover, in most European countries there are various ways of political support and commitment to the promotion of training on entrepreneurship. For this reason, questions such as the practice of teaching entrepreneurship and the features of the entrepreneur have been the subject of reflection. The answer to the question of whether or not it is possible to

develop these features in students has been debated and is not unanimous, but the training on entrepreneurship in universities is currently advocated (Storen & Norway, 2014).

Likewise, in the past, when the words sustainability and entrepreneurship came up in the same sentence, they were associated with the concept of viability of a company or a product / service. The broader concept of sustainability is now known and increasingly used. Traditional sustainability training included in entrepreneurship was limited and seen, not as fundamental and necessary, but only as a complementary aspect (Wyness et al., 2015). However, according to the same authors, the increasing economic, social and environmental challenges faced by companies, society and the planet have led to a paradigm shift. The awareness that business plays a key role in leading society to a sustainable future, and that corporate social responsibility is a role to be played by all, is an accepted and conscious reality around the world.

In addition, "corporate entrepreneurship" was a concept that emerged as a result of entrepreneurship training and runs through entrepreneurial activity within the organisations and through practices that go beyond creating a business (Storen & Norway, 2014). The link between this concept and that of strategic management focuses on the production of wealth (Pereira & Naguib, 2016). As a result of corporate entrepreneurship, employees demonstrate creativity in dealing with turbulent environments, as well as important capabilities to identify market opportunities, and willingness to participate in the development of new products, services or processes (Storen & Norway, 2014).

1.2 Strategic Entrepreneurship

Strategic entrepreneurship is a concept that combines two components of management, strategic management and entrepreneurship (Luke et al., 2011), and which arose from the perception of the existence of the strategy issue. This reality requires the understanding by a company's employees of the implications and results of their actions, that is, the process that, over time, results in the achievement of their objectives (Pereira & Naguib, 2016).

In this way, strategic management contributes mostly to the creation of efforts that promote the creation of value and wealth, basically promoting the competitive advantages that are the basis for the company to be able to compete in the market. Entrepreneurship identifies

opportunities that can be exploited in the market and focuses on the efforts that the organisation needs in order to achieve them, resulting in wealth creation (Yao, 2015).

(Luke et al., 2011) argue that entrepreneurship and strategy are conceptually inseparable, an intersection that translates into an important path for growth and financial performance. According to these authors, a strategic approach to entrepreneurship is related to the exploitation of resources and capacities and to the essential competences of a company and the promotion of the entrepreneurial activity. Strong talents and capabilities within the organisation are a key part for expanding and introducing something new to the market.

Having said that, strategy was associated with the eventual success or failure of a business merely based on the initial decisions. However, dynamic flexibility is a key feature of risk avoidance and strategic entrepreneurship (Pereira & Naguib, 2016). The combination of innovation and the identification of opportunities and growth are singled out as central entrepreneurship factors. For companies that do not want to take risks, this reality presents a strong obstacle to their performance, sucession and wealth over time (Luke et al., 2011).

Therefore, strategic entrepreneurship can be defined as the set of organisationally sequential innovations within existing enterprises that involve the combination of demand-seeking behaviours and advantages. It allows the company to apply its knowledge and capabilities in the current environmental context while exploring the opportunities to pursue in the future, applying new knowledge as well as new and improved capabilities (Maritz & Donovan, 2015).

Thus, the importance of the strategy is clear, along with entrepreneurship, as a way to achieve growth, survival and corporate sustainability (Luke & Verreynne, 2006). The search for advantages is an increasingly strategic behaviour, together with the search for more entrepreneurial opportunities. By combining these behaviours, companies can achieve competitive positions and create value for the company and its stakeholders (Maritz & Donovan, 2015).

Finally, environmental dynamism, hostility and complexity help companies turn the advantages of strategic entrepreneurship into higher levels of performance. Companies adjust strategic entrepreneurship to the environment and use it as a mechanism to transform environmental benefits at above-average performance levels (Herbert & Brazeal, 2004).

1.3 Importance and Impact of Innovation

In the current context of the increasing globalisation of world economies, entrepreneurial thinking must adopt a global mindset. In a market and in a realm marked by high global competition, increasing uncertainty and dynamic change, companies must become innovative in order to survive and grow (Ahn et al., 2015).

Havin said that, the concept of innovation has become more important and has been at the basis of creating new products, services and jobs. In general, it has been pointed out by many as one of the main reasons for the creation of value and wealth - in short, for the actual survival and succes of a firm or a business (Luke et al., 2011).

Innovation has left its mark on human history with its ability to change attitudes, habits, work methods and behaviours, becoming one of the central methods of growth, strategic change and value creation, facilitating the proliferation and survival in a world like the one we live in today (Franco & Oliveira, 2017).

Innovative entrepreneurship, related to corporate entrepreneurship, as previously mentioned, is a concept that arises in contrast with replicative entrepreneurship. This is associated with copying old ideas or setting up start-ups based on existing ideas. The first refers to providing the company (in the case of existing companies) or the market with processes, products or services (Storen, 2014).

Entrepreneurship and enterprise can be seen as the main axis for the development and growth of the economy. In contrast, in an economy that is managed, entrepreneurship operates in the opposite direction to its growth, whereas in an entrepreneurial economy, entrepreneurship is the driving force of its development. Similarly, general failure and the failure of a particular project, as seen by advocates and practitioners of this type of economy, is considered negative and a waste of human and financial capital. In entrepreneurial economics it is, however, seen as one of the possible and normal results of the activity. Experimental activity in a high-risk external environment may result in the discovery and implementation of new ideas, but also in their failure. This is normal and is part of the normal learning process. As a result, there has been a decline in venture capital investment (Warnecke, 2013).

Therefore, entrepreneurship is currently a prominent topic in several countries. The concern with the development of this activity is visible. The most important factor for all countries is their economic well-being, and for that we need to innovate. Therefore, in today's world it is argued that innovative entrepreneurs are the answer and play a key role in

economic development and growth (Gunawan, 2016). As a result, in Europe, entrepreneurship training with the aim of promoting innovative and entrepreneurial skills, and encouraging more young people to create and develop their own enterprises, has increased significantly in recent years (Storen, 2014).

Innovation is clearly recognised as a key element for entrepreneurship, along with the identification of opportunities and, as a result, for growth. It enables organisations to improve and participate in turbulent, dynamic and competitive markets, managing to stand out from competitors and gain market share. Innovation allows us to attract attention and win customers, developing competitive advantage and generating wealth - it satisfies one of the main objectives of strategic entrepreneurship. Thus, creating new technologies and generating innovations in the marketplace is crucial for companies to achieve their long-term results and benefit society, regardless of size or age (Luke et al., 2011).

However, few companies have all the resources and skills they need to remain at the forefront of innovation. These companies have a harder time creating scale, leveraging resources and mitigating risk. In today's highly dynamic and competitive market, strategic alliances have become a business reality. Small and medium-sized enterprises face greater difficulties in restricting resources, skills and capabilities, which does not mean that only these companies make strategic alliances. In fact, regardless of size, entrepreneurial and innovative companies turn to strategic alliances as a way to become more efficient, complete and competitive in internal operations, and may even expand their business to new markets and keep pace with fast market changes (Zhao, 2014).

Finally, when the focus of business ceases to be the short-term financial results giving rise to the performance and development of technology, it makes companies continuously invest in technological innovations. The development of new technologies and the introduction of innovations opens a window for new market opportunities, even between sectors, and the knowledge generated by them results in competitive advantage (Ahn et al., 2015).

1.4 Portugal's Behaviour Towards Entrepreneurship

The Global Entrepreneurship Monitor (GEM) aims to study and compare levels of entrepreneurship in different countries on the current year. For some years now, Portugal has been participating in the world's largest study on this subject. The main comparison index is

the Early-Stage Entrepreneurial Activity Rate (TEA). The GEM seeks support by establishing partnerships with institutions in some participating countries. In Portugal, it has the support of ISCTE-IUL (Instituto Universitário de Lisboa) and Spi Ventures (a consulting company) for conducting studies through surveys.

In 2012, according to TEA, Portugal ranked as 44th out of 69 countries in the type of innovation-oriented economies within 3 possible classifications. Other countries, such as the United Kingdom, Germany, France and the United States of America, are also included in this forecast.

Innovation-oriented economies are those where a gradual shift to the services sector is most visible as wealth matures and increases, which seems favourable to Portugal. However according to the 6th edition of the Amway's Global Entrepreneurship Report, in 2016, only 16% of the Portuguese consider that the national society is favourable to entrepreneurship, second to last in a list of 44 countries considered in the study. In contrast to this figure, the average result is 38% in Europe and 43% globally.

To measure entrepreneurship, Amway used the AESI Index, which analyses parameters related to desire, stability and viability. Portugal ranked 31st in the list, which is led by India, China and Thailand (all with 79%). According to Gonçalo Pernas, professor and vice president of Audax - Center for Entrepreneurship and Innovation at ISCTE-IUL, the problem lies in the educational system that results in a poorly developed entrepreneurial spirit. In his own words, "We are a risk-averse culture, for those who undertake it is risky." However, there is a new generation that looks at entrepreneurship as an excellent opportunity. In this sense, according to the results of the study mentioned, the Portuguese are more optimistic about the possibility of being entrepreneurs than about the path of entrepreneurship itself.

Having said that, on 6 June 2017, the Portuguese government launched Startup Portugal - National Strategy for Entrepreneurship which consists of a set of initiatives aimed at promoting entrepreneurship and attracting investment to Portugal. The goal is to value the investments made in the last decade in human resources qualification, infrastructure and technology, and to offer a set of opportunities to launch or invest in new businesses today. In addition, this year, and in 2018, in Lisbon, the largest technology start-ups event in the world, WebSummit, was held. Also, in 2018, the government launched 19 measures aimed at accelerating entrepreneurship following the Startup Portugal program. In addition, focusing on research and technological development (R & TD), Portuguese companies are becoming more and more entrepreneurial. By the end of March 2018, they presented more than 3,7

thousand applications, proposing an investment of 2,4 thousand M €. Between 2007 and 2017, there was a 30% increase in R & D investment, one of the indicators that allow us to gauge the development status of a country (data provided by the PORDATA source). Thus, both the dynamics created with the Incentive Programs and the evolution of R & D expenditure (public + private), allow us to say that Portugal has had a positive evolution.

Euro - Thousand

Anos	Setores de Execução	
	Total	Empresas
1982	32.627,4	10.193,4
1990	259.535,5	67.764,7
2001	1.038.431,7	330.310,7
2003	1.019.581,0	338.038,1
2005	1.201.111,6	462.014,9
2007	1.972.732,6	1.010.790,0
2008	2.585.074,9	1.295.099,0
2009	2.771.599,7	1.311.069,6
2010	2.757.554,6	1.266.296,1
2011	2.566.449,9	1.216.345,6
2012	2.320.132,8	1.153.332,2
2013	2.258.471,0	1.072.908,7
2014	2.232.248,9	1.035.966,2
2015	2.234.369,7	1.036.532,3
2016	2.388.466,9	1.156.466,1
2017	Pro2.562.711,1	Pro1.295.247,2

Table 2 - Expenditure on research and development (R & D) activities: total and sector companies

Sources: DGEEC/ MEd-MCTES, PORDATA (2018)

SYNOPSIS OF CHAPTER 1

Entrepreneurship is fundamental to the development of an economy, whether local, state or national.

Today, the world economy is characterised by a high rate of innovation, the growing importance of science and technology, by information and knowledge, and globalisation. Staying competitive is key to surviving on this economy. As a consequence of this dynamics, knowledge is shared, ideas come up, solutions are generated and markets grow exponentially. Yet, competition multiplies, technologies are developed and products quickly become obsolete. Companies need to act in order to put quality products and / or services on the market. In addition, it is vital that this happens faster and at more competitive prices.

Corporate entrepreneurship is looking for innovative ways to further increase a company's profit and growth by diversifying the range of businesses and products or by introducing new working methods. "No matter what, entrepreneurship is a symbol of risk, disruption and paradigm change, while also being a synonym of solutions", explains Eduardo Leite, Ph.D. in Management and Professor at the University of Madeira. "The entrepreneurial individual gathers certain behavioural competences which are fundamental in the economic development of businesses, namely by initiative in decision-making, vision, organisation and even management."

Also, the phenomenon of entrepreneurship is of crucial importance for economic development since the emergence of new companies entails the generation of new jobs. It is in this context that we have witnessed, all over the world, the accelerated growth of entrepreneurship, especially technological, triggered by companies called start-ups. Entrepreneurial attitudes can be linked to the idea of finding solutions to problems in a society. According to the Theory of Economic Development, Schumpeter argues that entrepreneurs are the driving force behind economic growth by introducing innovations that make existing products and technologies obsolete.

We can therefore conclude that entrepreneurship has had a great impact worldwide, especially regarding the transformations in the global market which clearly aim at economic profit. It is due to this that Portugal has sought to stimulate young people through a network of start-ups and events such as the Web Summit held in Lisbon.

CHAPTER 2 - IMPACT / EVOLUTION OF RENEWABLE ENERGY

Renewable energy sources are natural resources that can regenerate in a short time and in a sustainable way. Nowadays, concerns about the levels of pollution from human activities have increased, so these energies are of enormous importance as they emerge as a solution to this problem. Earth heat (geothermal energy), biomass, tidal and wave motion, wind, sun and water are examples of renewable energy sources. The ability to regenerate together with being clean energies ensures sustainability for future generations and the planet's balance.

In addition to the above, these sources avoid the import of fossil fuels, such as coal and natural gas, avoid the emission of greenhouse gases and contribute to the reduction of the price of electricity in the electricity market. This way, it is possible to conclude that these energies contribute to a greater economic and environmental sustainability of the country.

2.1 Definition, Importance and Market Opportunities

Non-renewable energies have so far been abundant and are the reality known to most people, given their associated benefits. However, in addition to being polluting and consequently harmful to the quality of life for future generations, fossil resources are finite and therefore the transition to clean and renewable energies is a necessity (Amigues et al. 2015).

As with many other concepts, it is not possible to find a uniformly accepted definition of energy or of renewable energy policy. A possible definition for renewable energy policy can be a policy whose objective is to promote and implement this type of energies, fuelling a stable and sustainable internal market for clean energy (Zhang et al., 2013). The same author also distinguishes industrial policy on renewable energy as a policy that, in this sector, focuses more on the competitiveness and capacity of the renewable transformation industry.

There are several types of energy that can be harnessed for different purposes, opening new doors to existing companies and giving opportunities to the development of industries and new markets. It was established that the fundamental motivations that stimulate the development of renewable energies are, among others, to ensure environmental security and

preserve the environment, and to ensure energy security and its reserves for future generations (Teleuyev et al., 2017).

For example, biomass is the oldest source of renewable energy and uses plants and waste. Wind power can be harnessed to produce energy without generating any greenhouse gases or waste. Still, the amount of energy that can be generated by the sun (solar energy) exceeds the amount of world energy needed, making this inexhaustible source one of the most promising and popular (Ni & Chen, 2011). Likewise, in order to generate electricity, one of the most commonly used energies in everyday life, hydroelectric power, is one of the main finite types that add many environmental benefits (Luu et al., 2017). Finally, geothermal energy is characterized by a source of heat from the interior of the earth and translates into a huge set of possibilities and opportunities that can be harnessed (Hammons et al., 2007).

Issues that focus on climate change and energy security have boosted interest in electric vehicles. There are several issues that can influence a person's propensity to buy an electric vehicle. Youth, ecological lifestyle, education, affordability and concern about costs in the future are some examples that vary in a person's propensity to buy an electric vehicle. This means that, for example, if a person is young and has an ecological lifestyle, his/her tendency to enter this market increases (Hidrue et. al., 2011).

The objective of the decrease of the consumption of fossil fuels is a reality so urgent that all Europe, and even the whole world is involved. Therefore, increasing the share of renewable energies in total energy consumption is an objective for everyone. (Kutan et al., 2018).

In order to become more energy efficient, Europe has been trying to reduce carbon emissions by defining several policies in which the government has been a strong actor and mediator. Also, apart from Europe, other industrialised countries globally recognise the dire need of being committed to becoming more sustainable nations. In the last decades “higher fossil fuel energy consumption have lead to higher CO2 emissions across the developed and developing countries around the world.” (Kutan el. al., 2018: 1765).

China, for example, has become one of the largest economic powers in the world over the last three decades, but has also been the largest energy consumer since 2009 and the largest carbon emitter in the world since 2007. Consequently, China has made efforts to become more energy efficient through the development of renewable energy and the use of the necessary equipment, namely with wind power and solar photovoltaic sources. This effort has led to the development, in terms of both manufacturing and installed capacity, of the world's largest wind power market (Zhang, 2013).

In addition, several countries have reported significant investments in projects related to these clean energies and in energy-efficient technologies. Brazil, South Africa and India are some examples that demonstrate this commitment of everyone to address climate change. The SE4ALL plan, whose goal is Sustainable Energy for All, aims to increase the share of these energies from 18% to 36% over the years 2012-2030, compared with the global energy mix (Kutan et al., 2018).

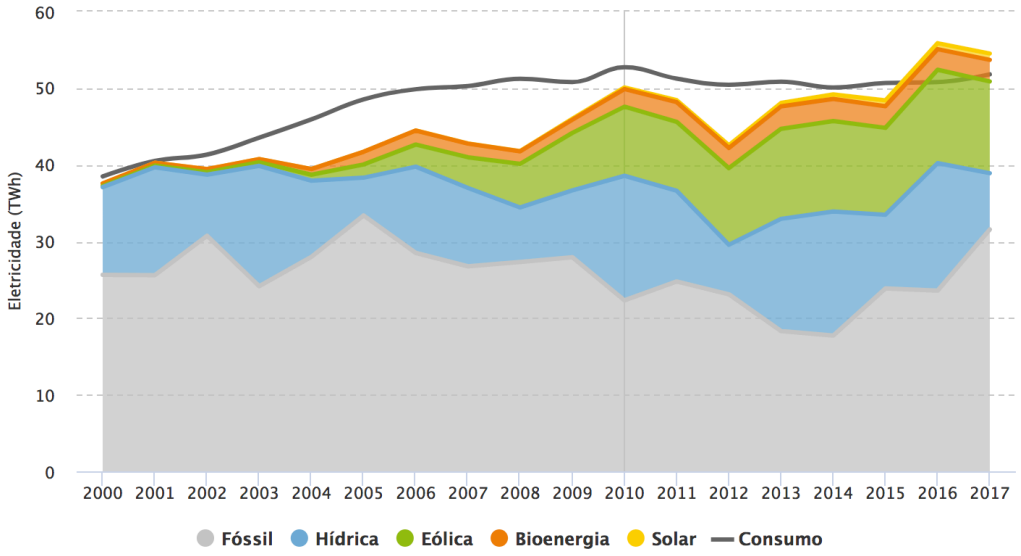
However, for the global transition to the use of renewable energy to proliferate successfully, there is the need of government support for the implementation of policies and for fiscal and financial support, among others. Specifically, since 2005, the Chinese government has been implementing several industrial policies that include financial support for innovation, as well as tax exemptions for imports of foreign key parts and for complete sets of foreign equipment.

In addition, state banks and local governments have begun to provide significant financial support to the renewable energy manufacturing industry. According to the same author, the aim was to enable China to invest in research and development in this industry and to become self-sufficient in renewable energy equipment (Zhang, 2013).

Thus, according to international experience, countries with the use of large-scale renewable energy sources have implemented a strategic state policy for the efficient use of these energies (Teleuyev et al., 2017).

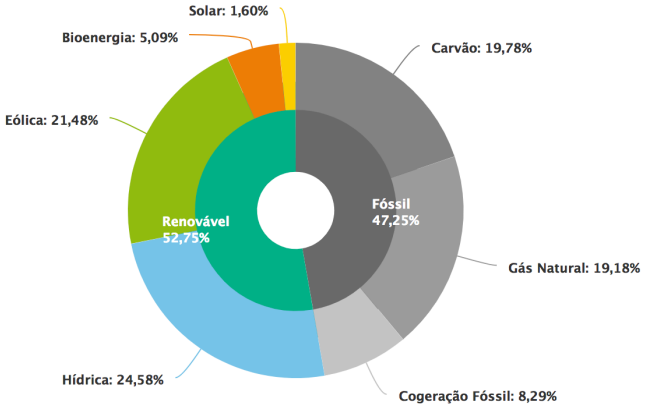
2.2 Portugal's evolution over the years

The greater use of Portuguese endogenous and renewable resources to produce electricity has changed the mix of electricity production in Portugal.



Graph 1 - Evolution of Electric Power Production in Mainland Portugal

Source: APREN (2018)



Graph 2 - Balance of the Production of Electricity of Mainland Portugal

Source: APREN (January to October 2018)

Years	Tolal	Production of electricity From renewable sources						
		Total	Water> 10MW	Water< 10MW	Biomass	wind	Geothermal	Photovoltaic
1995	33.264	9.501	7.962	492	988	16	42	1
2000	43.764	13.260	11.040	675	1.296	168	80	1
2001	46.509	16.083	13.605	770	1.345	256	105	2
2002	46.107	10.190	7.551	706	1.473	362	96	2
2003	46.852	18.037	15.163	891	1.394	496	90	3
2004	45.105	12.597	9.570	577	1.547	816	84	3
2005	46.575	8.616	4.737	381	1.651	1.773	71	3
2006	49.041	16.187	10.633	834	1.704	2.926	85	5
2007	47.253	16.593	9.927	522	1.882	4.037	201	24
2008	45.969	15.140	6.781	517	1.852	5.757	192	41
2009	50.207	19.017	8.108	901	2.087	7.577	184	160
2010	54.093	28.755	15.459	1.088	2.614	9.182	197	215
2011	52.465	24.691	11.294	820	2.923	9.162	210	282
2012	46.614	20.410	6.093	567	2.951	10.260	146	393
2013	51.673	30.610	13.701	1.167	3.051	12.015	197	479
2014	52.802	32.405	15.071	1.341	3.049	12.111	205	627
2015	(R)52.421	(R)25.512	9.048	(R)752	3.104	(R)11.608	(R)204	(R)796
2016	60.279	33.448	15.689	1.221	3.070	12.474	172	822
2017	59.432	24.309	7.009	623	3.220	12.248	217	992

GWh (Gigawatt-hour)

Table 3 - Production of electricity: total and from renewable sources (2018)

Sources: DGEG / MEc, PORDATA

In the period between January and October 2018, electricity produced on the continent had a distribution of 52.7% of renewable origin, the remaining 47.3% from fossil energy sources, with a the generation of a total 45 873 GWh of electricity. These resources, therefore, have played an increasingly decisive role in consumer's satisfaction. Between January and June 2018, renewable energy sources accounted for 38.6% (161 GWh) of the total electricity production in the Autonomous Region of Madeira and accounted for 41.3% (158 GWh) of the total electricity production in the Autonomous Region of the Azores.

After having achieved the lowest value of the last two decades in 2014, Portugal's energy dependency on the outside world increased again in 2015, followed by a decrease of 3.5% in 2016, reaching the value of 74.8%, according to data from the DGEG. In 2017, according to APREN, the production of renewable energy in Portugal accounted for 42% of the country's electricity consumption and exports. The production of electricity from renewable energy sources has lowered the market price. According to APREN, in the same year the country was able to avoid the import of fossil fuels valued at 770 million euros, reducing the value of CO2 emission licenses by 49 million euros.

In addition, a study carried out by this institution estimates that electricity production from wind farms, photovoltaic sources and small hydropower plants recorded gross benefits of 660 million euros in the national economy because they reduced the wholesale electricity market price by 18.2€/MWh. Until 2020, Portugal must achieve a 60% penetration rate of renewable energy in order to meet the European Union's targets. In addition, the European Parliament has stated that the target for 2030 is that the European Union consumes at least 32% of energy from renewable sources, such as the sun and the wind. José Blanco López, the Spanish representative in the European Parliament goes further, saying that he wants a carbon-free economy by 2050.

SYNOPSIS OF CHAPTER 2

In general, it is said that a source of energy is renewable when it is not possible to establish a time limit for its use. They are virtually inexhaustible but limited in terms of the amount of energy that can be extracted at any given time. This is the case of the heat emitted by the sun and the energy produced by the wind, tides or water courses.

Thus, in addition to reducing CO2 emissions and consequently contributing to better quality of life and better air quality, and to avoiding the emission of greenhouse gases, they allow the creation of new jobs and favour investments in depopulated areas. They also reduce the energy dependency of our society, whether towards fossil fuels or foreign countries, reducing the import of fossil fuels and improving the country's trade balance, and leading to research into new technologies that allow better energy efficiency.

High investment costs and negative visual impacts are some concerns but, with so many benefits, many countries are interested in investing in these energies and in improving environmental impacts. They are managing to do so and the member countries of the European Union, and specially Portugal, are no exception. Bearing this in mind, Portugal is working in a serious and binding way to achieve these goals. According to Jorge Seguro Sanches, the Portuguese representative in Parliament, the measures "should not only be indicative, but should also respect what are firm objectives on the part of each country" and, in this sense, "the work being done at the moment has as its goal that the incorporation of renewables be superior to the targets that are established."

CHAPTER 3 - ELECTRIC MOBILITY

The development of the economy and of technologies has brought negative impacts to the environment over the years. Daily activities, such as traveling, correspond to gases released into the atmosphere and are detrimental to the planet's sustainability. Thus, with the concerns about sustainability and the search for new important perspectives, recent and existing companies have become more focused on solutions and on ways to adapt to this new reality.

Thus, taking this into account and respecting natural ecosystems and the need for economic growth, the balanced development of human society clearly requires the movement of people and that it is done in an increasingly sustainable way. Electrical mobility is a reality that, although recent, is important and growing. This market, with the demographic and environmental vision of the future, has the potential to catalyse the development of new technologies, consumer behaviour and business models. There are opportunities that offer some prospects for markets and industries and provide economic development.

3.1 Theoretical Foundations, Classifications and Industries

Electrical mobility represents a turnaround both at the environmental and economic levels, introducing a completely new concept to the way mobility was perceived and used. This revolution has strong implications for the way electricity is generated, thus representing an open door to economic development and to an entrepreneurial and innovative business opportunity. It can bring multiple benefits to the world, already perceived by a large part of industrialised and developed countries (Dias & Pereira, 2012).

Given that electric mobility is a new reality and a new business area, the business model should also follow a rationale that is different from the conventional one, moving away from classic business models (Fernandes, 2012). Although many are unaware of it, the invention of the first electric vehicle goes back to the 19th century, more precisely to the year 1834. Electric mobility is not something new, but the importance and dedication given to its development is. The combustion engine vehicles took the main stage in the beginning of the 20th century, at the time of its mass production (Fernandes, 2012).

It was in 1910, when vehicles that, despite being powered by electricity, were made up of an internal combustion engine, that occurred the rise of the automobile. The benefits of

reach and size made possible by liquid fuels have brought numerous improvements to society (Leurent & Windisch, 2011). The technology and the dedication required for its development was far bigger than what was expected and therefore this market has never been able to benefit from economies of scale. The internal combustion vehicle gained weight and thus became the dominant design of the automotive industry (Fernandes, 2012).

The negative effects of air pollution and the increase in the price of oil has raised many concerns. Thus, after its appearance followed by a decline in the late nineteenth century and early twentieth century, these issues increased the interest in electric vehicles in the 1960s and 1970s in the USA. The Clean Air Act of 1965 prompted several research institutes and companies to dedicate themselves to this technology and this market for the development of electric cars. However, the results were not encouraging. Contrary to what was expected, around the world, in the late 1970s, less than 4 thousand electric vehicles were sold. Public interest in these vehicles was renovated in the second half of the 1980s and in the early 1990s, once again giving the hope to their stakeholders that electric vehicles would finally become a mass-market reality (Dijk et al., 2012)

The shift to electric mobility for several countries in Europe, Japan and the United States, emerged in 2008 as a result of the sharp rise in oil prices, stimulated by the alliance between two world-renowned car companies: Renault and Nissan (Pereira & Bento, 2012).

The implementation of electric mobility will have a very significant impact of transport on climate, specifically on pollution. Nowadays, the car has become the most important means of transportation for most families in the world. Ease of mobility and reachability add a plethora of appealing benefits for society in general (Leurent & Windisch, 2011).

However, it should be remembered that cars or other transport which use fossil fuels also have many disadvantages. As the author notes, emissions of gaseous pollutants with consequent acid rain and environmental changes due to the greenhouse effect, noise, price and finitude of fossil fuels are just a few examples.

In order to fully understand the concept of electric mobility, it is essential to get to know and spread this concept to its potential consumers, increasing the perception of the behaviours to be adopted and their implications (Daubitz & Kawgan-Kagan, 2015).

Electrical mobility, of course, presupposes the use of renewable energies, which are inexhaustible. These green / clean energies contribute significantly to the reduction of pollution and of all its effects, improving the quality of life. In addition to eco-driving, it has a high impact on more ecological traffic conditions (Leurent & Windisch, 2011).

The trend, with the introduction of the first hybrid vehicles, is to gradually move to purely electric vehicles, and that, in the long run, internal combustion vehicles will not continue to be the first choice of urban mobility (Dias & Pereira, 2012).

When we think of electric mobility and its success and proliferation in everyday life, we must think about energy supply and its distribution to users (Leurent & Windisch, 2011). This form of mobility can eliminate the constraints brought about by combustion engines. However, although electric mobility helps reduce negative environmental impacts, it also presupposes a perfectly integrated network between electric vehicles, electricity suppliers / distributors and collection networks (Blasius, 2017).

For electric mobility to be a successful environmental sustainability strategy, people must change routines and alter their urban traffic experience. To do this, they have to know more about the theme and must have appealing adaptation conditions (Daubitz & Kawgan-Kagan, 2015). The current process of charging for electric vehicles is little known and often seen as inconvenient.

For this new offer to gain competitive advantage, it is necessary to adopt a gradual strategy. The goal is to create a new market space for the use of these vehicles and to reduce the risk of clear competition witht the standard of conventional mobility and other rival products. The pressure for companies that have already entered the electric mobility business is increasing. They must adapt to the new reality and redefine their traditional business model. It is fundamental to leverage the advantages that exist in the distinguishing features of electric vehicles, to present them and to highlight them, leading to their entry into the market by creating new value propositions for the potential user (Kley, et al., 2011).

Therefore, the most appropriate value propositions that should be considered and highlighted in order to meet expectations and, consequently, to satisfy users' needs are: the standardisation of charging infrastructures; the reduction of the total buying cost for the user; the provision of additional services; the offer of leasing of the battery and / or vehicle; the provision of energy efficiency; the reduction of the rates inherent to the charging service; the facilitation of the availability and convenience of a charging infrastructure; the effective communication of information, energy and financial flows (Fernandes, 2012). In general, it can be concluded that the provision of a high-quality service is required. For this, it is necessary to create an efficient solution to obtain operational economic gains, that deliver value to the potential users. The aim is to attract potential users to the use of this type of vehicle, highlighting its advantages in order to put potential risks into the background (Midler & Beaume, 2010).

However, there are some drawbacks. Batteries can have very high prices and their current range is still limited. For the implementation of electric mobility to succeed, there is undoubtedly a need for progress in the development and industrial production of technologies, vehicles and various components. Is is also necessary to ensure accessibility throughout the life of the vehicle, to ensure the existence and efficiency of recharging infrastructures and the range in terms of distance and storage of battery power (Leurent & Windisch, 2011). The adoption of new methods and strategies for sustainable travel, efficient transportation and collection methods is essential (Daubitz & Kawgan-Kagan, 2015).

New concepts of mobility and new architecture of business models are needed in order to transform the technological potential and advantages of electric vehicles. The aim is to increase acceptance of this new market, show the added value for consumers and, consequently, increase the sale and use of electric vehicles. The new concepts can relate several factors, variants and components of this market adapting to different people and contexts. An example might be the more efficient use of the vehicle's capacity, concretely exemplifying the car-sharing cost of the vehicle. Another possibility may be that the battery of the electric vehicle can be charged in off peak periods taking advantage of lower prices (charge shifting) and in periods of greater demand to return power to the network (back-feeding). In addition, another idea is to use the battery also as a stationary energy storage device and to improve the economic efficiency of the vehicle. Finally, the provision of a mix of mobility services, such as ensuring availability of infrastructure is very important. Access through the vehicle's navigation system to the charging stations available in real time can be decisive in the decision to adopt this type of vehicles and mobility (Fernandes, 2012).

Basically, new and promising approaches to better use of vehicle capacity and / or innovative mobility concepts are emerging. The sharing of cars or fleets of vehicles and the integration of public transport systems used for longer journeys are examples, among many others (Kley et al., 2011).

The ongoing public concern about "green mobility" creates new opportunities for this market and opens a window of opportunity for its development and mass expansion. Public authorities are considered a key factor in the development of electric mobility. Their intervention is fundamental in several aspects, from the support to the investment, to the use and entry into this market / purchase of electric vehicles, among others. Public authorities are also seen as key players in the customer's system, since collective environmental values are clearly a strong point of electric vehicles (Midler & Beaume, 2010).

The importance of some factors such as government intervention and the existence of favourable conditions for consumers such as adequate infrastructure and efficient vehicles is fundamental in this project. This was clear when, in 2008, for the implementation of the plan of electric mobility in different countries, it was required that those countries fulfill certain conditions. These include tax incentives to cooperate with the project, support legislation and the installation of a minimum number of recharging stations (Pereira & Bento, 2012).

One of the obstacles to the purchase of electric vehicles is their high cost. To overcome this and to promote the purchase of these vehicles, there are many options (Wiederer & Philip, 2010). For example, the type of charging can be by cable, through the exchange of batteries, or wireless. In addition, the battery and vehicle do not have to belong to the same owner, so several combinations can occur in order to reduce the cost of ownership (Fernandes, 2012). For the development of electric vehicles to be possible, it is mandatory to make heavy investments on specific technologies and new infrastructures associated with electric mobility. The financing of these investments requires innovative business models and risk sharing in the emerging phase (Midler & Beaume, 2010). Regarding the infrastructure that supports the charging of electric vehicles, there are defined critical aspects of design. These aspects refer to the different levels of speed in the information systems between vehicle and network. (Fernandes, 2012). For example, an immediate modification to the charging profile is possible. The information can be processed with different intervals, from the real-time information to the planning for the next day making this possible. (Kley, et al., 2011)

To this end, the European Commission has published the "European strategy for clean and energy efficient vehicles." In this communiqué shared in 2010, more specifically at the end of April, Europe's intentions to become the leader in this market and the technologies associated with and necessary to these clean vehicles were clearly stated. In order to do this, the strategy is to encourage the development of energy efficient vehicles and implement them, reducing the dependency on fossil fuels. The European Union is clearly committed to contributing to sustainable growth. The objective in 2018 was to implement 5 million vehicles. Is intended to start mass production of electric vehicles, in conjunction with the development of batteries. (Leurent & Windisch, 2011).

Also, other countries outside Europe have been active. In 2009, the US published the Recovery and Reinvestment Act of America. Its objective is to fund the research and development of alternative technologies and to put one million energy-efficient vehicles on the road by 2015. The enacted law supports the use of vast alternative fuels as well as advanced vehicle technologies. Since 2008, China has emphasised its dedication to issues of

electric mobility, having set a deadline of only 3 years to produce 500 thousand vehicles powered by alternative energy, electric energy and hybrids. "Next Generation Vehicle Strategy 2010" was an initiative of Japan in April 2010 which requires that for 40 years there should be a diffusion of electric vehicles. To that end, it is expected that there will be joint support in new technologies and vehicles by 2030. (Leurent & Windisch, 2011).

In addition, in 2008, the alliance between two well-known combustion vehicle companies, Renault and Nissan, undertook to launch in the American, Japanese and some European markets, among them Portugal, vehicles of 100 miles energy efficient, in 2010, (Pereira & Bento, 2012).

Having said that, it is the global markets that determine the priorities and directions that organisations must follow. It is from these global trends that companies define which strategies they adopt to respond to the market and remain competitive (Kumar, 2015).

As such, the automobile industry accelerates the development and growth of various infrastructures, having a multiplicative effect on the economic and industrial growth of any country. Consequently, it is a strong catalyst for significant employment opportunities (Brondoni, 2012). Toyota, for example, started the development of a high-voltage vehicle in mid-1994 by implementing an innovative design called Prius I. This vehicle was first marketed in mid-1997 and later a second-generation Prius was developed and released in mid-2003 (Midler & Beaume, 2010).

This industry, characterised by strong competition, allied to environmental issues and concerns, led companies to cooperate so that they could innovate in processes and products worldwide. Thus, globally known companies, such as Mercedes-Benz, Honda, Toyota, among others, have already invested large sums of money in research and development. These investments were aimed at energy systems and their reengineering, in the development and design of energy-efficient motors in different types of alternative energies. In this sense, natural gas technology, hydrogen engines and gasoline-electric hybrid engines have been the focus. The goal is always to reduce emissions of polluting gases with increasingly efficient engines at the lowest cost (Brondoni, 2012). In Toyota's case, for example, the implementation of hybrid technology for other Toyota and Lexus branded products occurs only after the second generation of the Prius, through a third "project-to-sign" learning sequence. Renault, meanwhile, compared with this learning sequence of the Prius Vanguard project, implemented a multiproject learning program (Midler & Beaume, 2010).

As a conclusion, the electric mobility can be considered a radical innovation, to the extent that it translates into a major change for urban displacement. In addition, it requires

large investments, the involvement and cooperation of several entities, and also implies the simultaneity of the concepts of entrepreneurship, strategy and technological innovations (Pereira & Bento, 2012).

3.2 Electric Mobility in Portugal

The electric mobility in Portugal is undoubtedly an innovative phenomenon that, contrary to many possibilities and contrary to what happens when the theme is new technologies, has placed the country at the forefront of innovation (Pereira & Bento, 2012).

Portugal quickly realised that the social and economic context in which it was located was the ideal one to "venture" into an entrepreneurial project such as electric mobility, taking into account the environmental consequences and the economic development of the country. Portugal therefore presents a significant advance in the introduction of technological and social innovations when compared to countries with levels of development equal to or higher than ours (Dias & Pereira, 2012).

3.2.1 Evolution and Importance of the Government's Role

For Portugal, the history of electric mobility began in 2008. Entrepreneurship demonstrated by the Portuguese government resulted in the creation of a private pilot venture and the introduction and development of innovative technology in this new market. The country had made huge investments in renewable energies and was politically committed to reducing the impact of CO2 emissions (Pereira & Bento, 2012), concerned with the dependency on oil and without reserves of oil or gas.

Road transport generally accounts for about 80% of the total energy used. This reality, together with the potential advantages of environmental performance and the independency from oil, were the main motivations that led the government to show itself so proactive, through the development of incentive programs for electric mobility. This was demonstrated with the National Plan of Action for Energy Efficiency, with measures to encourage the purchase of energy-efficient vehicles, through tax credits and tax exemptions for electric vehicle (EV) expenses, and with the MOBI.E program (Oliveira, et al., 2015).

After the alliance between Renault and Nissan, Portugal was one of the main places of interest for their needs. The starting point was launched in the American, Japanese and European markets in 2010 with 100-mile electric executives (Pereira & Bento, 2012). According to the authors, in 2010, the implementation was carried out in 25 municipalities, with 25 charging stations. There were benefits for companies which generated environmental profits, together with traffic tax and free parking in some areas, among other incentives (Oliveira et al., 2015). The Renault Nissan project included three main dimensions: vehicle technology, marketing and business model. The design process of the cars was deeply restructured to minimise the power consumption of the car's components. In addition, a new method of market creation was tested. Although customers of the automobile industry were individuals (or fleet managers), Renault-Nissan adopted a "customer system" approach involving public entities (Midler & Beaume, 2010). The classic approach would have been to first reconfigure its Research and Advanced Engineering divisions to address the challenges of learning electrical mobility before engaging in development projects.

However, policies and efforts have not exactly produced the expected results. An explanation for the fact that between 2011-2012 only 289 cars were sold may be the lack of prior knowledge by consumers. The main obstacle to the success of electric vehicles in society is the autonomy of these vehicles, as well as a charging infrastructure that supports the development of the fleet (Dias & Pereira, 2012). In addition, the context of economic crisis in which these policies and initiatives were implemented should be taken into account (Oliveira, et al., 2015).

3.2.2 MOBI.E

The visionary role of the Portuguese government was instrumental in creating a standardised side of production that led to a new actor in this market, MOBI.E. The option for a single open network with billing management and flow transparency, in which the energy retailers earned points and the users of the charging network could use any charging station, was the strategy adopted (Pereira & Bento, 2012).

MOBI.E, a Portuguese company that operates battery recharging stations for electric vehicles, had an innovative approach that was different from the others that already existed. Contrary to what has already been observed in other European countries with city or region-centred supply networks, the global perspective of MOBI.E has made Portugal stand out as

the first country to set up a network of energy-efficient vehicles at national level (Dias & Pereira, 2012).

This company played a key role in the implementation of the electric mobility project in Portugal because all previous studies pointed out that, unless there were sufficiently safe and comfortable charging stations on the public road, drivers would not adopt this new sustainable behaviour. This technology was therefore the basic condition for the launch and development of electric vehicles in the country. By the end of 2011, a single, sophisticated and intelligent network was in operation throughout the country with 1,1 thousand recharge stations (Pereira & Bento, 2012).

Having said that, the MOBI.E model is part of the clearinghouse concept. The managing entity has the function of acting as an intermediary in the billing process. Therefore, this company manages the information between the infrastructure operator and the service user in this process. It is important to note that, according to the Portuguese model, the value of this billing includes two factors: a charge to use the infrastructure (paid by the user) and for services associated with the charging process itself. Regarding the support infrastructure, the charging platform is open to any type of vehicle. Thus, this is the best solution for the standardisation of technical procedures. At this time, and considering what has been observed over the years, it is not possible for a company or a private individual intending to enter the market of electric mobility to do it isolated, that is, without being part of the MOBI network. This regulation, which underlies this model and mirrors the market model adopted by Portugal, has significant weight on the competitiveness of this sector. In terms of service systems, associated with the charge shifting logic, in this model the charging is performed according to an indirect control through the energy price. (Fernandes, 2012).

3.2.3 Customers

If one examines five features associated with electric vehicles, namely battery life, battery consumption (focusing on savings), pollution released (in order to reduce it), charging time and vehicle performance, it is possible to draw some conclusions. Therefore, it is clear that the decision of the users to buy an electric vehicle depends on several factors, such as the age of the user, his/her ecological lifestyle, the level of schooling, among others (Hidrue, et al., 2011).

In addition, the user's belief that the price of fuel can increase significantly is an important factor, as well as the convenience, ease, speed and accessibility of vehicle charging in terms of location. From the point of view of potential users, the main concerns are the battery autonomy, the long charging time and the (high) purchase price of a battery (Hidrue, et al., 2011). However, the weight of each of these aspects is not the same when deciding to purchase an electric vehicle. Price, cost and battery autonomy are the most critical and valued aspects (Fernandes, 2012).

Despite repeated calls for the use of electric mobility, which began during José Sócrates' governments and continued with Passos Coelho, the high price and weak autonomy tend to make it difficult for customers to make a purchase decision, which affects the growth of the sector. However, despite being few, over the years the presence of these vehicles on the roads has increased. In 2011, between January and August, 128 electric vehicles were sold, of which Nissan Leaf represented 76 vehicles, just over 50%. Later, according to data from the Automobile Association of Portugal (ACAP), between 2014 and 2015 there was a percentage increase in sales of electric vehicles. In 2014, 135 electric vehicles were sold among 172,357 thousand vehicles sold in the total market (including heavy goods vehicles), so electric vehicles accounted for 0.08% of the total number of cars sold. From 2011 to 2014, only 950 electric vehicles were sold in the country. In 2015, in Portugal 1,305 units of electric vehicles were sold, a 360% increase compared with 2014. In fact this means 50 times more electric vehicles or plugin hybrids than in 2010, according to estimates made by the Automobile Association Portugal (ACAP).

In the segment of conventional hybrids, sales are considerably above the values recorded for the electric ones. According to ACAP, from January to September 2015, for example, 2,319 thousand cars were marketed, against 1,301 thousand registered in 2014, an increase of 78%. This difference from pure electric vehicles is due to the fact that hybrids allow the same use as cars with gasoline or diesel engines. In this way, the limitation of the autonomy of the pure electric is exceeded.

By 2016, in comparison with the same period of the previous year, sales of electric cars in Portugal had already increased 43% in the first six months of the year, representing 1.45% of the trade of cars. Thus, the increase seen in 2015 was due to the highly developed public charging network and is certainly an example to follow. Recognised for being spacious and affordable, by 2016 the Portuguese network had already more than 1,200 thousand recharging points spread across 457 locations. In addition, the distance between the charging points was reduced. Another reason were the incentives offered by the Portuguese

Government for the purchase of electric or hybrid vehicles, which were a great motivation for buyers. The incentives in 2016 fell from 4,500 thousand to 2,250 thousand euros, but with the obligation to deliver a gasoline or diesel car with + 10 years, the sales of electric vehicles continue to increase.

Having said this, in 2018, electric vehicle sales nearly tripled in Portugal between January and April when compared to the same period of the previous year. Thus, during this period there was a positive percentage variation of 170.9% over 2017, for a total of 1,184 thousand vehicles, according to ACAP data.

3.2.4 Partners and Competitors

Due to a strong commitment to the European Union, the Portuguese government has succeeded in encouraging countries such as France and Germany to enter the electric mobility market with energy-efficient vehicle plans (Pereira & Bento, 2012).

In managing product lifecycle costs, the role of external networks in organisations and the integration of suppliers into product development are important factors to take into account. Both factors can also be applied to the E-Car scenario. Thus, there are several opportunities for companies to increase revenues and reduce costs associated with their operations. Having said that, partnerships, joint ventures and collaborations between companies are some possible examples. This way, it allows companies to share processes, knowledge, activities, resources and skills, improving their performance, while also individually contributing to the expansion of this market and to making it more competitive (Giannetti et. al., 2016).

Electrical mobility is a topic that has attracted many companies involved in the urban mobility sector. For example, many companies in the automotive sector have started to develop hybrid vehicles, i.e. vehicles that have both an electric motor and an internal combustion engine, such as Toyota with Prius. Subsequently, in addition to these vehicles, there are hybrid electric vehicles with autonomy extension, vehicles with combustion batteries and vehicles which are only electric. Some companies that have dedicated themselves to these projects are Nissan, Opel and Mitsubishi, among others (Dias & Pereira, 2012). Better Place was one of the first companies to be present in this market. Its entrepreneurial vision led this company to build a network of different stakeholders, government agencies, as well as car manufacturers and battery producers (partnership). Thus, the company was founded with the

ambition to create an innovative ecosystem. This intention was translated into the creation of an "intelligent network" of charge stations and battery exchange that are powered with electricity. The electricity needed at these stations would be generated from renewable sources, such as solar and wind power (Giannetti et al., 2016).

Although its value proposition was unsuccessful and in 2013 the company filed for bankruptcy (Giannetti, 2016), Better Place was a proactive electric vehicle charging point company manufacturer (Carpenter et. al., 2014). One of the challenges that it embraced was to try to find a way of managing and minimising costs and the innovation of the business model. (Giannetti et al., 2016). For this purpose, one of the possible examples is the creation of a new mobility business model. In this sense, commercial intermediaries could offer electric vehicles at lower starting prices, while at the same time charging the consumer higher costs per mile. Also, the company studied the feasibility of implementing energy-efficient vehicles, namely electric vehicles, in Tokyo (Carpenter et al., 2014). In Denmark, in 2009, it also implemented a vast network of infrastructures, both for recharging and battery replacement (Leurent & Windisch, 2011).

Although it was not successful, Better Plece presented an innovative business idea. This was based on a value proposition where the ownership of the vehicle was separate from the ownership of the battery. The goal was to develop a global infrastructure that would offer a fast battery replacement service, that is, infrastructures where batteries could be inserted, charged and recharged. The process would be to insert the batteries into the electric vehicle, recharge them and then install them in another vehicle. The process of changing the battery in each vehicle should be faster than the time to fill the fuel tank. This could make the commercial value of an E-Car comparable to that of an ordinary car (Giannetti et al., 2016).

Therefore, consumers did not buy the battery but rather an electric vehicle while signing a contract with Better Place. Subsequently, the consumer had at his disposal an infrastructure, such as recharging points and automatic battery exchange stations, made available by this company. Better Place would have to manage battery charging. "Battery exchange stations" were therefore a key element of this model. Although the business idea and the business strategy were promising, several errors, such as the investment estimation, were committed, which led to the failure of Better Place (Giannetti et al., 2016).

3.2.5 Setbacks and Opportunities

With the emergence of electric mobility, more attention is paid to the development of electric vehicles. This way many changes are taking place, which are triggered by the appearance of these vehicles in the automobile industry, the battery industry and the utilities industry. However, for a more consistent and broader entry of electric vehicles into the automotive market, a socio-technological transition should occur. But this transition entails barriers and obstacles to be overcome related to the technological aspects of the vehicle itself. An example is the battery life. Other examples of some barriers are the infrastructure and the charging time and economic aspects such as the total cost of ownership of the vehicles. However, for a public charging infrastructure to be viable, there must be a minimum number of electric vehicles to support the costs of the infrastructure. In the same way, the adhesion to electric vehicles is influenced by technological and economic factors. The autonomy and costs of the vehicle and battery respectively are some examples (Fernandes, 2012).

Possible problems along the way should be seen as entrepreneurial improvement opportunities. For electric mobility to succeed it must be safe and convenient for its users. In this sense, several research and development projects have been launched by energy transport companies in countries all over the world which, like Portugal, have made previous investments in renewable energies (Pereira & Bento, 2012).

In addition, the price of fuels influences the purchase decision of an electric vehicle. Therefore, the savings achieved by the acquisition of these vehicles are not yet high enough for most of the consumers (Oliveira, et al., 2015). Thus, cars that can return energy to the network during peak periods are interesting for many companies because the incorporation of costs and efficient energy prices can be a great change in this market (Pereira & Bento, 2012).

Having said that, one of the most relevant obstacles to entering the market of electric mobility and to the mass adoption of the E-Car is the high cost of the battery. This factor makes the vehicle's acquisition cost too high for most (potential) customers. In fact, each technology has specific features in terms of materials and battery design. The greater efficiency of these technologies can make the difference in terms of the cost of production of the E-Car, that is, lower cost of battery production for their manufacturers can translate into a lower final cost of electric vehicles as a whole. However, this is not the only fact that can minimise the final cost of these vehicles. The cost of batteries can also be influenced by multi-stakeholder agreements (OEM, supplier, etc.) within the network (Giannetti, 2016).

Essentially, there are three barriers / obstacles to the large-scale development of electric vehicle infrastructure, including regulatory, economic and technological barriers. As for the former, the effect of government policies on investment in charging infrastructure for electric vehicles must be highlighted. Economic barriers affect the participation of private capital in the development of the charging infrastructure. Finally, technological barriers are essentially related to uncertainty in charging and battery technologies and infrastructures, in their standardization and in the applications of smart networks (Fernandes, 2012).

SYNOPSIS OF CHAPTER 3

The electric mobility market depends on renewable energies and, therefore, has attracted growing interest and has gone through an evolution over the years. Significant increase in the price of oil, growing concerns about environmental issues, current quality of life and the sustainability of future generations have opened several doors for these markets that depend directly on the so-called clean energies that have been characterised by plundering for some time.

There are several entities interested in the electric mobility market: from producers to electric vehicle dealers, producers and suppliers of electricity, operators of charging stations, government entities, among many others. In the specific case of Portugal, the government is one of the main interested parts because electric mobility contributes significantly and in a positive way to meet European environmental goals, and because this market contributes to the decrease of imports and to the improvement of the country's trade balance. Moreover, this market supports the dynamism of the economy, since it powers research and development (R&D), leads to innovation and investment, as well as to the emergence of new businesses, technologies and companies and the creation of new jobs.

When you think of electric vehicles there is a certainty that they will contribute to a cleaner planet. With zero emissions, the electric car could, in fact, be the solution in the fight against pollution in large urban centres. All over Europe, the political will to ban gasoline or diesel vehicles from major city centres is already significantly visible as a way to improve air quality and to encourage the purchase of electric vehicles. There is an undeniable advantage in the purchase of an electric vehicle as opposed to a motor vehicle fuelled by fossil fuels (gasoline, diesel, gas). In addition to being zero-emission vehicles and to contributing to the reduction of noise pollution, they are associated with low costs of use: while using a petrol vehicle costs around € 10 per 100 km, at least, one diesel vehicle costs € 7 per 100 kms and a gas vehicle costs around € 5 for the same distance, whereas an automobile powered by electricity covers the same 100 kms for only € 2. To reinforce this idea, in the case of Portugal, there have always been other incentives to reduce expenses associated with the use of these vehicles. As for tax incentives, they have a significant weight in the final calculations of drivers who join this market, not only in immediate terms but also over time. As for the former, in 2017 a subsidy of € 2,250 thousand was awarded for the first one thousand drivers who bought an electric car. As for incentives with benefits over time, we can consider a low IUC that varies between 7.91 € and 35.87 € or the exemption of parking payment in several

points. Of these, we can highlight, for example, in Lisbon, the places managed by EMEL. There are also other incentives besides tax incentives that contribute to the reduction of the cost of using electric vehicles and that encourage its purchase. For example, the partnership of several car brands with EDP, an electricity distributor, allowed those who purchased an electric vehicle in 2017 and joined an electric mobility plan to deduct the cost of charging for 15 thousand kilometres. This figure corresponded to a significant saving for the first 500 Portuguese drivers that chose this market, corresponding to 400 € in their electricity invoices.

Portuguese are buying more electric and hybrid cars, but at a much slower pace than most European countries, with extreme cases such as Norway, Denmark and Sweden where more electric vehicles than vehicles with combustion engine are already sold. One of the main problems preventing Portuguese citizens from joining this market are the two classic factors: autonomy and high prices of electric vehicles, with average values ranging from € 35 thousand to € 40 thousand. There has been a repositioning, but the technology used is still significantly costly for most Portuguese citizens, even with the option of monthly rental of batteries, as opposed to their purchase, offered by some brands. On the contrary, in favour of the option for electric cars is the fact that the costs for every 100 kilometres covered are four to five times lower than with combustion engine cars.

Having said that, any electric appliance requires an initial investment that, from the outset, tends to be compensated over the years.

CHAPTER 4 - RESEARCH METHODOLOGY

Research methodology is a discipline derived from logic, whose object is the study of the scientific method (Tarski, 1977). The scientific method consists of a set of practices used and confirmed by the scientific community for the exposition and confirmation of a given theory. The methodology thus appears to refer to the phases and procedures involved in a given investigation. This way, it refers to concrete models of work that are used in a discipline or specialty, and it also refers to the set of procedures and recommendations that are transmitted to the student as a curricular part in higher education (Hernández Sampieri et al, 2003).

According to Vergara (2006) and Vilelas (2009), and considering the classification criterion proposed by them, there are two possible ways of classifying the methodology used in the creation of research documents, referring to the ends and the means. The first, referring to the ends, concerns applied and exploratory research. The second, referring to the means, is linked with the field study and bibliographical research.

4.1 Origin of the Case Study

Bearing this in mind and taking into account the features of the research carried out, the method used was the case study. This method appears as a research strategy that emerges as an obvious choice for students or other researchers seeking to pursue a research project on a modest scale based, as in the current case, on a limited number of organisations (Rowley, 2002).

The research supported by case studies has been increasing and earning a higher reputation mainly in areas related to management. This growing notoriety in the field of education and the social sciences owes a lot to authors such as Yin and Stack. These two authors, however, have different perspectives in their work. Both have sought to deepen, systematise and give credibility to the case study within research methodology. Thus, the case study as a research strategy is approached by several authors: Yin (1993 and 2005), Stake (1999), Rodríguez et al. (1999), are some examples that we can mention. For these authors, a case may be something well defined or concrete, such as an individual, a group or an organisation. On the other hand, the same authors also see this method as something less

defined or defined in a more abstract way, such as decisions, organisational changes, programs or implementation processes. For Yin (2009), the case study method is particularly appropriate for issues centered on "how" and "why". Therefore, he thinks it is an adequate method when one intends to investigate in depth a contemporary phenomenon in a real context. According to the same author, the essence of a case study, and the central tendency among all types of case studies, is the attempt to clarify one or a set of decisions (Schraam, 1971). Ponte (1994), also focus on a specific situation with unique features. The intention is to discover what is characteristic in this particular situation, in order to contribute to the global understanding of the phenomenon being studied.

Yin (2005) discusses the general features of case study design, assuming that cases can be single or multiple, and can be both holistic (with a unit of analysis) or incorporated (several units of analysis). This combination results in four different types of case study design: Single Case Holistic, Multiple Case Holistic, Single Case Incorporated and Multiple Case Incorporated. Stake (1999), on the other hand, adopts a very illustrative classification, based on the objectives that the investigators have when adopting the case study methodology. Thus, case studies may be intrinsic, instrumental or collective. In the first case, the intrinsic type, the interest of the investigation falls on the specific case. What is important is to understand exclusively the specific case, unrelated to other cases or to broader issues. In the second, the incremental type, the case itself has a more secondary interest. They are distinguished from intrinsic ones insofar as they are defined by the interest in understanding a broader problem from a specific case. The case is the vehicle for understanding or enlightening a problem or the conditions that affect not only the case studied, but also other cases. In collective case studies, the researchers study several cases in order to do a better analysis and, consequently, to have a better understanding and theorisation.

4.2 Application of the Method

The thesis resulted from the attempt to investigate a contemporary phenomenon in the context of real life (Yin, 1994). The lack of knowledge and information about the practices of the companies of the sector and involved in the project, always focusing on the main company responsible, created the need to further explore the theme. The objective was to understand the theme, its origin and the development of the theme up to the present moment.

The research began with bibliographical research and the treatment of information, comparing theory with reality. Fieldwork and the collection of data from interviews ocurred during the second stage. Finally, the third and final stage involved the qualitative analysis of the data, including the complex task of analysing the information reproduced in audio from the interviews. The case studies seem to inherit the features of qualitative research. The term qualitative research has been used as a general designation for all forms of research that are mainly based on the use of qualitative data. This includes data related to ethnography, naturalistic research, ethnomethodology, life story methodology and biographical approaches, case studies and narrative research (Rodríguez et al., 1999). Also, Bogdan and Bilken (1994) use the term qualitative research as a generic term to group diverse research strategies which are rich in descriptive phenomena regarding people, places and conversations, as well as statistical treatment. According to Fragoso (2004), throughout the study, the researcher must ensure that the methods and techniques for collecting information are used in order to obtain sufficient and relevant information. To do this, it must collect and organise data from multiple sources in a systematic way (Dooley, 2002). However, this may lead to excessive collection of information for analysis.

Concerning the means, the investigation was based on a primary source, with the application of semi-structured interviews, since it involved a compromise between the script of issues previously established and some spontaneity and improvisation. Specifically, it was a planned but spontaneous interview, which allowed us to collect many important data that generated quantitative information (Werr and Styhre, 2002). Thus, its informality and flexibility allowed a deeper dialogue, which enabled the collection of important data that came up spontaneously. Secondary sources, such as bibliographic research and information processing, were included in the systematised study developed in scientific articles, newspapers, books, magazines and electronic networks.

4.3 Epistemological Convictions and Potential Contributions to Entrepreneurship

Despite the advances that qualitative research obtained from the 1970s onwards, the use of the case study as a research strategy began to raise greater interest only around 1980.

Thus, taking into account the studies carried out and the articles published about administration, the case study has become a recognised and widely used method because it

allows to relate practical and theoretical cases, both specific and generic. This method is useful and frequently used in the areas of human resources, public administration, information systems, production and marketing, organisation theory, finance and accounting (ROESCH, 1996). In this sense, Farina (1997) points out that this method describes a real problem situation within an organisation, with decisions based on strategic reasoning. In this way, it is a dated issue linked with a set of internal and external circumstances of the organisation.

4.4 Benefits and Limitations

Conducting a case study is not an easy task, it requires time and dedication from the researcher. One of the advantages of the case study is its applicability to human situations and to contemporary real-life contexts (Dooley, 2002). However, the work is often subject to criticism due to methodological limitations in the choice of cases, the analysis of data and the generation of conclusions supported by the evidence

In this specific case, a major limitation of research is the evolving character of the market as well as the difficulty in finding reliable information. However, as the interest of this investigation focused on discovering the origin and the whole evolution to the present moment, the outdating of past information is non-existent.

In addition, taking into account the qualitative approach, one of its main advantages, when compared to the quantitative one, is depth and breadth. This is related to the value and veracity of the evidence that can be obtained through multiple sources, in this case interviews and document analysis. It allows the researcher to obtain informal and relevant details which are difficult to reach with the quantitative approach. In addition, it also allows a much closer and more systemic relation with the object of study. By contrast, the quantitative approach seeks to interpret a specific object of study with the definition of variables that cannot be fully identified and analysed with the application of statistical tools.

Despite the wide use of case studies in the social sciences, criticisms of this approach are still frequent, especially regarding its methodological rigor and the limitations of generalising its results to other phenomena (ALENCAR, 2000). Farina (1997) argues that case-based research is highly subject to intuitive, primitive and uncontrollable analysis. For many authors, the case study does not allow generalisations to be made for other cases, since the research is limited to one or more objects and thus does not constitute a truly representative sample.

However, despite the limitations, the case study is the most appropriate method to know all the nuances of a given organisational phenomenon. Three criteria can be defined to guarantee the excellence of the research:

(a) Validity - it can be internal, when it refers to explanatory studies that look for causal relations, and external, when the findings of the case study can be generalised, that is, its results are applicable to other cases (YIN, 2005);

(b) Generalisation - it is closely related to validity and sometimes is called external validity, and the results of the research are used in specific applications (GUMMESSON, 2007); and

(c) Reliability - it is the main criterion of science. A study with high reliability can be replicated by other researchers (GUMMESSON, 2007), and the objective is to ensure that another researcher can reach the same results, using a case study protocol (YIN, 2005).

SYNOPSIS OF CHAPTER 4

The purpose of a case study is to gather detailed and systematic information about a phenomenon (PATTON, 2002). It is a methodological procedure centred on the understanding of the dynamics of the real context (EISENHARDT, 1989). It involves a deep and exhaustive study of one or more objects, in order to allow their ample and detailed knowledge (GIL, 2007).

A case study is a history of past or multiple sources of evidence, which may include data from direct observation and systematic interviews, as well as public and private archives. In line with this, the main benefits of conducting a case study include the increased understanding of contemporary real events, the testing of an existing theory and the development of a new theory.

The case study may have the following purposes:

(a) Exploratory - in this phase, the objective is to develop ideas and hypotheses for research, with many researches starting with the case study and generating a list of hypotheses for quantitative research;

(b) Definition of a theory - in a specific area where cases are clear, the case study will build theory;

(c) Testing the theory - despite its limited use to test a theory, the case study method has been used in operations management to test complex issues; and

(d) Improving the theory - insofar as case studies can also be used to deepen and validate the empirical results of previous research.

The qualitative type of approach which has been used, should present the following features:

- qualitative research has the natural environment as the direct source of data and the researcher as a fundamental instrument;
- qualitative research does not seek to enumerate and / or measure the events studied, nor does it employ statistical instruments in data analysis;
- qualitative research is descriptive;
- researchers use the inductive approach in the analysis of their data;
- it starts with broad issues or focus of interests, which are being defined as the study develops;
- the meaning that people give to things and their life is the essential concern of the investigator;

- it involves obtaining descriptive data about people, places and interactive processes through the direct contact of the researcher with the studied situation;
- it tries to understand the phenomena according to the perspective of the participants of the situation under study.

In conclusion, based on the theoretical references used in this work, it is known that the case study does not allow to generalise the results obtained regarding a certain phenomenon.

In spite of the limitations in obtaining data during the research carried out, it was possible to show the high degree of use of the case study method.

PART II

THE ELECTRONIC MOBILITY HSTORY, ITS AGENTS AND MOBI.E

5.1 MOBI.E: Activity and Business Model

MOBI.E is a relatively recent company, which started its activity at the end of 2015, and has got a very clear objective that is defined by law, namely in the Decree-Law No. 39/2010, later changed to the Decree-Law No. 90/2014, and which define the company's responsibility. Thus, the general responsibility of MOBI.E is to manage the information associated with the network of charging stations.

In order to understand the success of this network, it is important to know how the Portuguese network was designed, how it works, what are its stakeholders and their interactions. Portugal has a system which is slightly different from the one is implemented in other European countries, where users of electric vehicles can charge on any existing charging station with public access, which requires only one way of accessing the network. Therefore, the basic function of MOBI.E is to manage this information.

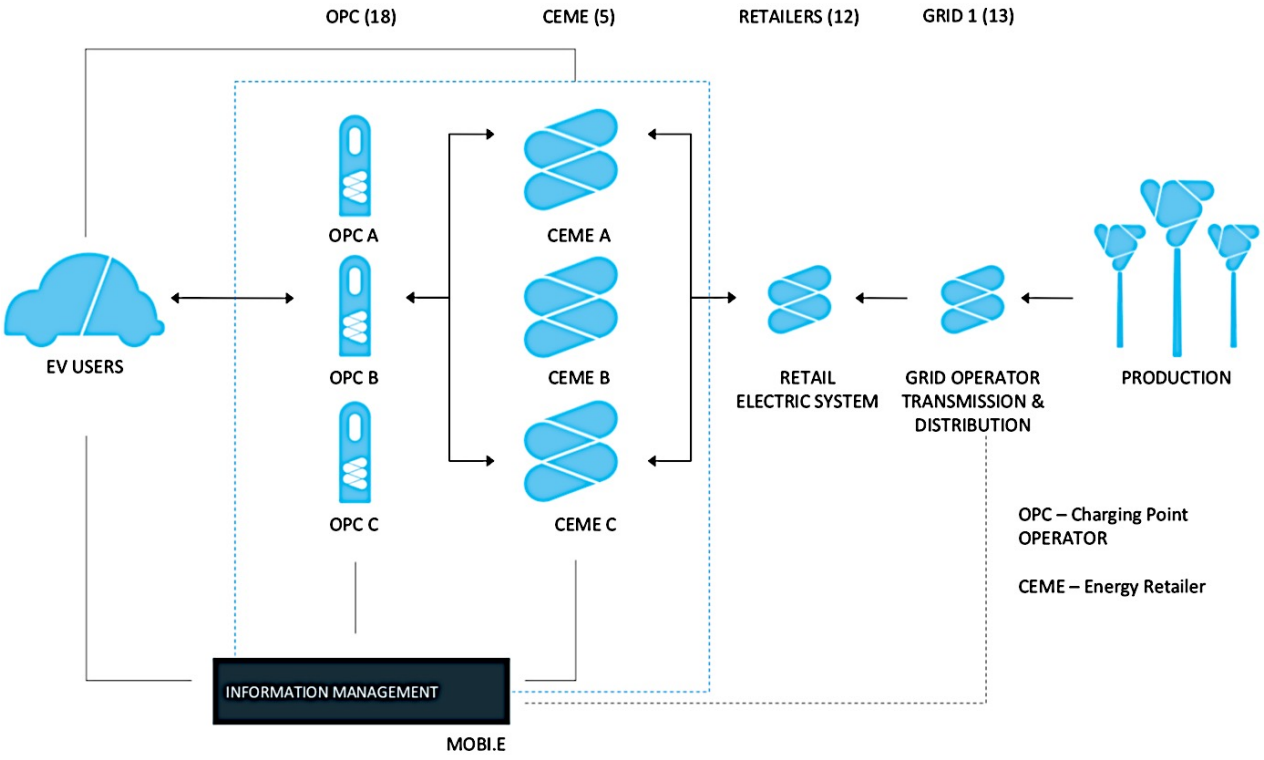


Image 1 - Electric Mobility Model: Business Interoperability and Competition at Work

Source: MOBI.E, S.A

The aim of the creation of the network was to allow anyone in Portugal to charge at any charging station with its own electronic mobility contract, and to allow anyone without an e-mobility contract in Portugal to charge on time at any charging station. To do this, a compromise between regulatory, legal and market scope is required, ensuring a balanced integration with the electricity sector and defining the maximum limits for roaming charges (number of charges and maximum price).

So, when a user goes to a charging station, MOBI.E knows who the user of that charging network is, and it also knows with whom that user has a contract to buy electricity. Subsequently, MOBI.E receives this information and makes it available to the operator. This way, the electricity supplier knows that the user, its client, has loaded his/her vehicle on that charging station and then it can return the money to him/her. Summing up, we can see that, up to this point, besides MOBI.E, there is a specific user, who is a client of a certain electricity supplier.

At this stage, MOBI.E acts and makes the connection with EDP Distribuição, which is the manager of the national electricity network, so that all the energy that is consumed in the charging stations and that, in the background, is transmitted to the vehicles, is discounted on the electricity sector. Having said this, we conclude that the main function of MOBI.E is to manage the information it receives from all the charging stations, to process it and to distribute it to all the players of the electric mobility sector. These are: (a) the operators of the charging stations; (b) electricity suppliers for electric mobility; (c) power network managers (in this case EDP Distribuição).

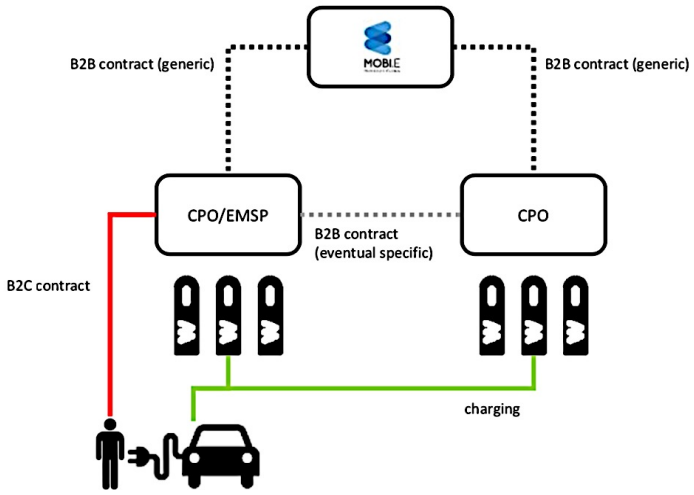


Image 2 - Use case: PT electric mobility framework - Contractual relations

Source: MOBI.E, S.A

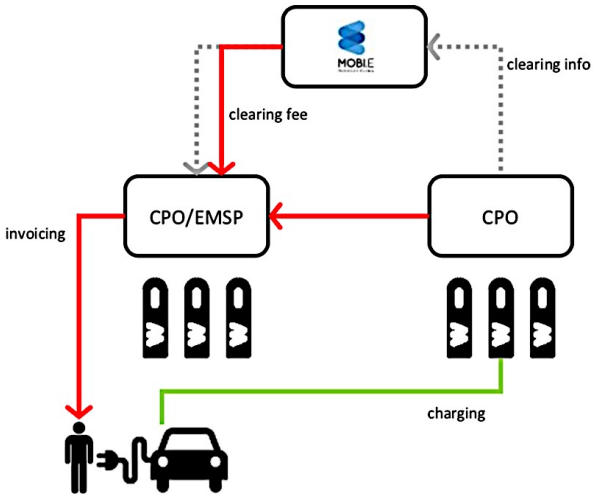


Image 3 - Use case: PT electric mobility framework- Invoicing

Source: MOBI.E, S.A.

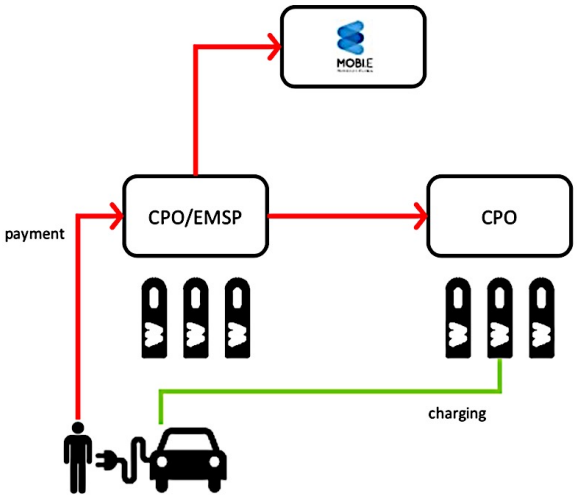


Image 4 - Use case: PT electric mobility framework payment

Source: MOBI.E, S.A

Thus, the players in these contractual relations are the charging stations operators (CPO). The stations are mandatory in places with easy access for the general public and must be available to any user. The operators must be licensed for EVSE (electric vehicle supply equipment) operation. and do not have a direct contract with the users. Also, the Charge Point Operator registered as Electric Mobility Electricity Reseller (CPO/EMSP) is the union of the CPO with the electricity supplier for EV (electric vehicle) charging and does not have any type of direct contract with the users of the network. Finally, there is the Electric Mobility Manager (MOBI.E), which makes EM clearing (e-roaming) and the exchange of management information for the electric network.

The contracts establish relationships between Service Operator (platform), Charging Operator (platform) and Charging Operator Service Provider (automated).

Each operator must have a contract with all the Retailers of Electricity for Electric Mobility and each Retailer of Electricity for Electric Mobility must have a contract with all the operators. Additionally, all Operators and Retailers of Electricity for Electric Mobility must sign a contract with MOBI.E, S.A.

To optimise this process, a standard contract with MOBI.E is made available. By signing this contract with MOBI.E, S.A., Operators and Retailers of Electricity for Electric Mobility will automatically accept that they are signing a contract with the other relevant players (Operator A with all Retailers and Retailer B with all the Operators). The main items in this contract will be the Key Process Indicators and the Service Level Agreements. Both Operators and Retailers of Electricity for Electric Mobility will have to comply with them when joining the network.

All information flows occur at a daily level (real-time information exists within the e-mobility sector but official and quality-checked data is only shared after crossing information with the Days Sales Outstanding (DSO).

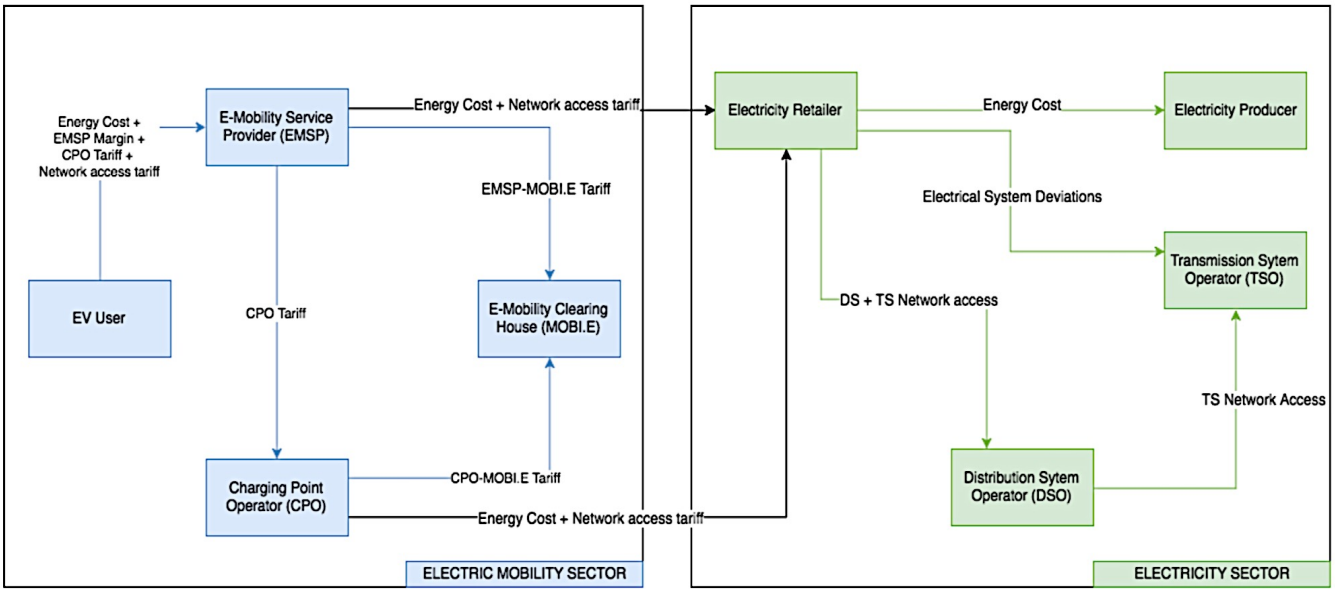


Image 5 - Energy, information and financial flows

Source: MOBI.E, S.A.

In addition, integration of private networks can also be made. The Charge Point Owner (CPOw) can only exist in private premises and takes on a similar role to that of the charging point operator (CPO). There must be a separation of e-mobility consumption, thus eliminating any impact on the existing contract. In addition, the charge is exclusive for

authorised vehicles (cards) or others, without introducing costs into the account. The owner of the installation bears all costs related to consumption, misuse of the equipment and lack of communication with MOBI.E. An "informative" meter can be set up upstream of the charging stations to monitor the overall consumption. Finally, the investment in electrical installations and / or recharging stations can be shared between the owner of the facility and any other entity with the rights to use it, such as a private car park or a condominium user.

As far as the identification of the user of the MOBI.E network is concerned, there are two possibilities: the EVSP MOBI.E RFID card and the MOBI.E application. Thus, regarding the card issuing process, the EVSP may be permitted to use the card for purposes other than e-Mobility. The Electric Vehicle Supply Equipment can create its own cards and MOBI.E supports a card registration process inside the MOBI.E network to associate the card with a specific user. This company offers the card creation service on behalf of EVSP, with its own brand and with a specific process for card registration with EVSP systems. MOBI.E-EVSP cards exclusively identify a contract and therefore a specific user;, however, in specific circumstances the card may be used only for user identification. These situations can be related with, for example, energy supply discounts. In this way, the user will continue to have access to information about all charges that occur in his / her user area on the portal, with the energy for the charging being provided by EVSP with a contract with the offering party. It should be noted that in this model all agreements are made at the energy level and not at the finance level.

For billing authorisation there are two possibilities: when the charging station is online and when it is offline. For the first, the authorisation can be given at the beginning of the recovery, when all conditions are checked for the existence of a valid and active contract, or during the charging, where all conditions, including the balance of the account, are monitored continuously as the whole process unfolds. Regarding the second scenario, when the charging station is offline, the authorisation occurs at the beginning of the charging, through a list of authorised card permissions. However, this type of charging will be increasingly restricted to specific conditions. In addition to the above, MOBI.E systems can perform real-time validation in three different ways:

- by initially validating the account balance, setting a minimum negative balance or, on the contrary, a maximum account balance in the case of post-paid;
- by means of a provisional calculation of the balance of the account which is made during the entire recovery, thus allowing interruption of recovery, if necessary;

- by the activation or deactivation of the user account by the ESVP according to the conditions it defines.

In addition to the above, EVSPs are free to define their own tariffs in the relationship they establish with the EV user, allowing several variations, such as: fixing a certain monthly price for an all-inclusive case or the definition of variable prices; per kWh; per minute; per average kW; maximum EVSE power; per period of time, per load; or even a combination of all of them. CPO-EVSP tariffs are freely defined, provided they are non-discriminatory in terms of EVSP and it must protect itself against the possibility of changing the value of the CPO-EVSP tariff, which is defined by EVSE.

Still, it is also important to understand how the billing and payment process works. In this regard, MOBI.E does not receive money from end users, it provides generic payment gateways that can be used by EVSPs. EVSPs can use their own means of payment and gateways, for which MOBI.E provides an integration interface. As long as one meets all information sharing requirements with MOBI.E, the EVSP can choose its own means of payment and MOBI.E is responsible for controlling the EVSP billing processes for end users and from CPO to EVSP. For this purpose, MOBI.E offers three billing options. The first one goes through the complete electronic invoice service, with a branded EVSP invoice delivered to the user, through a certified billing platform. Another possibility is the use of API for direct integration with EVSP/CPO's own billing system, which will be responsible for issuing and sending the invoice. Finally, the option of using the API for data sharing that contains disaggregated data and that allows EVSP/CPO to bill its clients, according to the agreement established between them. Ad-hoc charging can be done using the credit card based on the application. In this device, all the available offers of all EVSPs for ad-hoc charging are displayed and the payment is done directly to the EVSP through a single payment gateway. This sets the desired ad-hoc charge rate which can be set per charging station or globally. The interface can be implemented at the application level by an EVSP or locally via a web interface.

Finally, it remains to be seen how international roaming works in Portugal.

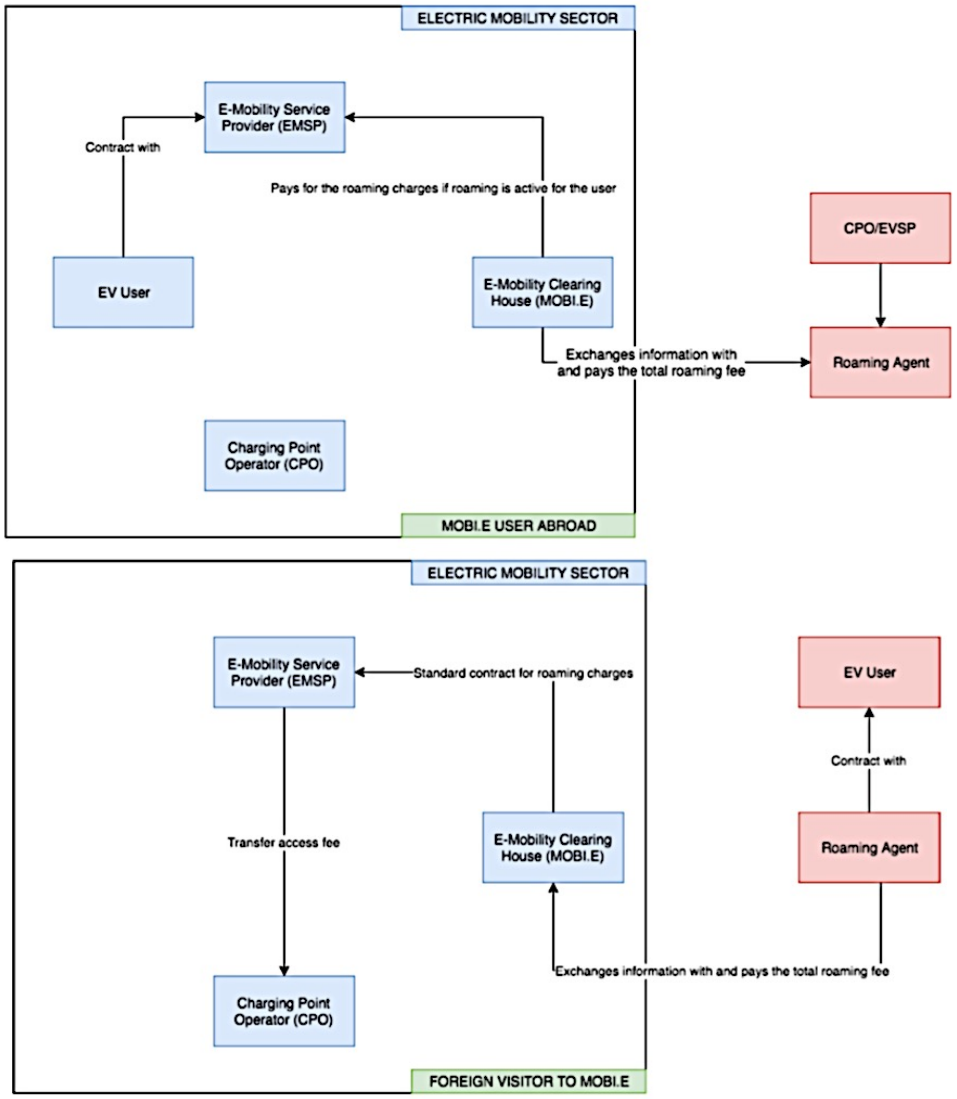


Image 6 - International roaming in practice for Portugal

Source: MOBI.E, S.A.

To ensure roaming, MOBI.E works as the counterpart of the visitor system. In this case, the company takes on the role of e-mobility customer and buys electricity from its supplier. For roaming, MOBI.E applies a standard price rate, and ad-hoc prices will always be available, according to the ad-hoc charge.

Having said this, it is clear that the goal of the creation of the network was to allow anyone in Portugal to charge at any charging station with its own electronic mobility contract and to allow anyone without an e-mobility contract in Portugal to charge in any charging station. To do this, a compromise between regulatory, legal and market scope is required, ensuring a balanced integration with the electricity sector, defining the maximum limits for

roaming charges (number of charges and maximum price). The MOBI.E model entails that the Portuguese charging network has all public access points connected to the MOBI.E network and that any user of an electric vehicle can charge at any publicly accessible charging station. It also assumes that the user of an electric vehicle can use his/her network access card by paying, at the end of the month, the electricity he/she has consumed to his/her supplier.

In addition to this central function, also defined by law, the company has "a more accessory role", in the words of its director, which is to promote electric mobility in Portugal. This means that it must also promote the conditions for people to have an electric vehicle.

Finally, since it was created, MOBI.E has also been playing a role that it is not defined by law, or at least not by the law for electric mobility, but in other documents. This role is to guarantee the transition of what was the initial pilot project, which started in 2009 and created the national model that currently exists, to a market phase, that is, to ensure that the players of the electric mobility sector can develop their normal activity which is defined by law.

5.2 First phase: Reasons for interest, evolution and stimulating agents

For Portugal, the start of the project for the implementation of electric mobility happened in 2009, with little participation from the general public, that is, the government played an important role on the dynamisation of electric mobility. This happened because there was a clear policy for renewable energy. The network was launched in 2010 by José Sócrates, but was stopped during the government of Passos Coelho. It was António Costa who, about four years later, took up this initiative again. Portugal already had a fairly high renewable energy production capacity and therefore it made perfect sense to reduce its dependency on the outside world in terms of fuel. Because Portugal does not have any source of oil and therefore has to import this type of fuel, deciding to move the vehicles into electric power, and mainly to produce that renewable energy in the country, could only result in gains. Therefore, public policy promoted this trend that would lead to the appearance of electric vehicles. Fundamentally, in the words of Alexandre Videira, director of MOBI.E, "there was a push from the public side and, basically, a network was installed but a network designed from the ground up" which is the model detailed above.

Having said this, so far, it is possible to divide this project essentially into three moments, namely a start and rapid development, followed by a stagnation and degradation of the infrastructure of the charging network. This phase required a restructuring of the project

and the update, conclusion and expansion of a new investment. Finally, there was a third moment, the second phase of the project, which requires that all the conditions are met so that one can enter the market phase and that this effectively happens. Thus, the following years stand out:

- 2009, the year in which the MOBI.E project started. This year and the next, 2010, were years of great investment and growth of the network;
- The period between 2010 to 2014, after the financial crisis in the country, were years of full stagnation of the project;
- 2014, the year in which a necessary change was made to the regime of electric mobility;
- the year 2015 that signals the beginning of the activity of the public company MOBI.E, S.A. to carry out the information management of the electric mobility network;
- the period between 2017 and 2018, a period dedicated to the completion of the pilot project, the expansion of the network to the whole country and the start of commercial activity; and
- the years 2018 and 2019 marked by the beginning of the market phase.

At the outset there was a strong interest in this market arising from the concerns, goals and explicit environmental policies in the National Action Plan for Energy Efficiency (PNAEE) (2008-2015) and the government was focused on complying with it. The Resolution of the Council of Ministers No. 80/2008, of 17 April 2008, among other decisions, included the approval of this plan, also known as "Portugal Efficiency 2015", which integrates the policies and measures of efficiency, and determined that the Ministry of Economy and Innovation was responsible for monitoring the plan. It also stated the determination that they constitute revenues of the Energy Efficiency Fund to create

Thus, the reasons for the focus of the government of José Sócrates were diverse. In fact, during both governments lead by Sócrates there was a kind of euphoria around this issue. In his second term, for example, he intended to reach a share of 10% of electric cars by 2020. He also offered an incentive of five thousand euros to buy electric cars, which could reach 6,500 thousand euros if the delivery of the old vehicle was included. Following this plan, PNAEE, the Government wanted to position the Country as a pioneer in the adoption of new models for mobility, to be sustainable from the environmental point of view and to explore the relationship with the electricity network, maximising the advantages of energy produced from renewable sources. The production of energy essential to the circulation of the electric

vehicles would, from the outset, benefit from the use of renewable sources. Thus, in order to foster the start of electric mobility in Portugal and to achieve the objectives underlying it, on 20 February 2009, the Resolution of the Council of Ministers No. 81/2009 was approved and the Program for Electric Mobility was created in Portugal. It should also be noted that the goal of creating conditions for the massification of electric vehicles was contemplated on the State Budget for 2009, approved by Law No. 64-A / 2008 of 31 December. Incentives were provided for the acquisition of such vehicles, such as the deduction of 30% of the charges, with a limit of € 796, of the amounts spent on the collection of personal income tax. Another example of planned incentives was the total exemption of the vehicle tax. Having said this, among other objectives, the Council of Ministers established strategic objectives for the Program for Electric Mobility. Among others, we can highlight the acceleration of the adoption of electric vehicles, the gradual conversion of the car fleet and the incentive to create attractive conditions for investment in Portugal - all production and development activities related to Electric Mobility, which promoted Portuguese technologies and innovations. In addition, the Council defined the phases of the Program for Electric Mobility. The pilot phase, which was intended to be completed by the end of 2011, included the construction of a minimum experimental infrastructure for electric mobility at a national level covering 25 municipalities and the main roads. The growth phase should start in 2012 and entailed the extension of the experimental infrastructure, with the adoption of solutions, particularly in the field of the charging network, which would had been tested successfully in the pilot phase. Finally, the consolidation phase would begin as soon as the demand for electric vehicles reached a sustained level, which created the conditions for the introduction of a bidirectional charging system. Also, measures were created, in addition to those already foreseen in the State Budget for 2009, to promote the pilot phase and the massive use of electric vehicles. It is possible to highlight, for example, the fixing of a cost increase of up to 50% in IRC for the acquisition of fleets of electric vehicles by companies. There was also the implementation of the necessary experimental infrastructure of charging, setting as targets the creation of 320 charging points in 2010 and 1,350 thousand in 2011. Furthermore, there was a plan for the acquisition of 20 electric motor vehicles by the Government, with the purpose of dissemination and demonstration, together with the implementation, in Portugal, of a platform for research, development and testing of mobility management systems, as well as the annual acquisition of 20% of electric cars in the process of renewal of the government's car fleet.

The objective was for the Network for Mobility (MOBI.E) to have 1,330 thousand jobs throughout the country, which would highlight Portugal, making it the "first country in

the world to have a national supply network for electrical cars", as underlined by José Sócrates, who at that time was the country's Prime Minister. Portugal was, in fact, at the forefront of this market and these technologies. The country's reputation was one of the reasons why Cacia, a Portuguese parish in the municipality of Aveiro, was chosen to host the new battery factory of the Renault / Nissan alliance. The new battery factory in Aveiro envisaged the creation of 200 direct jobs and an investment of 160 million euros. According to José Sócrates, the expectation was that: "When the next electric cars arrive from all manufacturers, Portugal will be able to offer consumers not only a competitive price but also a national charging network." This investment ended up being suspended later on.

Initially, one of the main objectives for the MOBI.E program was to minimise the emission of gaseous pollutants, as well as to increase the energy efficiency with the efficient use of renewable energy sources. The intention was to develop an intelligent charging network for electric vehicles. This network should be implemented in different spaces, such as public roads, charging stations, service stations, homes, hotels and airports, among others. In addition, it was intended to introduce the mass-market use of electric vehicles. To this end, the goals to be achieved in the pilot network protection, "RENER Living Lab", were defined. First, the implementation in 2010 of the national charging system with the installation of 320 charging stations. The installation of the first charging station would be in Lisbon, in June and September of that year, respectively,. During 2011, 1,350 thousand charging stations were planned, 1,300 thousand of which would be normal charging stations together with 50 fast charging stations on the pilot network and the main national roadways. The beginning of the activity of the Management Entity for electric mobility was expected to take place in May / June 2010 and the presentation of MOBICar should be made in October of the same year. However, many of these goals have not been achieved. It should be noted, for example, that MOBI.E, the managing body for information on electric mobility, only started operations in 2015. In addition, when creating this charging network, in 2010, it was expected that only during the three following years electric car users could reset their battery levels without paying anything. However, the beginning of payment at the fast charging stations happened only on 1 November 2018.

The stagnation phase was mainly due to the financial crisis, the international crisis of 2011 and the change of government, which led to a strong disinvestment in the network and infrastructure. The electric mobility was no longer a priority for the government that had to solve the financial crisis in the country. As governmental and public investment were the main reasons for the development of the network, this new reality made the whole project

stop for about 4 to 5 years.

Having said that, in the opinion of the director of MOBI.E, the main reason for the great success, leadership position and prominence of the network of Portuguese electricity was the idea of a single contract as the only element necessary to be able to use all the infrastructure available in the country. This has had two advantages: first, the reduction of the infrastructure cost for the country, because it was not necessary to create several parallel networks. There could be multiple networks of several operators however the number of charging stations needed would be very different. Hence, the investment that was going to be made in the country in optimised charging stations. In addition, it has minimised the strong visual impact it would have on the landscape because it would not be pleasant to have 3 or 4 different charging stations of the 3 or 4 companies that would exist in each place. Also, the connection with electric mobility allowed Portugal to find faster solutions, from the regulatory point of view, than other countries, and technological issues had been more easily accepted, both in Portugal and abroad. Specifically, Portugal has developed all the necessary software for the evolution of the project, a fact which probably has turned EFACEC, for example, into one of the world leaders in chargers supply. In addition, there is another Portuguese company, Magnum Cap, which despite having never been involved in the project, benefited from all the process, know-how and circulation of people associated with its various entities in the country. This resulted in Magnum Cap having a position in the current market of some international relevance, with interesting projects for buying and selling electricity to the network. In conclusion, another great advantage for Portugal in this market was the combination in a single project of the more technological aspect, the more regulatory vision of the industrial development and the vision of development and integration within the energy sector. These three areas have made it possible for us to have a nationwide project that has an impact on the development of the country.

5.3 Second phase: Strategy and attempt of development

The second phase of the electric mobility project is marked by:

- the beginning of the activity of MOBI.E, SA, in 2015, to manage the information of the network of this market;

- the conclusion of the pilot project and the simultaneous expansion of the electric mobility network throughout the country during the years 2017 and 2018; and

- the beginning of the commercial phase and of the Market phase.

The beginning of the transition to the Market phase occurred on 1 November 2018 with the beginning of the payment on the fast charging stations. However, at the time of the introduction of this charging network, in 2010, the intention was to allow free charging only during the following three years. But, given the poor level of adherence, it was decided to extend this scheme for a longer time, with no limit currently defined.

As mentioned above, Portugal underwent a phase of strong expansion, the network achieved great success; however, subsequently, due to the crisis in Europe and the government change, there was a stagnation and even degradation of the network during almost 5 years. One of the problems of this public network of charging was precisely related to this, the fact that some equipment was damaged. This demanded a necessary reformulation of the pilot project in order to complete goals which were previously defined and were not yet achieved, and to set new goals. Only later, when the government of António Costa took office, did electric mobility take centre stage and became, once again, a clear commitment for the country. At that time that there was a reformulation of the project and the basis to resume the whole process again started to be developed. At this stage, in the opinion of Alexandre Videira, director of MOBI.E, the great difficulty was to get everyone to believe once again in this idea and in this Market. After a big commitment in 2009, the installation of the network in 2010 and a major sudden stop in 2011, it was difficult to recover the credibility, veracity and confidence in the project by the possible future operators. MOBI.E has played an important but difficult role during the years 2015 and 2016 at this level. In this sense, the network advantage for Portugal was that the evolution of the remaining countries in this market did not stagnate. This has led people to understand and believe that, eventually, if it was more promoted by the public or more promoted by the market, electric mobility would certainly become a reality. Despite the difficulties, all this led to the resumption of the project, the national commitment on electric mobility and the preparation of the population to invest in the market.

Having said that, the major milestone in the recovery of this project and the beginning of the second phase for electric mobility in Portugal was the reformulation of Decree-Law No. 39/2010, with Decree-Law No. 90/2014, at the end of 2014. Fundamentally, the most significant change resulting from this transition was the deregulation of the operation of the charging stations. In this sense, initially the operational activity of the charging stations was regulated by governmental entities, which meant that, those who wanted to operate charging stations would receive a certain amount of KW / h, defined by the state. This way, companies

that installed chargers knew in advance how much they would receive. With the amendment of the decree-law of 2014, companies who want to be the owners of charging stations, can hold the number they want and have the remuneration that they deem most convenient and that they define internally by KW / h. Therefore, the government has stopped interfering and defining monetary values to carry out this activity. Thus, the operation of the stations and the commercialisation of electric mobility electricity operate in a market regime, from the beginning of the market phase. The only activity that is regulated is the activity of the management entity, MOBI.E, since MOBI.E is unique, it is not in the market, and therefore its activity is regulated by the government. In conclusion, besides these legal reformulations and the natural evolution of the technological features of the devices, from the model point of view, everything that was designed in a global way at the beginning of the electric mobility project remains unchanged.

The Market phase aims basically to ensure that the pilot network that was initially installed is in operation, requalifying the negative impacts that the stoppage of the project had in order to make it operational again under the market regime. In addition, another intention of this phase is to ensure a set of charging stations envisaged in the initial phase and that have not yet been installed. There is also a new orientation to ensure that all the municipalities of the country will have at least one 22 KW charging station, what is commonly called a semi-fast charging station.

At the time of the start of payment at the fast charging stations, the official beginning of the market phase, 59 of this type of stations and 550 normal charging stations were in operation in the country. Therefore, the start of the market phase was signaled by the beginning of the payment at these 59 charging stations. From that moment on, the goal was to make a phased transition, while re-qualifying the entire network - the network commonly called the normal network, where the charging speed is slower during the first half of 2019. After the completion of this task, payment will begin at these charging stations. At the end of 2019, therefore, payment is to be made at all charging stations of the network. From that moment on, what is defined in Decree-Law No. 90/2014 was that, entities which are defined in the network, such as MOBI.E itself, will start to develop their normal activities. As such, MOBI.E will begin to develop the activities for which it was created, managing the information of the electric mobility network and leaving the part that is related to charging stations. After this stage, charging station operators will install and make charging stations available on public roads or in private and publicly accessible locations, such as shopping malls, car parks, hotels, restaurants, etc., to the customers of this market. The operators are

therefore remunerated according to the charging that is made in the respective stations. Electricity suppliers for electric mobility effectively sell the energy that is transferred to electric vehicles through a defined contract with users. This entity, the electricity supplier for this market, besides providing energy to the users, with whom it establishes a contractual relationship, guarantees that, because they have the same contract, the user can charge their vehicle in any existing charging station in the country.

In conclusion, from the market stage onwards, a model will be put into practice, which has been designed and structured from the outset with a somewhat complex configuration in which the users of the charging stations use the equipment provided by the operators to charge their vehicles, without having a relationship with these entities. In fact, in this model, users only need to have a contract with a certain electricity supplier for electric mobility, and the financial transactions carried out by the users associated with the operation are only carried out with this entity. Electricity suppliers for electric mobility are therefore responsible for distributing the money by the operators and by all the entities that are within the system.

5.4 Electric Mobility: Market Evolution

In the Portuguese model, there are three fundamental entities for the network's function, which are:

- the user of the network;
- the electricity suppliers which have a contractual relationship with the user;
- the operators of the charging stations, which have no direct relationship with the user of the electric vehicle, although he/she will have access to the charging stations.

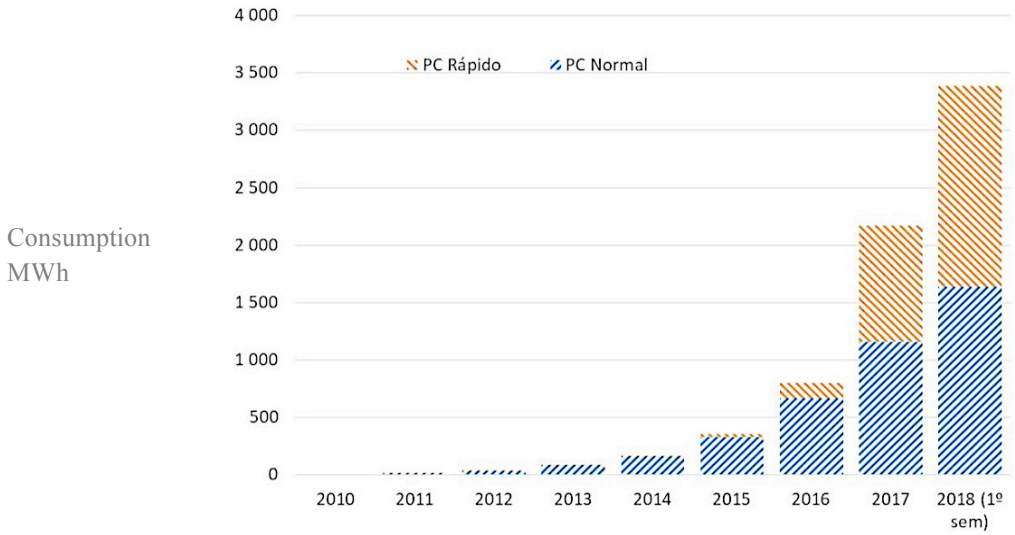
Nowadays, the operators in Portugal are Mobiletric, Prio.E, EDP Comercial, Elergone Energia, Galp, EDP MOP, EV Power - Charging Solutions and KLC. By law, Retailers of Electricity for Electric Mobility must also be Operators, but Operators do not have to be Retailers of Electricity for Electric Mobility. Current retailers include EDP Comercial. However, the Electric Mobility Market encompasses many more entities and businesses than those mentioned, among which are the vehicle suppliers, the producers of those vehicles' components, the companies that develop the technologies associated with the Market, among many others. Today, foreign markets are not very different from this one. Although the same terms are not used, the way people pay, without being equal, is not very different. However, a few years ago the reality was quite different. When Portugal decided to enter this market, its

operation abroad was different from both the Portuguese one and from the one that now exists in those countries because, for them, the market operated in the same way right from its beginning. As a result, the operators in some countries were electricity suppliers, whereas in other countries they were automobile manufacturers with partnerships with small businesses. There were also other countries where some operators were start-ups. These companies, the operators, were creating charging networks which were mostly local, and this resulted in a major disconnection between cities in the same country. Thus, what happened a lot in the countries of central Europe, where electric mobility is more developed (with the exception of Scandinavian countries), was that, when drivers moved between cities in the country there were different operating companies in each region. This multiplicity of charging networks meant that the drivers of electric vehicles, in order to travel, had to make contracts with all the operators to be able to charge their electric vehicles (EV) in each region.This type of situation never existed in Portugal. For the users of this market, from its beginning, a single contract and a card that is made available by MOBI.E are the necessary elements for access to the network. Therefore, Portugal was a model for those countries when they wanted to interconnect their networks. Initially, entities from central European countries travelled to our country several times in order to understand the operation of the national model. This, eventually brought about the convergence of existing models. In fact, at the heart of Europe, there are now several replicas of the Portuguese model for network interconnection. It is not yet clear how the market will evolve, what will predominate and what will disappear. What is certain is that there are already several companies at European level, called mobility services providers, ou e-mobility servies provideres, with whom, essentially, users hold a contract. Thus, they have contracts with several operators allowing to load the EVs in several different networks. It is not a system equal to the Portuguese one but it already has several similar aspects. Therefore, some of those companies that have started to appear already have some relevance at this level. Likewise, Portugal, specifically the MOBI.E company, is also working with these companies to ensure roaming between Portugal and other countries. This will allow Portuguese drivers to use the foreign networks abroad and will ensure that foreign users can charge their vehicles in Portugal with the contracts they have in their native countries. In the future, some type of coordination will be necessary between the parts involved in the system. However, for now, this is not possible.

The current outlook for the electric mobility market is positive. More than half of the total energy production in the country, about 60%, is produced by renewable energy sources. The focus has been on the development of battery technologies and electric vehicles, both

with more attractive prices and offers. The Portuguese political framework is favourable to the development of this market resulting in tax incentives, direct subsidies for electric vehicles, free parking and public charging. All this combined has contributed to the strong growth of this market.

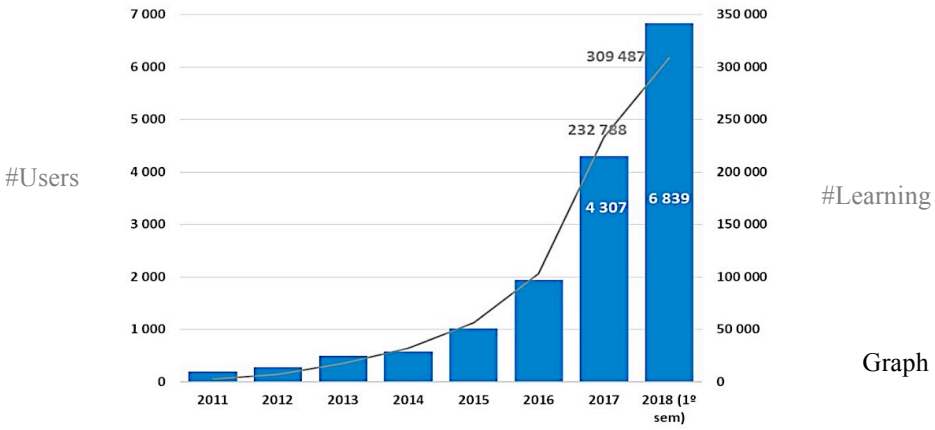
The consumption of energy by the network has increased significantly over the years, with a notable growth since 2011, specially the values recorded in 2016, 2017 and the first half of 2018.



Graph 2 - The Network Energy Consumption

Source: MOBI.E, S.A

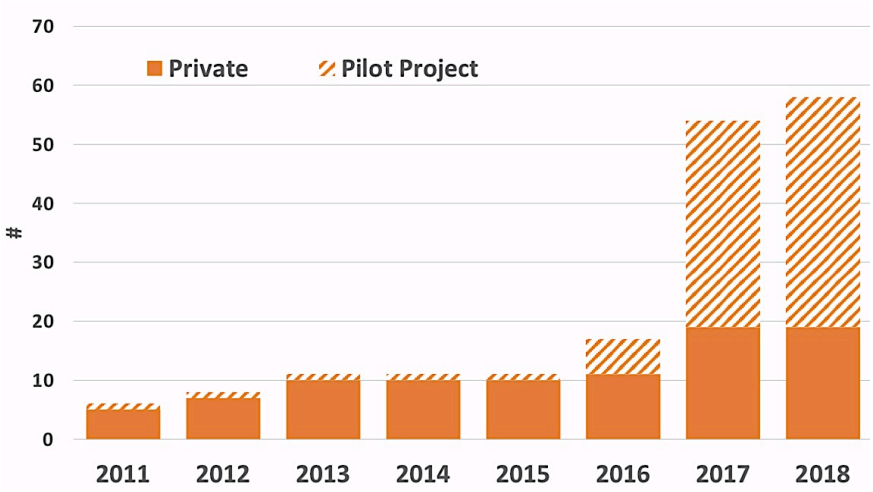
These values confirm the evolution of the network and of the electric mobility market. New investments, technological upgrades and partnerships are being made by all players in this market, offering more attractive conditions, more autonomous vehicles and a more convenient and efficient charging network. The results are visible.



Graph 3 - Number of Uploads and Users

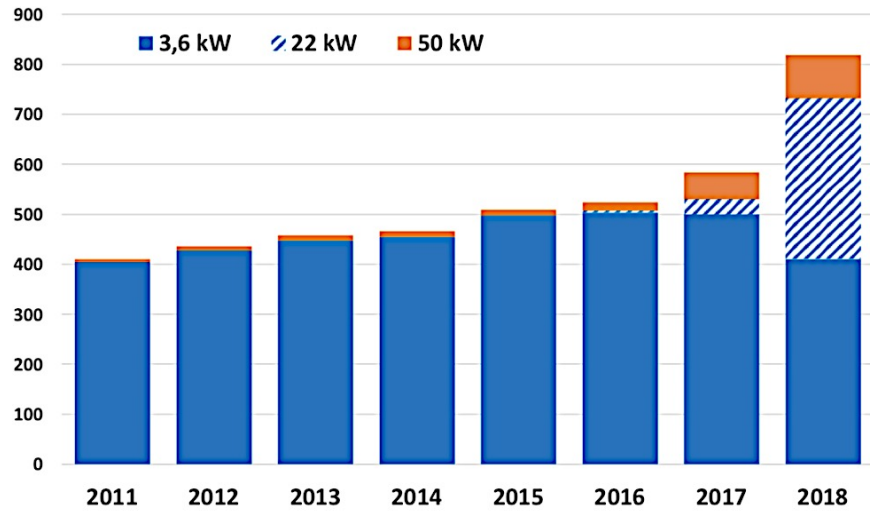
Source: MOBI.E, S.A.

Therefore, the charges made on the MOBI.E network represented more than 40 million km.



Graph 4 - Number of Fast Chargers (45-50 Kw)

Source: MOBI.E, S.A.

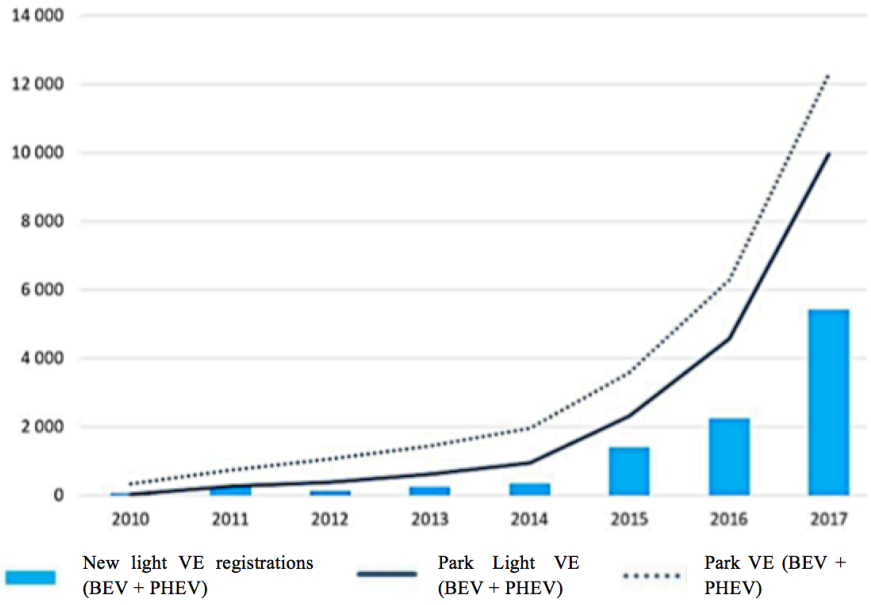


Graph 5 - The Network in 2018

Source: MOBI.E, S.A.

The network consists of 608 EVSEs, 550 standard chargers (from 3,6 kW to 22 kW), of which 404 are from the pilot project and 146 from private investment, 58 fast chargers (from 45 to 50 kW), 39 from the pilot project, 19 from private investment, 1,469 PLUGS (among these 1,316 were normal charging and 153 were rapid charging). In addition, in Portugal 69 municipalities are covered with EVSE and 198 municipalities have users, of

which 8 are from abroad. At the end of 2018, it was decided that there would be 31 new fast chargers of 50 kW and 302 new chargers of 22 kW, and that each municipality in Portugal must have at least one 22 kW EVS. All this makes it more appealing for current and potential customers to be present in this market. As a result, the number of electric vehicles on Portuguese roads has increased annually since 2010 (with one only exception in 2012). These figures are good indicators of a promising future for this market.



Graph 6 - Electric vehicles in Portugal

Source: AT - Tax Authority, MOBI.E estimates

The Portuguese are buying more electric cars. In the first four months of 2018, sales almost tripled (+ 170.9%) in Portugal compared to the same period in 2017 - 1,184 vehicles were sold, according to data provided by the Portuguese Automobile Trade Association (ACAP). In May 2018, the European Association of Automobile Manufacturers (ACEA) noted that the option for alternative energy in the European Union increased by 26.9% in the first quarter of that year: the number of cars with electric batteries grew by 34.3% and plug-in hybrids increased 60.2%. These are good indications for the current market situation and for future developments. Also, it is expected that the Portuguese government will continue to give incentives and to promote this Market. In the State Budget for 2019, the funds to encourage the purchase of these vehicles will continue to be provided. In the document one can read: "Regarding the promotion of electric mobility, the existing incentives will be maintained, among which are the tax incentives to reinforce the consumption of electric vehicles by the companies and the incentive of 2,250 euros, both for companies and

individuals." Also, the government is going to buy more electric cars. The growth in sales is due to several factors, including the increasing autonomy of electric cars, which gives consumers greater confidence. In Europe, Nissan was probably one of the first companies to launch the electric vehicles of this new generation, but now there are fundamentally two brands, Renault and BMW. There are, of course, other brands, such as the Korean Hyundai and Kia, which are also appearing. However, although they also have interesting solutions, for the time being they do not have the same weight in the European market. The proposal for the State Budget of 2019, taking into account the increasing adhesion of the Portuguese citizens to electric cars, includes the total coverage of the national territory and the conclusion of the second phase of the pilot network, with the installation of a charging station in each municipality during this year.

In addition, a good indicator of the current state of the economy is also the general interest and the specific projects of companies in this market. This is the case, for example, of EDP and Efacec, whose strategy is to jointly invest in rapid charging stations for electric fleets, in order to create innovative solutions adapted to consumers. They also aim to play a central role in the evolution of electric mobility, contributing decisively for the decarbonisation process through the electrification of consumption. Through this partnership, EDP and Efacec will share projects and business opportunities in the various markets where the two companies operate, in order to accelerate the transition to a society that uses more electric energy. Another project of EDP involves Barraqueiro, the Iberian leader in road transportation and a great operator in the segment of railway and subway. The objective of this partnership is to join forces and knowledge to develop, test and demonstrate solutions of electric mobility in public transport fleets. Also, in premium brands such as Tesla, the evolution has been continuous, both at the level of vehicles (with an increase in power) and the European network of filling stations (with free charges). The autonomy of a vehicle model of this brand allows almost unrestricted movement, making it possible to use these vehicles in urban circulation and in longer trips.

5.5. What is Happening: Recent Activities

The market for electric mobility in Portugal is still expanding. Despite the consequences of the disinvestment period in the network, the country is not far behind in terms of evolution and development. From the point of view of dynamics, Portugal was

overtaken by some countries, such as the Netherlands, Belgium, Norway, Denmark, among others, and, in terms of dimension, also by England and France. However, despite some delay, the country is close to the other countries mentioned. In addition, from the point of view of vehicle sales, in the last months of 2018, Portugal has been among the countries where the percentage of electric sales has recorded the highest values. This market is therefore developing: "We are on a good path for Portugal in order to once again have a strong impact on this market.", says Alexandre Videira.

Currently, the national legislation that guides the electric mobility sector covers the Decree-Law No. 90/2014 that defines the legal regime of electric mobility, applicable to MOBI.E, the access and exercise of activities related with electric mobility, as well as the rules designed for the creation of a pilot electric mobility network, together with Order No. 8809/2015, which basically integrates the action plan for electric mobility. In addition, it is important to mention Order No. 6826/2015, which determines the continuity of the activity carried out by the managing body of the electric mobility network, MOBI.E, S. A. The Regional Legislative Decree No. 5/2017/M establishes an electric mobility network and regulates the organisation, the access and exercise of electric mobility activities and the incentives for the use of electric vehicles. Also, the Directive No. 6/2016 refers to the guidance for measurement, reading and availability of data of the electric sector in mainland Portugal. There is also, Regulation No. 879/2015 which defines the exercise of activities related to electric mobility covered by the regulation of ERSE and the Resolution of the Council of Ministers No. 49/2016 that gave MOBI.E, S.A. the skills required to ensure operational and relocation level decisions on all charging stations subject to the pilot network status. This document also defines the completion of the first phase of the MOBI.E pilot network, and launches the second phase of the expansion of the MOBI.E network to municipalities not covered in the first phase. Decree-Law No. 4/2018 creates an incentive to promote the exchange of electric vehicles for municipal and inter-municipal passenger transport, as well as for the collection of recyclable or non-recyclable waste. Order No. 4389-a / 2018 covered the discount applied to the price of electric power in 2018. This market is also covered by Ordinance No. 240/2015, Ordinance No. 241/2015, Ordinance No. 252/2015, Order No. 220/2016, Order No. 221/2016, Order No. 222/2016 and Order No. 231/2016. The first document establishes the amount of fees due for the issuance of electricity trading licenses for electric mobility and charging point operation. The second defines the technical requirements for the assignment of licenses for the operation of charging stations. Ordinance No. 252/2015, which reviews No. 949-a / 2006, approves the technical rules for low-voltage

electrical installations. Ministerial Order No. 220/2016, on the other hand, limits the minimum powers and defines the technical rules that must be met by electric vehicle charging facilities in buildings and other urban operations. The next document dictates the rules applicable to the installation and operation of the charging points of electric vehicle batteries and Ordinance No. 222/2016 defines the terms applicable to licenses for private use in the public domain. These rules apply to the installation of battery charging stations for electric vehicles in a public place, of public access, in the public domain. Finally, the last document limits the coverage, conditions and minimum capital of the compulsory insurance of third party liability of the activities of commercialisation of electricity for electric mobility. It is also worth mentioning two documents, among them Notice No. 2836/2017 covering the first phase of the program to support electric mobility in public administration and which would refer to the financing of 170 electric vehicles. At European level, the 2014/94/ue directive defines a common framework of measures for the creation of an infrastructure for alternative fuels in the European Union. The aim of this measure is to reduce oil dependency and mitigate the environmental impact of transport.

Having said that, the current work (during 2018 and 2019) will end with the installation of all charging stations, by setting up the planned charging stations of the pilot network in municipalities that do not yet have charging stations. It will also prepare all procedures, all manuals and all legislation necessary to start payments on the network. Basically, the focus is on preparing everything necessary to start the market phase, so that the entities intervening in the Portuguese model of electric mobility can carry out the activities for which they were created - something which MOBI.E expects to happen by the end of 2019. On 1 November 2018, at zero hours, the payment of the charges at the fast charging stations began. Therefore, the first phase of transition also began. At the end of 2019, it is expected that payment will start in every network charging stations. To make this possible, the functions that have been developed must requalify the entire network so that it can be operational under a market regime. In addition, there is a great focus on ensuring a set of charging stations foreseen in the initial phase and which have not yet been installed. Also important is a role given to MOBI.E at a later stage in order to ensure that all municipalities in the country will have, at least, one charging station of 22 KW, which is commonly referred to as the semi-fast charging station. Therefore, the current concern is the installation of all charging stations in order to prepare all the procedures and paperwork necessary for the beginning of payments on the network.

In addition, the model that will begin to be put into practice in the market phase will be the one Portugal has had from the very beginning. This did not happen with the countries of central Europe, which made them come to Portugal in the phase of market launch in order to understand how the Portuguese model was organised because they also wanted to interconnect their networks. Consequently, although it is still unclear how the market will evolve - which initiatives will develop and which will disappear -, in central Europe at present, there are a number of network interconnection initiatives. In spite of this, it is true that there are already several European companies called mobility services providers or e-mobility services providers, which have a contract with users and with several operators, which allows the users to drive their vehicles into several different countries. MOBI.E has also worked with these companies to ensure roaming between Portugal and other countries. The aim is to ensure that Portuguese users can charge their EVs abroad in all these networks and ensure that the opposite also happens. There are already several agreements established at this level, however, none has been implemented precisely because, while Portugal did not enter the market stage, one did not pay to charge an EV, and therefore no roaming was necessary. With the beginning of the payment, Portugal started working on several international roaming solutions and, at the same time, on solutions that allow a person who arrives here and who has no contract with any Portuguese or foreign entity, to charge his/her vehicle. The implementation of these solutions was planned for the beginning of 2019.

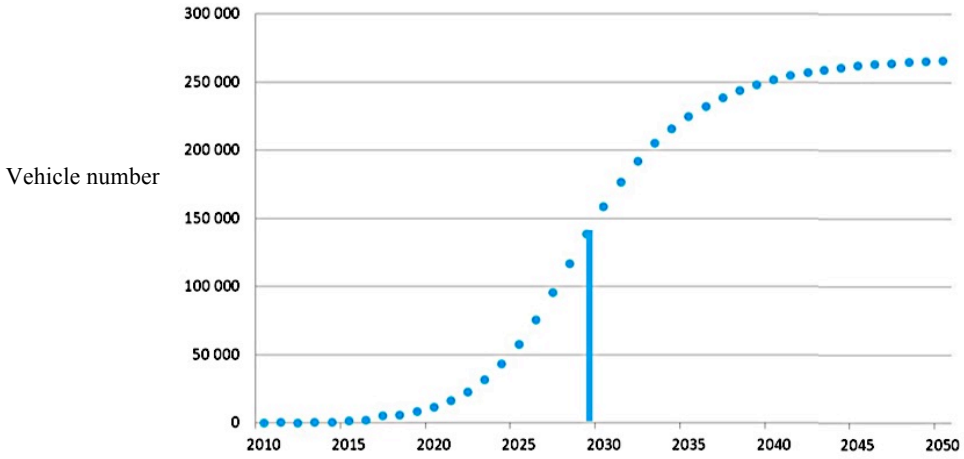
5.6. The next step: Forecasts and future perspectives

As mentioned above, from this moment on, the sector has fully entered into its market phase. The prospect is that, by the end of 2019, payment will start at all network charging stations, and from there on, the entities that are defined in the network start to carry out their normal activities. Thus, after the full entry into the market phase, MOBI.E starts to develop the activities for which it was created.

With this in mind, technological developments are expected at the level of self-production and storage of high-power power. There should also be new forms of integration with other mobility services and developments at the level of Vehicle-to-Grid (V2G). As for the power of the chargers, significant efforts have been made to increase it. Standard chargers should have a capacity of 3.7 kWh to 22 kWh, which should be 50 kWh for fast chargers and 150 to 350 kWh for ultra-fast chargers. The objective is that vehicles with 20 kWh have an

autonomy range of 120 km, those with 40 kWh have 250 km of autonomy and those with 80 kWh have an autonomy of 400 km. Approximately 80 to 85% of the charging is expected to be of medium duration in residential / business / parking spaces and that 15 to 20% of the charging is to be made in publicly accessible spaces.

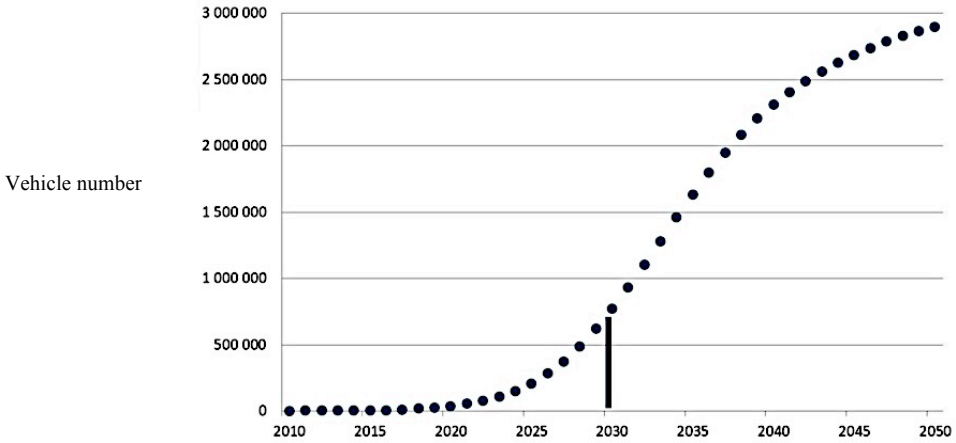
Also, with regard to the number of electric vehicles, a strong growth of sales is expected, mainly between 2020 and 2030, which will continue until 2050, but with lower growth rates after the year 2030. Market shares are estimated to be 50% by 2030 and 85% by 2050.



Graph 7 - Sales of Electric Vehicles

Source: MOBI.E, S.A

As for the cars on the road, it is intended that in 10 years it will be possible to replace batteries of electric vehicles (BEV) and, after 15 years, the replacement of the Hybrid Electric Vehicle Plug-in (PHEV) will begin.



Graph 8 – Electric Vehicles on the Road

Source: MOBI.E, S.A.

In addition, in terms of future investments in this market, a reinforcement of the public access PCR network will be made, and a national reinforcement of the PCR / PCUR network, with special attention to charging in interior spaces, both residential and commercial. This will be done at the level of the infrastructure of the buildings and of the assembly of equipment. Regarding the total consumption in the country, it is estimated that 20% of the energy used is for the electric mobility market and that 15 to 20% is used in the MOBI.E network. These data were provided by that company. Also, investments are planned at the level of charging in public buildings, both for central administration and local authorities. There will be investments in the research, development and innovation of electric vehicles, the decentralised production with V2G and the integration with other types of mobility. There will be a strengthening of the national electricity network in order to ensure power in critical locations, both within cities and at national level, and a third referral on this matter will be available after 2030.

In view of this, the objectives for the future are to ensure the transition to the market phase and, subsequently, to ensure integration with the rest of Europe from the point of view of roaming charges. In addition, for now Portugal is the only country with a clear integration between electric mobility and the electric sector. This fact is a great advantage for Portugal as it allows to quickly prepare what is expected to be the electric mobility from the point of view of the charging and that is related to the bidirectionality of the charging. This has to do with the possibility of the user being able to charge a specific EV at the charging station and, at the same time, being able to supply his/her own energy to the network. From the technological point of view, this is already possible. There are numerous experiences and pilot projects relatively developed and with promising results, but the regulatory aspect is the central issue at the moment. What are the necessary procedures and how can legislation be tailored to make this possible are the key issue for its implementation. Thus, because the Portuguese model is integrated into the energy sector, at this level the country has a significant advantage which allows the faster settting up of all the necessary connections compared with other countries. Another issue related to the integration of the electric sector refers to the domestic production of energy, for example through solar panels or with small fans in the house, and the usage of energy that is produced by users in charging vehicles electrical installations. If the entity concerned is not connected to the network, this is possible and even relatively simple from the technological point of view, but not from the regulatory point of view. What happens is the production of domestic energy in order to sell it to the network, but without being able to sell

it, for example, for an electric vehicle. Neverthless, the director of MOBI.E believes that the connection in electric mobility will allow Portugal to find faster solutions, from a regulatory point of view, compared with other countries, and that Portuguese technological issues have greater acceptance, both in Portugal and abroad.

When thinking about Portugal's future, it is also necessary to think about the future of electric mobility because the country is not alone in the market and, as the current world is an open economy, these countries influence each other. With regard to the emergence and entry of new companies in the market, specially at European level, in order to understand the trends, it is important to bear in mind that there are the electric car manufacturers and a group of companies that want to enter the electric mobility services market. Some of these companies already have some experience on the mobility sector in their countries. These include companies related to the bus industry, parking meters, management of mobility platforms associated with cities and car park management, among others. There is an interesting set of companies with a lot of enthusiasm in the electric mobility market and keen to understand how it will evolve, although this is still unclear to everyone in Alexandre Videira's opinion, director of MOBI.E. In addition, there is still a very strong industry involved: German companies such as Volkswagen, Mercedes, Porsche and also the PSA group, the Peugeot Citroen group, which are currently dominating the world car industry but have not yet defined what their strategy will be, nor have they fully entered into this market. Therefore, it is expected that when this happens, probably by 2021, the electric mobility market will receive a completely different boost, with an increase in the range of options that users have.

Thus, the vision of MOBI.E for the future is to make Portugal the place of reference for the design, development, manufacture, engineering and testing of new technologies, services and products of electric mobility. Also included are self-production and storage of high-power charging, new forms of integration with other mobility services and developments at the level of Electric Vehicle charger with V2G (Vehicle-to-Grid) functionality.

SYNOPSIS OF CHAPTER 5

The Portuguese charging network for electric mobility was innovative and attracted the interest of several countries and companies. The reason why the Portuguese electric network was so successful and achieved its leadership position was the fact that there was only one contract for the access to all the country's infrastructure. This has led to lower infrastructure costs and optimised investment in charging stations in the country. The reason for these advantages is that it is not necessary to create several parallel networks. This convenience has resulted in mutual benefits, both for investors and for users who had more practical conditions. Combining this with the public effort at the time, made Portugal stand out for having an innovative technological infrastructure adequate to the operation and the circulation of electric vehicles.

In 2009, when the project was created, there were no normal chargers for electric mobility, there were only a few little appliances for domestic use. Portugal developed the first chargers to be used on the street for electric mobility. In addition, we have developed all the necessary software for the evolution of this project, which probably has turned EFACEC, for example, into one of the world leaders in the supply of fast chargers. All this is due, basically, to the initial commitment on the development of Portuguese technology.

Thus, from the point of view of innovation, this project has an interesting feature: it was thought from the beginning, not only as a technological project, but also as a national business project. This means that three key areas have been interlinked - a policy of innovation, an industrial policy and an energy policy - in the development of the project. This meant that not only the entire technological part but also the model itself and the relationships have been developed, so that all of it works together, which is probably the most complex part of the electric mobility. In addition, it was possible to integrate the whole project with the energy factor. Portugal is still the only country that has a clear integration between electric mobility and the electricity sector. This allows to prepare what is expected to be the electrical mobility from the point of view of the charging from outside in a more efficient and faster way. Something that, in the future, could place Portugal at the forefront of electric mobility, more specifically, regarding the network of domestic vehicles.

These were the main reasons for the differentiation of the Portuguese network: ease of use and convenience for users, and integration at national level of the three key areas for the development of this market. This great advantage, combined with the public effort that was made at the time in order to have an adequate infrastructure for the operation and the

circulation of electric vehicles, were the great reasons for the leadership of the Portuguese network**.**

In conclusion, the combination in a single project of the technological vision, the regulatory vision, the vision of industrial development and the vision of development and integration with the energy sector, meant that the country had a nationwide project. This has had a positive impact on Portugal from the point of view of the country's development.

CHAPTER 6 – TEACHING NOTE

6.1. Case's Synopsis

The main objective of this case study is to understand the reasons that led Portugal to excel in the electric mobility market. The fact that the country is an example of reference in such a technologically dependent market is something new and deserves attention, analysis and understanding.

Having said thais, in this chapter we will address the best way for the interpretation of this case study. It should be noted that the objective was to perceive the interconnection of events: how this innovative idea came about, why Portugal ventured into a market that was highly dependent on technology and its development, the reason for success and subsequent regression. But also to understand in what phase we are currently on, what are the current practices and what evolution is expected for the market.

Finally, it is important to mention that, since MOBI.E is the current entity that manages electric mobility in Portugal, the analysis of its history and its activities was the focus and the key to understanding the full development of this market.

6.2. Target Audience

This case was written to be easily readable and to improve the understanding of an innovative market such as that of electric mobility. It aims to contextualise the situation by analysing past and cause-effect relationships, the present and what is expected in the future. It can be used by students who attend undergraduate, postgraduate and executive education programs in modules related to entrepreneurship, strategic entrepreneurship, intrapreneurship, strategy (specifically business strategy and corporate strategy), management, innovation management, management technology and product and service development. One can also contact people related to the cars, transport and e-mobility markets. Topics such as innovation, technology, renewable energies, internationalisation, global competitiveness, creation, development and growth of a market and a company and the related processes are also addressed.

6.3. Set out the learning objectives and identify the key

After reading and analysing the case, with the discussion of the case study, readers, students and participants should be able to:

- Understand the chronological evolution of the Electric Mobility sector in Portugal;
- Identify the critical moments of the MOBI.E from the beginning of the project to the present;
- Identify the reasons that made Portugal attractive and interesting for the development of this market;
- Understand the model of Electric Mobility in Portugal;
- Perceive who are the participants of the Portuguese model of electric mobility and the relationships they establish between themselves;
- Understand the innovation challenges for a company in this market;
- Understand and evaluate the importance of the government's role for the evolution of the Electric Mobility, as its dynamic factor (or not);
- Understand the strategic management framework of MOBI.E, S.A.;
- Understand the functions and role of MOBI.E, S.A.;
- Present the reasons why the initial objectives defined in the MOBI.E project were not achieved;
- Recognise some of the challenges faced by a new market, in this case, the Electric Mobility market;
- Understanding that entrepreneurship is directly related to innovation and is key to sustainable growth;
- Understand how differentiation and positioning contribute to the success of a product / service in the market.

This case study should also help to understand:

- The evolution of Electric Mobility in Europe;
- The model of the Electric Mobility in other European countries;
- The current situation and the opportunities of the Electric Mobility sector;
- Some perspectives and challenges for the future of Electric Mobility.

6.4.Teaching plan

Working Session	Actions	Goals	Time	Teaching Aids
1st class- Kick OFF	Context on Electrical Mobility Presentation of MOBI.E Watching Videos	To present the theme, the reasons for its interest and its potential in the current context.	30 30 30	https://www.xn--energiasrenovveis-jpb.com/etiqueta/carros-eletricos/ https://www.youtube.com/watch?v=FRQsllhB7RY-2017 https://www.youtube.com/watch?v=kkQ60ieYgKg
2nd class - Case presentation and Analysis of key points	Present the case Question and answer session focusing on the critical information of the case Watching Videos	Increase interest in case analysis and resolution	30 40 20	Case Study https://www.youtube.com/watch?v=FfSYYC3vKLE
3rd class - Additional discussion on information and Case resolution	Challenge participants to submit / report relevant information not included in the case text Guide the participants in the process of obtaining a list of relevant conclusions from the case information	Empowering self-employment and drafting possible responses	35 55	Case Study
4th lesson - Analysis of the key points Closing of cases	Final questions and answers session focusing on key findings Presentation of the case by one or more groups Case wrap-up	Raise the discussion and conclude. Take advantage of the warp-up case and summarize the managerial implications and lessons learned.	45 20 25	PowerPoint support of cases exposed by students

Table 4 – Teaching Plan

Source: Proper Authority.

6.5. Discussion Questions

The questions that should be asked during the first lesson are the following:

1. What is electric mobility? To what extent do you benefit from renewable energy?
2. What is an electric vehicle? Why do you consider a zero emissions vehicle? What are the advantages and disadvantages?
3. What are electric charging stations? What types exist?
4. To what extent is electric mobility an enterprising, innovative and technological project?
5. How has the market evolved?

Subsequently, the following questions may be asked:

6. What is this case study about?

7. What reasons have made Portugal an interesting country for the investment of Nissan-Renault in this market?

8. What were the interests / advantages for the Portuguese government of the investment in this market?

9. What is the MOBI.E project?

10. What are the main roles of MOBI.E, S.A?

11. What roles does MOBI.E, S.A currently play?

During the third class, it is recommended that the following questions are presented:

12. To what extent is MOBI.E, S.A. important for the Portuguese model of electric mobility?

13. What were the 3 most critical moments in the history of Electric Mobility in Portugal? Why?

14. What are the most significant consequences of stagnation for the charging network?

15. Describe the Portuguese model of electric mobility. How is it organised? Who are the critical players of the Portuguese model of electric mobility?

16. Is there a better way to approach this market's management? What are other European countries doing? Was it always like this?

As a final conclusion and to try to summarise the fundamental ideas of the case study, the following questions are suggested:

17. What are the main success factors of the MOBI.E network?

18. Why did the objectives of the initial project remain unachieved?

19. What are the opportunities for electric mobility and for businesses (current or potential)? What are the expectations for the future?

6.6. Roadmap for Discussion and Case Analysis

The teachers / presenters should have a solid knowledge of electric mobility and of the Portuguese model in this market. They must know the activity of the company MOBI.E, its strategy, how it is organised and its functions. In theoretical terms, it must involve concepts

related to entrepreneurship, strategic entrepreneurship, innovation and international competitiveness. Any knowledge about electric vehicles, charging stations and their components are also useful.

Below are some suggestions for conclusions for the issues under discussion during the analysis and resolution of the case.

(class 1)

1- What is electric mobility? To what extent do you benefit from renewable energy?

Mobility is essential for the daily activities of the population. The high use of transport entails a high consumption of fossil fuels as well as high greenhouse gas (GHG) emissions. The concept of electric mobility or sustainable mobility is related to transportation electrification. This market aims to enable people to move around using electric vehicles and is now a much more accessible reality, compared to when the first experiences of developing electric vehicles were made. Today, the market offers practically all types of mobility vehicles we know in a version whose propulsion is totally or partially electric. In addition to purely electric vehicles, there are hybrid electric vehicles, which use propulsion systems based on electricity and another type of energy. In fact, there are already on the market electric vehicles for a wide variety of uses: people transportation and cargo or mining are some examples. By using electric motors that replace all or part of internal combustion engines, electric vehicles emit less GHG, less air pollutants and lower noise levels when compared with traditional vehicles.

Nowadays, in Portugal, a large part of the electricity produced is based on renewable energy, and about 20% of the final energy consumption depends on renewable energy, according to the National Action Plan for Renewable Energy (2010). This is happens because there is a network access system that gives priority to renewable energy sources, both at the level of network planning and development, and at the level of day-to-day management, according to the priority defined on existing the Order. Portugal, through the energies that it possesses, stands out in this Market and makes a difference. Access to Solar Energy and Wind Energy, which are very important for electric mobility, is facilitated by available resources and technologies, meteorological conditions and geographic position.

2- What is an electric vehicle? Why do you consider it a zero emissions vehicle? What are the advantages and disadvantages?

Electric cars are automobiles that have and move with an electric motor, replacing conventional engines that use fossil fuels. It is, therefore, a type of vehicle that uses propulsion by means of electric motors. Usually, we can find a primary energy system, one or more electric machines, and a speed and torque addition and control system.

The first prototypes were built in the early twentieth century, however their production was resumed in the 1990s in several countries, emerging as a sustainable alternative for the replacement of combustion models. Electric vehicles are part of the group of vehicles which are called zero emissions vehicles. They have a means of electric locomotion, and they do not pollute or emit any gases which are harmful for the environment. In addition to this feature, they are silent, minimising noise because electric motors are quieter than internal combustion engines.

Thus, these vehicles add a full set of advantages. First, the price can be a reference price. Maintenance of an electric car is cheaper than that of a fossil-fuelled car since it does not require frequent maintenance of the engine. Regular oil changes are a good example of required maintenance on a combustion engine, something which does not happen in an electric vehicle. The use itself comes out cheaper. Let us look at some approximate values: while a gasoline car spends at least almost € 10 per 100 km, and a diesel car spends about € 7 for the same number of kilometres, an electric vehicle consumes the equivalent of about € 2 per 100 kms. In addition, the benefits of cost savings extend to tax incentives. A 100% electric vehicle does not pay ISV (Vehicle Tax) and pays a reduced value of IUC (Single Circulation Tax), between € 7.91 and € 35.87. In some cities, electric vehicles do not pay parking, as is the case of the municipality of Beja, Lisbon, Porto, Funchal, Mirandela, Loures, Guimarães, Oeiras, Setúbal, Oliveira de Azeméies, Vila Real and Ribeira Brava. The companies are exempt of Autonomous Taxation and deduct the VAT amount, and the acquisition of electric vehicles also allows deductions in IRC. Since 2017, the State Budget includes significant tax incentives. This year, the big news was a subsidy of € 2,250, with no need to deliver a vehicle aged ten years or more, for the first one thousand people to present proof of purchase of an electric car, including the chassis number. In addition to this new feature, in the case of plug-in hybrid vehicles, it has reduced ISV by up to € 562.50, down nearly half if compared with the previous year. The disadvantages of these vehicles that were mentioned in the past are no longer a problem. As for charging, for example, electric cars can

be charged at home or at work, using a conventional outlet. Most electric cars have a regenerative braking system, which allows recharging the battery while it locks. In addition, the public charging network has been requalified, increasing the number of charging stations, and there are also more fast charging stations. The autonomy of this type of cars is increasing. Another important advantage, already mentioned, is that electric cars have zero emissions, contributing to a greener planet. And driving an electric car is indeed a pleasant experience. They are quieter, without an exhaust system, and allow for smoother driving when compared with a traditional car. Even at the highest speed, there is no need to worry about the gearbox. Finally, brands have been working to develop more and better technologies and components in order to be able to offer the market a larger, more diverse and more efficient range of electric vehicles.

Of course, they are not free of disadvantages. It is a fact that in recent years the autonomy of electric cars has grown, but there is still the fear of the driver that an electric vehicle will stop if it is not possible to charge it. However, on average, a European driver travels less than 40 km per day. There is also the charge time of the batteries which, in most cases, takes about eight hours when household energy is used. Although the State Budget envisaged a budget for the renovation and increase of this network, for drivers who use the street supply network, it is still very common to have difficulties. For example, finding a station that is not damaged and being able to stop the car next to it, since these places are often used as parking by traditional fuel vehicles. As for price, there has been a repositioning, but the technology used remains expensive. An electric vehicle requires an initial investment higher than that of a fossil fuel vehicle. The monthly rental value of the batteries (some brands have the option of purchase) is an amount that should also be considered in the calculations.

3- What are electric charging stations? What types exist?

At present there are around 500 filling stations active in Portugal (data from 2018 representing about 1250 outlets available), among which are charging stations categorised as normal, semi-fast and fast. The reference data for the three types of available chargers is: from 6 to 8 hours for a full charge at a normal station; about one hour for 80% of the charge at a semi-fast station; and 20 to 30 minutes for 80% of the capacity at a fast charging station. It is also important to remember that, with slight adaptations, the charging can also be done

using the domestic network. The upgrading and expansion of the existing network includes the installation of some super-fast charging stations.

4- To what extent is electric mobility an enterprising, innovative and technological project?

To begin with, it is an entrepreneurial project because it adds value, identifies opportunities (in this case environmental problems) and turns them into a profitable business. Also because it is through it that companies seek innovation, and are concerned with transforming knowledge into new products. The project therefore addresses a new need in the world and creates wealth while doing it. Entrepreneurship is thus strongly related to innovation because it can mean creating wealth through new products, markets, production methods and forms of organisation. To innovate is to invent, be it ideas, processes, tools or services. Basically, to adapt to a new reality and to face the changes that take place in social and economic structures, which is a reflection of the electric mobility. Finally, it is obviously a technological project because it is related to the development of technologies to produce electricity, transfer it to the batteries and, through these, to the vehicles, making them move. Technological innovation is therefore the process of invention, adaptation, change and evolution of current technology, in order to improve and facilitate man's life or work.

Tip: It will be easier to give some examples of what is happening today. To begin with one can refer the price factor. Electric vehicles are still expensive and more expensive than combustion vehicles. But the government incentives given for the actual buying (on taxes, especially for companies) and the much lower price of their fuel (electricity) with costs per kilometre of 2.15 euros make them competitive. These practices are clear evidence of an enterprising governmental vision. In addition, the trend will be to reduce the overall cost of these vehicles through the massive use of batteries. Technological developments, which allowed the manufacturing of batteries with cheaper material, also contributed to the reduction of their price. An example of the technological innovations of this Market is the Renault / Nissan group. The first generation of the Nissan Leaf, launched in 2010, had 150 km of autonomy wiht a single charge (battery pack of 24 kWh). Six years after, autonomy had grown by more than 60%. By 2016, the brand already had a version of 30 kWh and 250 km of autonomy. In the same year, still within the group, Renault presented Zoe with 400 km of autonomy. And other examples could be presented. More and more brands, not just premium

builders such as Tesla, are launching models with acceptable ranges and are helping to eliminate the idea that the car will stop halfway through the journey. In addition, although the slow charging continues to take between 6 and 8 hours, there are more public charging stations. MOBI.E stations, which had been abandoned for years, are now being renovated and expanded. More service stations are also being installed that allow a vehicle to get 80% of its charge in about 20 to 30 minutes. These stations already cover motorways such as the A5, A1, A2 or A22, with more stations being planned on more fast roads. This expanding market is a huge window of multiple opportunities for enterprising and innovative companies.

5- How has the market evolved?

If there is a world market where euphoria prevails, it is that of electric motor power. Every year technology moves forward, every year the goals are reviewed. Electrical mobility involves a new race for leadership, similar to what happened with mobilephones in the 1990s. The latest data, from 2017, point to three million electric vehicles on the world market. A scenario of 8 to 20 million electric cars is expected by 2020. By 2025 it is estimated that this number will be 40 to 70 million, which means an annual growth of almost 100% of the world market. By 2030, there are forecasts of 200 million electric cars. If analysed between 2017 a 2030 (13 years), the market will multiply about 66 times. Some examples may be mentioned to show the position of Portugal in this Market. In this new world, there is a Portuguese company with Angolan capitals, responsible for the public network of charging stations in Portugal, Efacec, which is considered "a pioneer in the area of electrical mobility and world leader in the production of fast and ultra-fast chargers for electric vehicles." It was this company that developed a supercharger for Mission E, the 100% electric Porsche, which will be launched worldwide in 2020.

Henrique Sánchez, President of UVE, says that electric mobility in Portugal is "in a phase of expansion of the initial core of the pioneers to an increasing number of new users of EV, both individuals and companies." This is visible. There are currently 51 fast charging stations (50 kW) and 80 semi-fast charging stations (22 kW) installed by MOBI.E, IKEA, Lidl, McDonald's, El Corte Inglés and Tesla hotel facilities. And the renovation and technological update of the 1,250 normal charging points has began.

In conclusion, this is an attractive, frantic market with many opportunities for potential investors.

(class 2)

6 - What is this case study about?

The case study aims to study, analyse and understand the evolution of the electric mobility market in Portugal. It seeks to understand the cause-and-effect relationships that led to the unleashing of this market, and which made Portugal the leader and a reference country in electric mobility, more specifically in the electric vehicle charging network. For this purpose, the network and the MOBI.E company are studied because it is the responsible entity for the information management of the electric mobility network. The main objective of this case study is therefore to understand the reasons that led Portugal to stand out in the electric mobility market. This is a very technological market, the fact that the country is a benchmark in a market with these features is something new and deserves attention, analysis and understanding.

7 - What reasons have made Portugal an interesting country for Nissan-Renault's investment in this market?

There are several factors that can be mentioned. One of them, at an initial phase in which the Portuguese model of electric mobility did not yet exist and was not so clear, is the geographical position of Portugal. Thus, the geographic and climatic conditions of the country make the production of solar energy, of wind energy, and of hydro power very profitable activities. These types of energy are fundamental for production.

At a later stage, the main factor in favour of the country was its model for electric mobility, entirely designed from the beginning, and which brought representatives from several countries to Portugal. All these countries wanted to get to know, understand and copy the Portuguese model.

8 - What were the interests / advantages that made the Portuguese government invest in this market?

The Portuguese government had recently invested heavily in the production of renewable energy. This market, based on electricity, would take advantage of this investment already made, optimising the additional investment needed. When Portugal entered this market, the first boost came from the public sector, that is, the government played an

important role on the dynamisation of electric mobility. This was due to a clear policy on renewable energy. Portugal already had a relatively high renewable energy production capacity and therefore it made perfect sense to minimise the dependency on the outside world in terms of fuels. Portugal does not have any source of oil and therefore must import it. Starting to move vehicles with electric energy, and even more, to produce renewable energy in Portugal, only had advantages. Therefore, it made and still makes sense to promote this trend of production and expansion of electric vehicles.

In addition, making the country part of a union of countries, Europe, in the current and globalised world influenced the goals, ambitions and opportunities of each country. At that point, the Portuguese government was focused on meeting the European environmental goals which had been defined. To that end, it had defined a set of explicit environmental policies with the National Action Plan for Energy Efficiency (PNAEE) (2008-2015) and the government was focused on meeting them. As electric mobility presupposes the replacement of fossil fuel vehicles by "zero-emission" electric vehicles, it is a strong support for the reduction of gases that contribute to the greenhouse effect. Finally, this market also contributes to the reduction of foreign dependency, with the consequent reduction of imports and a better trade balance.

9 - What is the MOBI.E project?

The MOBI.E project consisted of an intelligent charging network, unique in the world, which used electricity from renewable sources for the supply of electric vehicles. The initial plan for the charging network included a structure installation in 25 pilot cities, which guaranteed national coverage. The MOBI.E pilot network then comprises the creation of 1,300 normal charging points and 50 fast charging stations in public access spaces in mainland Portugal. The 25 cities of the pilot network are: Almada, Aveiro, Beja, Bragança, Cascais, Castelo Branco, Coimbra, Évora, Faro, Guarda, Guimarães, Leiria, Lisbon, Loures, Portalegre, Porto, Santarém, Setúbal, Sintra, Torres Vedras, Viana do Castelo, Vila Nova de Gaia, Vila Real and Viseu. The plan also anticipated that the fast charging stations would be placed preferably in the roads between these municipalities, in order to allow travelling between them, as well as in strategic zones to ensure emergency charging. The network must be accessible to all users and compatible with all brands of electric vehicles. MOBI.E is, therefore, a transversal and intelligent program at the service of the citizen. With the MOBI.E

card, any user could charge his EV at any point of the national network with maximum convenience and safety.

The model was ambitious and aimed to achieve environmental, networking, economic and proximity objectives and convenience, meeting the needs of the citizen. Thus, the system of Electric Mobility in Portugal contributes to the improvement of air quality and is a factor of carbon emissions reduction, specially at city level. In addition, it presupposes a reduction in external dependency on fossil fuels. Also, the pioneering and innovation of MOBI.E makes Portugal a Living Lab for projects of electric mobility that other countries want to develop. The MOBI.E pilot network is an integral part of the RENER Living LAB project. The municipalities have dedicated access through the MOBI.E portal in order to exchange experiences and share relevant information. It is important to note that the Electric Mobility program in Portugal is a powerful engine for the development of a mobility cluster based on the knowledge and technologies developed in the country. It is, therefore, a determining factor for attracting new companies and industries, with several effects in the creation of diversified and qualified employment. In conclusion, MOBI.E meets the needs of urban citizens, since it ensures an easy, comfortable, integrated and intelligent use of a non-polluting means of transport, coupled with a set of quality services through the use of new technologies.

10 - What are the main roles of MOBI.E, S.A?

MOBI.E, SA is a relatively recent company that started its activity at the end of 2015. The company has a very clear objective that is defined by law, namely in Decree-Law No. 39/2010, later changed to Decree-Law No. 90/2014, which defines the company's roles. Thus, the general responsibility of MOBI.E is to manage the information associated with the network of charging stations. The main function of MOBI.E is to manage all the information it receives from all the charging stations, to process it and to distribute it to all the players of the electric mobility sector. These are: (a) the operators of the charging stations; (b) electricity suppliers for electric mobility; and (c) power network managers (in this case EDP Distribuição).

11- What roles does MOBI.E, S.A currently play?

Besides its central function, also defined by law, another role that the company currently plays is to promote electric mobility in Portugal. This means that it must also

promote the conditions for people to have an electric vehicle. In addition to this, MOBI.E, SA has also been performing a function since it was created that is not defined by law, or at least not by the law concerning mobility power. This function is to guarantee the transition of the initial pilot project, which started in 2009 and created the national model that currently exists, to a market phase, allowing the players of the electric mobility sector to develop their normal activity which is defined by law. In order to do this, it must ensure that all the conditions of the network are created.

(class 3)

12 - To what extent is MOBI.E, S.A. important for the Portuguese model of electric mobility?

Since the general responsibility of MOBI.E is to manage the information associated with the charging network, to receive and analyse it, to process and distribute it to all players of the electric mobility sector (operators of charging stations, electricity suppliers for electric mobility and electricity network managers, in this case EDP Distribuição), this company is fundamental for the Portuguese model in this market. The basis of the model is that there is a single contract which is the only element necessary to use the whole infrastructure that exists in the country. This structure and the combination in a single project of the technological and regulatory vision of industrial development and of the development and integration with the energy sector could never be equally effective without MOBI.E, S.A.

13 - What were the 3 most critical moments in the history of Electric Mobility in Portugal? Why?

For Portugal, the start of the project for the implementation of electric mobility happened in 2009. The network was launched in 2010 by José Sócrates, but was stopped during the administration of Passos Coelho. It was António Costa who, about four years later, decided to resume this initiative that was practically inactive.

The second moment was stagnation. The stagnation phase was mainly due to the financial crisis, the international crisis of 2011 and the government change, which led to a strong disinvestment in the network and the infrastructure. The electric mobility was no longer a priority for the government that had to solve the financial crisis in the country. As the

government's investment was one of the main reasons for the development of the network, this new reality made the whole project stop for about 4 to 5 years.

The third critical moment of the electric mobility project is marked by the beginning of the activity of the company MOBI.E, SA, in 2015, to manage the information of the network of this Market. It also includes the conclusion of the pilot project and the simultaneous expansion of the electric mobility network in the whole country, in 2017 and 2018, together with the beginning of the commercial phase and the Market phase.

14 - What are the most significant consequences of stagnation in the charging network?

Briefly, there were three important consequences: the delay of the network creation, its degradation and the fact that people no longer believed and invested in the market.

The network achieved initial great success but subsequently, due to the crisis in Europe and the change of government in Portugal, there was a stagnation and even degradation of the network for almost 5 years. In addition to the delay and the failure to meet the initial objectives, one of the problems of this public charging network is the fact that some equipment is damaged due to this stagnation period. This required a redesign of the pilot project in order to complete defined and unachieved goals and to set new goals. The electric mobility became a prioritary issue later on, with the government of António Costa. It regained its position as an important commitement for the country. At this point, another great difficulty was to get everyone to believe once again in this idea and in this Market. At this level, MOBI.E has played an important but difficult role during 2015 and 2016. The advantage for Portugal was that the evolution of other countries in this market did not stop. Promoted by the public or by the market itself, the electric mobility sector would again become a reality.

In conclusion, despite the difficulties, all this led to the resumption of the project, the national commitment on electric mobility and the preparation of the population to invest in the Market.

15 - Describe the Portuguese model of electric mobility. How is it organised?

Who are the main players of the Portuguese model of electric mobility?

The Portuguese model is based on the idea of a single contract which is the only necessary element to be able to use all the infrastructure available in the country. This has had two advantages: the reduction of the cost of the country's infrastructure (because it was not necessary to create several parallel networks) and the convenience and ease for users. In addition, it has minimised the strong visual impact that the network would have on the landscape because it would not be pleasant to have 3 or 4 charging stations of existing 3 or 4 companies in each place. Another great advantage for Portugal in this market was the combination in a single project of the more technological aspect, the more regulatory vision of the industrial development and the vision of development and integration within the energy sector. These three areas have made it possible for us to have a nationwide project that has an impact on the development of the country. Thus, the Portuguese model is organised as follows: there is a company, in this case MOBI.E, whose function is to manage this information received from all charging stations, to treat it and and to distribute it to all players of the mobility sector. These are: the operators of the charging stations, the electricity suppliers for electric mobility and the power network managers, in this case EDP Distribuição. Therefore, we have an entity that is the electricity supplier which has a contractual relationship with the user. We also have another entity that is the operator of the charging station which has no direct relationship with the user of the electric vehicle since it is behind the charging stations available for the user. So, we have a model with a rather complex configuration: one will use the charging stations that are run by the operators but one has a contract with an electricity supplier for electric mobility and one pays this entity for its services. Then this entity is responsible for distributing the money among all the entities that have a role within the system.

16 - Is there a better way to approach this market's management? What are other European countries doing? Was it always like this?

A: The first part is meant to boost national pride, since the objective is to conclude that the Portuguese model is the best and that is why several countries have tried to imitate it. Nowadays, the models which exist abroad are not very different from this one. The names are not the same, the way people pay is not very different - although it is not quite the same as what we have, it is not very different either. But it is very different from what existed abroad some years ago. In other countries things were a bit different and the market worked right from the start. In general, the operators were creating charging networks, whether they were

electricity suppliers, or car manufacturers connected to small businesses or start-ups, depending on the country. And what happened in those countris? With the setting up of charging networks, this was the usual situation: I was living in Lisbon where there were two or three companies that had set up charging stations but they were mostly local. If I went to Leiria, for example, probably there would be a different charging network in that city. Therefore, I had to have a contract with the operators of the Leiria charging network. If I went to Coimbra, probably the network would also be a different one. So, what happened a lot in the centre of Europe was a multiplicity of charging networks, so I needed several contracts with different operators to travel from one place to another and be able to charge my car in each of the places. In Portugal this does not happen. It is enough to have one contract, which so far has been a card that is made available by MOBI.E and that it is used in all the charging stations. As was said, as of November 1, 2018, the model becomes different, and finally we will start to get what we had defined. But, from its beginning, our model was different from the one defined in central of Europe, which is where the electric mobility sector is more developed (with the exception of the Scandinavian countries). Anyway, initially we were a model for them, so they often came here to try to figure out what we were doing, why we were doing it, how we organised things. And they understood that they needed to interconnect the networks and nowadays, in central Europe, there are several network interconnection initiatives.

(class 4)

These final questions should be presented during the warm-up to organise, summarise and retain the key findings of the case.

17 - What are the main success factors of the MOBI.E network?

In this question one must first emphasise what was said in the answer to question 16. The great advantage was the ease of use and the convenience for users, combined with the public effort at the time aiming to create an infrastructure adequate to the operation and the movement of electric vehicles. We have already mentioned this but it is worth highlighting that this project has an interesting feature regarding innovation: from the beginning, it was designed, not only as a technological project, but also as a national business project. What does this mean? It means that we had a policy of innovation, we had an industrial policy and we had an energy policy, all of them associated and all of them with a strong weight in the

development of the project. This means that we have been able to develop all the technological part, but also the model, as well as the relationships. These were the basis for the whole model, and probably the most complex part of the electric mobility sector, together with the integration of this project with the energy sector. Portugal is still the only country that has a clear integration between electric mobility and the electricity sector. The interaction that we have with the electrical network allows us to be able to quickly prepare what is expected for the electric mobility at the charging level.

18- Why did the objectives of the initial project remain unachieved?

There was an international crisis, right? In 2011 we had an international crisis and there was also a change of government. The new government had to solve other problems and therefore the electrical mobility sector was no longer a priority, which meant that the whole project stopped for 4 years or 5 years. Towards the end of that period, the government had a new minister which admitted that the electric mobility had to be a clear commitment of the country and therefore began to lay the foundations in order to restart the process. The problem with this event was to lead potential users of electric vehicles to believe in and trust in the project again. One advantage was that the other countries did not stop and therefore people began to realise that sooner or later, mostly promoted by the public or mostly promoted by the market, electric mobility was going to be a reality. Therefore, people once again put it on the agenda and prepared the necessary investment. But it was not easy. It was a complex process and it was not easy to get everyone to believe in the projet and in this national commitment to the electric mobility sector.

19- What are the opportunities for electric mobility and for businesses (current or potential)? What are the expectations for the future?

We are going to ensure the transition to the market phase, which will occur in 2019, and then the start of payment on the entire network, which will turn electric mobility into a normal commercial activity. Then we must ensure integration with the rest of Europe from the point of view of roaming charges. Portugal is still the only country that has a clear integration between electric mobility and the electricity sector. The interaction that we have with the power network allows us to quickly prepare electric mobility at the charging level and that has to do with the bidirectionality of the system. I will charge my car at the charging stations

but will also be able to supply my own energy to the network. This is already possible from the technological point of view. There are many experiments and many pilot projects that are well-developed and already have successful results. But the central issue in this area is how to do this from a regulatory point of view, what procedures and what legislation are necessary for this to be possible. Portugal has a very strong advantage: the integration in the energy sector. This makes us think that the evolution will be much easier and that we will achieve these connections much more quickly than other countries. Another issue that is also related with the integration of the electric sector has to do with the domestic production of energy and with the use of energy that is produced by the users while charging electric vehicles. If I am not connected to the network this is already a relatively simple matter from the technological point of view but it is not simple from the regulatory point of view. How can I do this while my electricity is connected to the network? Nowadays, many people generate electricity through solar panels or with little fans at home, and then sell that energy to the network. But they can only sell that energy directly to the network, they cannot can not sell that energy to an electric car user, for example. In Portugal today, that is still not possible. But we believe that, because we have this connection in the electric mobility, we will be faster than other countries in getting solutions from the regulatory point of view. This will allow for greater acceptance of technological issues, both in Portugal and abroad. As a general idea: in 2009, when the project was created, there were no normal chargers for electric mobility, there were only a few little boxes appliances for domestic use. But, since the project was strong in terms of technological innovation, at the time we developed the first chargers to be used on the street for electric mobility. In addition, we developed all the necessary software for the evolution of this project and this has turned EFACEC, for example, probably into one of the world leaders in chargers supply. In addition, there is another Portuguese company, Magnum Cap, which despite having never been involved in the project, benefited from all the process, know-how and circulation of people associated with its various entities in the country. This resulted in Magnum Cap having a position in the current market with some international relevance, with interesting projects for buying and selling electricity to the network and abroad. And all this has to do with the investment that was made in the development of Portuguese technology.

At the heart of Europe, there are several network interconnection initiatives. It is not clear, at this moment, what will remain, what will disappear and what will prevail. At this stage it is not yet clear how the situation will evolve. What is certain is that there are already several European companies, known as mobility services providers or e-mobility services

providers, which make a contract with me and which have contracts with other companies and allow me to charge my vehicle on several different networks. It's not a system like ours but it is a very similar one. So, these companies have started to appear now and there are currently 4, 5, 6 companies with some relevance in Europe doing this: users have a contract with them and this contract allows users to load their vehicle in several stations in different countries. In Portugal, MOBI.E, is also working with these companies to ensure roaming between Portugal and other countries. This will ensure that Portuguese users can charge their cars abroad on all those networks. It will also ensure that foreign users can charge their vehicles in Portugal using the contracts they have abroad. This is still not possible between Portugal and other countries. We have established several agreements but they are not yet implemented. There is a very simple reason for this: in Portugal there was no payment. With the beginning of the payment, we are working on several international roaming solutions. And also in order to allow that a person charges his/her vehicle when coming to Portugal from abroad without a contract with a Portuguese or a foreign company. These are solutions that we are working on and, in principle, at the beginning of next year these solutions will already be implemented. We know the situation in Portugal and are interested on what happens in Europe in order to unserstand the possible evolution of the sector. There is the electricity sector, the car manufacturers and a set of other companies that want to enter the market of electric mobility services. Some companies already have some experience on the mobility sector in their countries. These include companies related to the bus industry, parking meters, management of mobility platforms associated with cities, for example – all of them are already involved on the electric mobility sector. In Portugal there are also, for example, the companies that manage car parking. So there is a very large and very interesting set of companies interested in electric mobility. This makes it difficult to try to figure out how this will evolve. The main concern is to ensure that there is an infrastructure where people can charge their vehicles and to ensure that users have access to this infrastructure. What was developed in Portugal at the time were the basis. Mainly, the operators of the charging stations and also a set of companies that make sure that anyone can charge an EV. Anyone can have a contract, in Portugal with a network operator and use that network. Or have a contract with a mobility service provider that allows that person to access not only its network, but also many other networks both inside and outside the country. The typology of these companies varies and now we will see which will be stronger in the future, in this market that is being born. In Europe, we have two main brands, Renault and BMW; then we have the Korean brands that are appearing. Nissan was probably one of the first companies to produce the electric vehicles of this new

generation. And now there are also some Korean companies like Hyundai and Kia that have very interesting solutions. There are other big companies - excluding the Americans, who have not yet got serious about this sector - like the German Volkswagen, Mercedes and Porsche, together with the PSA group (the Peugeot Citroen group). They have not yet defined what their strategy will be, PSA's president is very sceptical about electric vehicles, and therefore the company has not yet defined a very clear strategy for the development of electric vehicles. Then we have TESLA, which is American and has an important role showing people that electric cars can be normal vehicles and can do exactly the same as a conventional car with a combustion engine. There are also the other Americans who are still learning, with the exception of the Amperes - it is already an old car but was very successful and in Europe has been obtaining some success now but is not yet a strong brand. But all this to say what? That there is still a very strong industry, which is the German one that dominates the world's automobile industry and is yet to fully enter this sector. It is expected that they will come into full force in 2021 and this will give a completely different boost to electric mobility because the range of options that users have will become greater.

Conclusion

The main objective of this research was to study, analyse and understand the evolution of the electric mobility market in Portugal. It tries to understand the relations of cause and effect that led to the unleashing of this market and that made Portugal stand out. That is, the factors that have made our country a reference country in electric mobility, more specifically, at the level of the electric vehicle charging network. For this purpose, the same network was studied, as well as the company MOBI.E, S.A., since it is the entity responsible for the information management of the electric mobility network in Portugal. The investigation was therefore very useful since it allowed the analysis of an industry that has not yet been studied, generating a better understanding of the strategy that companies in Portugal and in Europe have been following.

Having said this, we can conclude that there are three critical moments on the history of electric mobility in Portugal: the start-up phase of the project in 2009 and the network creation in 2010, by José Sócrates; the stagnation phase resulting from the 2011 international financial crisis; and, finally, the third phase which was marked by the beginning of the activity of the company MOBI.E, S.A in 2015. This company has three main functions for the electric mobility market, two of them defined by law. Therefore, it should be concerned with the information management among all players in the electric mobility sector, with the development of this market (which involves creating the necessary conditions) and, finally, with ensuring the transition from the initial model to the market phase.

From the analysis of the results obtained, and taking into account the objectives defined, one can see the reasons that made Portugal a country of choice for the development of this new market. These were its geographical position and its innovative model based on the idea of a single contract, which is the only element necessary to be able to use all existing infrastructure in the country. Moreover, while Portugal was an interesting country for the first investors, our country also had other reasons to "take a chance" on this new market. Thus, the reasons for the interest of the Portuguese government were: to reuse the investment made in renewable energies, to achieve the defined European environmental goals and to minimise the dependency on oil from foreign countries.

A. Contribution of the Work to the Management and Academic Fields

The theme of this thesis focuses on business strategy, a topic of great importance in the field of management. Despite being a very broad concept, throughout this work, it was confirmed that this project is essential for management areas because it interconnects three fundamental concepts: entrepreneurship, innovation and technological development. The first is directly related to the fact that, in the face of adversity - in this case, environmental problems - it is be possible to identify a market opportunity, to add value and to turn that opportunity into a lucrative market. Innovation because, when faced with an alteration, it managed to follow the evolution of the market and to adapt itself to a new reality, handling the changes that occur in social and economic structures. Finally, because it is related to the development of technologies. In addition, topics related to business strategy and public and private investments are addressed, with the intention of understanding all the terms which allow a clearer analysis.

B. Limitations of the Study

In the development of this study some limitations became apparent in terms of the quantity and access to the information available and, simultaneously, in what concerns the reliability of the market and of its development. In addition, another problem worth mentioning was the difficulty in finding research about this industry and, above all, the lack of information about the companies which were studied.

C. Suggestions for Future Research

It would be relevant to continue to explore this market to confirm whether the targets will be achieved and whether it will develop as expected. Nowadays, there is the idea of the possibility of supercharged charging stations. At present, there are 500 active filling stations, 51 fast charging stations (50 kW), 80 semi-fast charging stations (22 kW) and the other normal ones.

In addition to the above, with the move to the market stage, the possibility of creating European roaming for electric mobility has been studied, allowing users to move without difficulty even beyond their countries' borders. Understanding how this possibility will develop in practical terms may also be very important.

Finally, since this is a market that influences so many other industries, it would also be interesting to see how and which companies will succeed in this market, and whether they will be linked to the production and / or distribution of energy, to renewable energy and to the automobile market, among others.

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