GOVERNMENT
OF SPAIN

INTERMINISTERIAL GROUP FOR
COORDINATION OF THE NATIONAL ACTION FRAMEWORK FOR
ALTERNATIVE ENERGY IN TRANSPORT

NATIONAL ACTION FRAMEWORK FOR ALTERNATIVE ENERGY IN TRANSPORT

MARKET DEVELOPMENT AND DEPLOYMENT OF ALTERNATIVE FUELS INFRASTRUCTURE.

IN COMPLIANCE WITH DIRECTIVE 2014/94/EU
OF THE EUROPEAN PARLIAMENT AND THE COUNCIL,
OF 22 OCTOBER 2014.

14 OCTOBER 2016

COORDINATED BY
SECRETARIAT-GENERAL FOR INDUSTRY AND SMALL AND MEDIUM-SIZED ENTERPRISES
PRESIDENCY OF THE INTERMINISTERIAL GROUP

TABLE OF CONTENTS

INDEX OF TABLES

INDEX OF FIGURES

INDEX OF GRAPHICS

I. INTRODUCTION

I.1. PRESENTATION OF DIRECTIVE 2014/94/EU

Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure[1] requires each Member State to adopt a National Action Framework (hereinafter NAF) before 18 November 2016 for development of the market for alternative energy in the transport sector and the implementation of the corresponding supply infrastructure.

For the purposes of the Directive, alternative energies are defined as those that replace, at least in part, conventional fossil fuels in the transport sector by road, sea and air. This includes the following energy sources:

- Natural gas, including biomethane[2], both gas (CNG-compressed natural gas) and liquefied (LNG liquefied natural gas)
- Electricity
- Liquefied petroleum gas (LPG)
- Hydrogen
- Biofuels, as defined in Article 2 i) of Directive 2009/28/EC

Each alternative energy source naturally has its niche, depending on the means of transport and the characteristics of travel, so today there are different options that can meet transportation needs. In this regard, the National Action Framework expresses a commitment to maintaining technological neutrality. Strategies and measures are directed on the basis that the transport sector is undergoing a continuous transition and that the market will define the most reasonable uses for each fuel, while technologically it is expected that all energy sources will evolve.

This National Action Framework for Alternative Energy for Transportation involves the implementation of a performance of essentially structural nature, aiming at continuity in the long term. In the following sections a detailed analysis is given of the current situation of the various alternative energy sources in each mode of transport and the expected scenario in terms of market developments. Also, the most important areas in which there should be action to support its implementation in transport are identified with, for each field, actions that can help achieve the objectives set out.

The objectives are the result of the analyses carried out taking into account the degree of penetration expected of each type of alternative energy and the maturity of the market, according to each means of transport, also assessing both the energy and industrial availability and pollutant emissions associated with each technology, such as territorial and demographic characteristics of Spain.

[1] Although the official translation into Spanish is 'Directiva 2014/94/UE del Parlamento Europeo y del Consejo de 22 de octubre de 2014, relativa a la implantación de una infraestructura para los combustibles alternativos', it is understood that the term 'alternative energy sources' ('energías alternativas' in Spanish – translator's note) better reflects its scope, since both electricity and hydrogen are energy sources and not fuels. In the same way, the term used for the combustible substances used in propulsion engines is fuel.

[2] Biogas (natural gas from renewable sources) with methane content greater than 90 % is called biomethane.

Table I-1. Main applications of alternative energy in each method of transport

FUEL	MODE / RANGE	ROAD-PASSENGER			ROAD-FREIGHT			AIR	RAIL	TOILET		
		SHORT	MEDIUM	LONG	SHORT	MEDIUM	LONG			INLAND	SHORT-SEA	MARITIME
LPG												
NATURAL GAS	LNG											
	CNG											
ELECTRICITY												
BIOFUELS (LIQUID)												
HYDROGEN												

Source: Communication COM (2013) 17 final

I.2. BACKGROUND

The European Union (EU) calls for strengthening competitiveness and ensuring energy security by diversifying energy sources, reducing the dependence of its Member States on energy imports. Similarly, the EU works to boost the use of renewable energies. For transport, this translates into a target of at least 10 % of the total used energy as established by Directive 2009/28/EC on the promotion of the use of energy from renewable sources.

The European Energy and Climate Package 2013-2020 sets targets for reducing emissions of greenhouse gases by establishing an emission reduction of 20 % over 1990 levels (10 % compared to 2005 in diffuse sectors for Spain); the target has been expanded to 40 % by the European Council for October 2014 to 2030 (30 % in diffuse sectors to be distributed among the Member States).

This ambitious goal is aligned with the recent agreement of the Paris Summit, reached at the XXI Conference of the Parties (COP21) to the Framework Convention of the United Nations on Climate Change, where its participants committed themselves to the aim of avoiding increasing the planet's temperature above 2 degrees Celsius.

This effort in reducing CO_2 emissions is also complemented by a demanding standard for vehicle manufacturers, setting maximum levels of CO_2 emissions for the average value of its total fleet sold. Regulations to reduce CO_2 emissions set very stringent targets for 2020 (95 g/km for passenger cars and 147 g/km for vans) requiring manufacturers to work on introducing new vehicles with alternative energy in the market.

The EU also has a legislative framework for improving air quality in Europe, such as Directive 2008/50/EC, with the aim of reducing emissions of pollutants that are harmful to health (acidifying substances, ozone precursors, tropospheric and particulate matter).

Different Member States are taking important steps to promote the development of alternative energy in transport, both road and sea, air or rail. In relation to road transport, the EU must ensure that the growing number of vehicles that use alternative energy sources can circulate throughout the entire territory of the EU. It is necessary that all countries make proportional efforts on developing the market for alternative fuels and the existence of the necessary supply infrastructure. Directive 2014/94/EU paves the way for this market with the aim of facilitating development of a single market. With this document, Spain joins the efforts of other countries in the European Union by identifying the current status of alternative fuels and the expected future development of the market, and identifying measures at our disposal that will meet our international commitments.

In addition there are other important reasons for Spain to decisively boost market development of alternative fuels and associated infrastructure. The transport sector, with 36 200 ktoe (kilotonnes of oil equivalent), represents 40 % of final energy consumption in Spain, ahead of the industrial and residential sector. This consumption is characterised by an almost exclusive dependence on petroleum products.

In turn, road transport accounts for 80 % of total consumption in the transport sector which depends at 98 % on petroleum products. Therefore, road transport contributes very significantly to the high external energy dependence of Spain (close to 70 %), with the import of a large amount of petroleum products per year (approx. €50 billion per year). This dependence directly affects the trade balance, as the negative energy balance reaches approximately €40 billion, and causes the uncertainties associated with price fluctuations and the international political situation.

The commitment to alternative energy in transport can help flatten the curve of electricity demand by managing recharging EVs in off-peak night hours and stimulating the use of electricity from renewable sources.

It is also an opportunity for the Spanish gas system. Spain has a privileged position in availability, knowledge and technology of natural gas, being the European country with the largest number of regasification plants, and with an extensive network of transport and distribution, which allows the development of natural gas, in both compressed and liquefied forms, for land, sea and rail transport. The use of natural gas in transport would significantly reduce local emissions.

Regarding biofuels, Spain has 36 industrial production plants that can absorb the development of increased use of these fuels.

Our refineries are producing, as part of their refining processes, liquefied petroleum gas, LPG. Its use in transport can also very significantly reduce local emissions in cities. LPG is therefore considered as a transition fuel towards the future.

Finally the hydrogen produced with renewable electricity and used in fuel cells is seen as one of the most interesting sources for the future.

From the environmental point of view, alternative fuels also represent a great opportunity for Spain. The Spanish automotive fleet comprises some 25 million vehicles, of which 73 % are passenger vehicles and 17 % commercial vehicles. Each litre of petrol consumed emits 2.35 kg of CO_2 into the atmosphere, and each litre of diesel about 2.64 kg, although consumption of diesel engines is smaller. Thus, the transport sector accounts for almost a quarter of global emissions of greenhouse gases in Spain. While there is potential for current diesel or petrol engines to improve their technology and reduce their consumption and emissions, it is necessary to introduce alternative energy in transport for the reasons given above.

The combustion process of engines also generates local pollutant emissions that have harmful effects on both health and the environment. The high concentration of vehicles in urban areas makes the vehicle the main source of pollution in the city. In compliance with Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, Spain has annually communicated information on air quality to the European Commission. In large cities limits are still being exceeded in the case of particulate matter and NO_2. The National Plan for Air Quality and Atmospheric Protection 2013-2016 (Air Plan), includes actions related to emissions of pollutants, with special emphasis on those originating in urban areas where vehicles using alternative energies can improve these levels of emissions.

Alternative Energy Vehicles (AEVs) offer solutions to the necessary reduction in emissions of local pollutants helping local administrations in their actions to improve air quality. They can also contribute to the reduction of CO_2 emissions in the transport sector, a diffuse sector with complex performance.

Last but not least, the promotion of alternative energies for transport may involve significant development of Spanish industry, ensuring maintenance of the wealth generated by our automotive sector and affirming its future leadership in the world, including in these technologies. Currently six of the 17 plants in Spain are producing vehicles with alternative energy. We have also developed many research projects around these technologies, allowing the emergence of new industrial players with

specific solutions for new engines or infrastructure equipment for recharging these vehicles. There are also industry initiatives for electric two-wheelers.

Spain therefore has both knowledge and experience in these technologies and has the potential to respond to the technological and industrial challenges that should allow it to lead this industry in the coming years. It is necessary to position the Spanish automotive and industrial equipment industry as a reference in a key technological alternative, increasing participation in the value chain of new components and modules for vehicle production, recharging infrastructure and intelligent transport infrastructure. At the same time, Spain should be positioned as a key market for manufacturers for compliance with their CO_2 emission targets by producing new models of cars and light commercial vehicles in Spanish plants.

Industrial activity in the automotive sector in Spain (vehicle manufacturers as well as equipment and components) represents over 250 000 direct jobs, to which must be added the activities of associated services such as dealers and workshops. Spain is the second largest carmaker in Europe, behind Germany, and the first commercial vehicle maker, occupying the eighth position worldwide. However, Spain is not present throughout the value chain of manufacturing these vehicles. Spain needs to position itself better in components and equipment with higher added value. These include battery packs, fuel cells, electrolysers, specific technological solutions for engines or equipment for recharging infrastructure. In this way, Spain could take advantage of the existence of the specialised research centres and technical centres of the brands themselves, as well as of an electronics industry equipped to develop artificial intelligence for vehicles, transport and recharging infrastructure, and communications to ensure network interoperability.

But it is not only a great industrial opportunity for the automotive industry. Natural gas, mainly liquefied, is a great opportunity for emissions reductions in shipping, which will face great challenges posed by increasing limitations on emissions. Spanish shipyards have the necessary knowledge and experience in this technology, as evidenced by the fact that there are several ships under construction in our shipyards that will be powered by natural gas.

Transport of both passengers and goods in Spain is an economic sector of strategic importance for industry, trade and mobility of people. In recent decades there has been an unprecedented growth resulting from the globalisation of markets for goods and services as well as income growth and changes in the lifestyle of citizens, with more trips per person and more distant destinations. Transport is a dynamic vector of growth and diversification of economic activity.

For the above reasons, Spain is committed to promoting the use of alternative energy in transport from the perspective of technological neutrality. This technological neutrality should be understood not only in respect of the various alternative fuels but also for conventional fuels, i.e. petrol and diesel. Technological developments and their future market success are not entirely predictable. For this reason, no technologies should not be ruled out prematurely with others treated as ‘winners’. Different technologies can coexist based on their ability to adapt to different needs. Committing to technological development associated with a single technology can reduce possible progress in another, significantly reducing the potential long-term technological progress. For this reason, it is necessary that any policy impulse revolves around the principle of technological neutrality and it should be the market that finally proposes the best solution for each field of transport.

STRATEGY TO PROMOTE ALTERNATIVE ENERGY VEHICLES (AEVS)

On 26 June 2015 the Council of Ministers approved the Agreement communicating the Strategy to Promote Alternative Energy Vehicles (AEV Strategy) in Spain for the period 2014-2020. The AEV Strategy is part of the Agenda for Strengthening the Industrial Sector in Spain. It is an action plan comprising a set of proposals to improve conditions in all areas of industrial activity in Spain, and contribute to the growth of industry, its competitiveness and an increase in its share in the overall GDP.

The AEV Strategy represents an increase in all the alternative energy sources in the Comprehensive Strategy to Promote Electric Vehicles 2010-2014, presented on 6 April 2010 by the Government.

The AEV Strategy 2014-2020 was developed by the Secretariat-General for Industry and Small and Medium-sized Enterprises within the Interministerial Working Group created for this purpose. Particular attention is given to the contributions of the Autonomous Communities, local authorities and principal sector associations. The Strategy aims to establish Spain as a country of reference in the field of alternative energies applied to the road transport industry, boosting industry associated with the automotive sector, all within the framework of current energy-related and environmental challenges. To do this, the AEV Strategy analyses the particularities of each of the technologies representing an alternative to conventional fuels, i.e. petrol and diesel. It proposes specific actions structured in 30 measures that cover three areas of action. These are interlinked by means of a stable regulatory framework that gives continuity to all actions taken, making it possible to offer guarantees to the market, to investors in infrastructure and to the drivers of industrial production. The aforementioned three areas of action are:

- Industry: encouraging industry involving vehicles using alternative energy sources and the associated points of supply, with the aim of placing Spain at the forefront of driving these technologies. It includes measures for the industries producing vehicles, components and supply infrastructure, as well as measures for boosting research, development and innovation (RDI).

- Market: designing actions to drive demand for a market that is sufficient to boost economies of scale and supply, making it possible to consolidate infrastructure and industrial production in Spain. It includes measures for dissemination and awareness-raising of new fuels and technologies, as well as measures to stimulate vehicle acquisition.

- Infrastructure: including measures to promote a network of infrastructure able to cover the mobility needs of users and allow development of a market for alternative fuels.

I.3. PREPARATION OF THE NATIONAL ACTION FRAMEWORK

The preparation of this National Action Framework has required coordinated action by the ministerial departments with relevant responsibilities. The purpose was to achieve a broad ranging perspective. Also taken into account were the Autonomous Communities, local authorities and the economic sectors involved, with the needs of SMEs specifically included. In order to guarantee movement of people and goods throughout the European Union, Spain has also cooperated with neighbouring countries.

Details are given below of how the National Action Framework was designed in order to create synergies and complementarity between all institutions to coordinate and optimise actions to support alternative energies in transport.

GENERAL STATE ADMINISTRATION

The Government Commission for Economic Affairs (CDGAE) by agreement of 30 July 2015, created the Interministerial Group for the coordination of the National Action Framework for alternative energy for transport. The nature of this Interministerial Group corresponds to the provisions for corporate bodies with functions of analysis, proposal, advice and monitoring in Law 40/2015, of 1 October 2015, under the legal arrangements governing the Public Sector. In this regard, it has been established with the following functions:

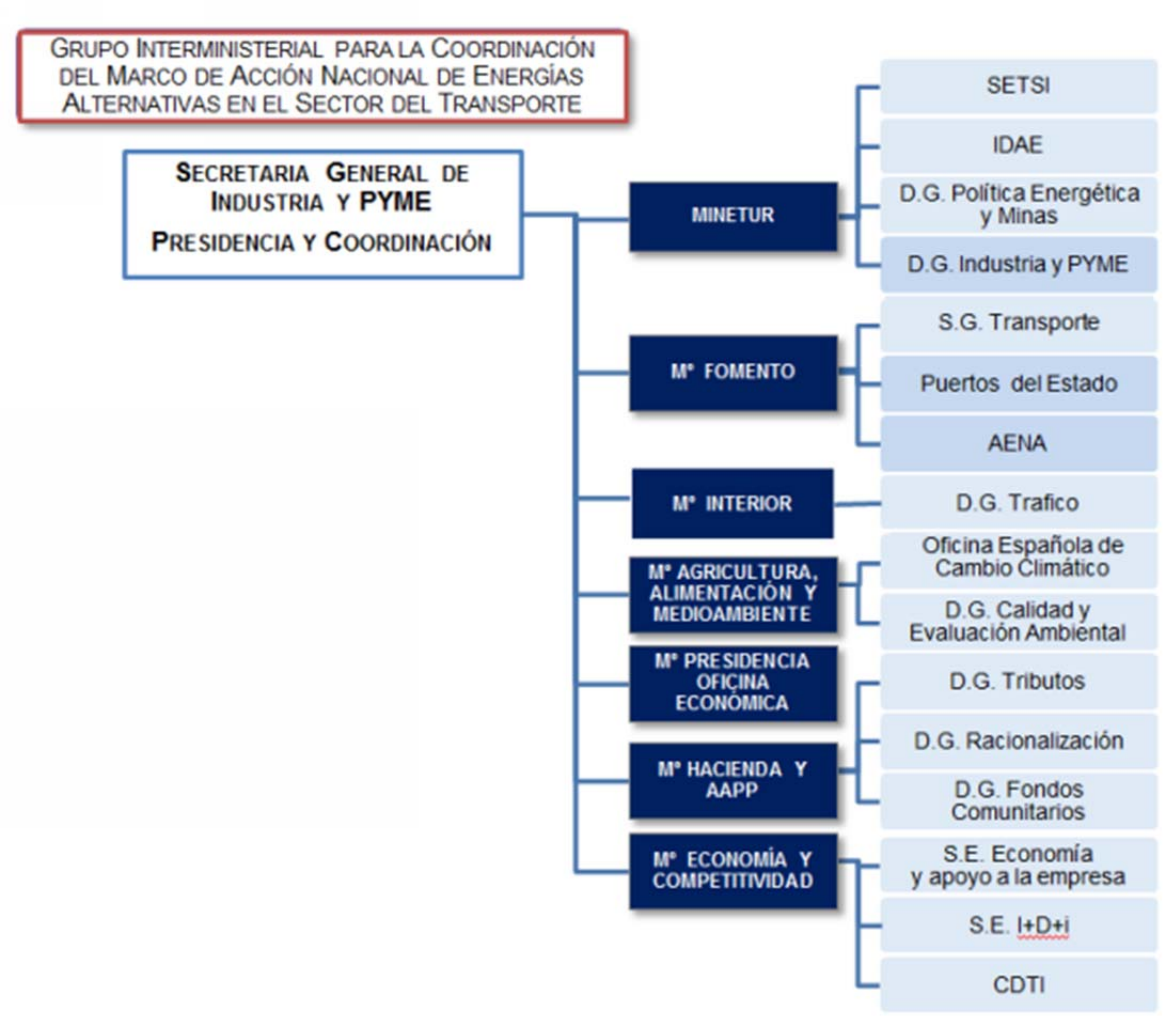
a) Promote to and coordinate with the State Administration for the development of a Framework of Action for the development of the market for alternative fuels in the transport sector and the implementation of related infrastructure.

b) Submit to the Government Commission for Economic Affairs the final version of the National Action Framework and its triennial reports and revisions as appropriate. Article 10.1 of the Directive establishes the obligation of each Member State to submit to the Commission a

report on the implementation of their national action framework no later than November 18 2019, and thereafter every three years.

c) Monitor and review the goals, objectives and measures proposed in the National Action Framework.

Figure I-1. Component members of the Interministerial Group for the Coordination of the National Action Framework for Alternative Energy Sources for Transport



Source: Agreement of the Government Commission for Economic Affairs of July 30, 2015.

KEY TO FIGURE
Left-hand side text boxes:
INTERMINISTERIAL GROUP FOR THE CO-ORDINATION OF THE NATIONAL ACTION FRAMEWORK FOR ALTERNATIVE ENERGY SOURCES IN THE TRANSPORT SECTOR
SECRETARIAT-GENERAL FOR INDUSTRY AND SMEs
Middle column of dark blue boxes:
MINETUR – Ministry of Industry, Energy and Tourism
MINISTRY OF PUBLIC WORKS
MINISTRY OF THE INTERIOR
MINISTRY OF AGRICULTURE, FOOD AND THE ENVIRONMENT
ECONOMIC OFFICE OF THE PRESIDENCY

MINISTRY OF THE TREASURY AND PUBLIC ADMINISTRATION
MINISTRY OF ECONOMY AND COMPETITIVITY
Right hand column of pale blue boxes:
SETSI (Secretary of State for Technology and the Information Society)
IDEA (Institute of Advanced Studies)
D. G. Energy and Mines Policy
D. G. Industry and SMEs
S. G. Transport
Puertos del Estado (State Ports)
AENA (Spanish Airports Operator)
D. G. Traffic
Spanish Office of Climate Change
D. G. Environmental Quality and Evaluation
D. G. Taxes
D. G. Rationalisation
D. G. Community Funds
Secretary of State Economy and support to business
Secretary of State R & D & i
CDTI (Centre for the Development of Industrial Technology)

Under the Interministerial Group, sub-working groups have been created in which the different sectoral departments of the ministerial departments involved participated (Directorate General of Industry and SMEs Directorate General for Energy Policy and Mines, DGT, IDAE, *Puertos del Estado* (State Ports), Spanish Climate Change Office, General Secretary of transportation, etc.) to study the technical aspects arising from the implementation of alternative energy in transport.

AUTONOMOUS COMMUNITIES

Through the Working Group of the Market Unit of the Secretariat-General for Industry and SMEs (SGIPYME) the coordination of measures within the National Action Framework has been promoted, with action plans developed by the Autonomous Communities. Consultations with the different regions have made it possible to set objectives in line with the decentralised structure of Spain and establish coordinated actions between them.

LOCAL ENTITIES

Dialogue with local authorities was conducted by the Spanish Federation of Municipalities and Provinces (FEMP) and the Network of Smart Cities (RECI). In order to facilitate coordination with the existing 8 114 municipalities in Spain, in October 2015 an IT tool[3] was set up for municipalities to report on their plans and the measures that they plan to carry out in the field of alternative energy in the National Action Framework.

INTERESTED PRIVATE INITIATIVE

The involvement of private stakeholders in the preparation of this document has provided a comprehensive view of the current market and the use of alternative energies in transport and specifically in its associated infrastructure. This collaboration continued throughout the process of preparing the NAF, through ad hoc meetings and the exchange of information and statistical data. It culminated in the consultation process[4] with economic sectors and agencies held in June 2016. Their involvement will continue during the monitoring phase of the NAF.

[3] http://www.minetur.gob.es/industria/es-ES/Servicios/estrategia-impulso-vehiculo-energias-alternativas/Paginas/cuestionario-municipios.aspx

[4] Appendix A includes a list of business associations and organisations that participated in the preparation of the National Action Framework.

COOPERATION WITH OTHER MEMBER STATES

In November 2015 the governments of Spain[5], Portugal and France signed a joint declaration for the promotion of electric vehicles called the Spanish-Portuguese-French Initiative for the promotion of electric vehicles. This initiative identifies ten actions to encourage the deployment of electric vehicles and launch a working group to improve coordination and implement an infrastructure project for public recharging points in the Iberian Peninsula.

Additionally, the Ministry of Industry, Energy and Tourism together with the Ministry of Public Works has promoted the establishment of consortia of private entities, both Spanish and Portuguese, for strategic projects to implement infrastructure for electricity, natural gas and LPG in the Trans-European Transport Corridors (Mediterranean and Atlantic) in order to connect the Iberian peninsula with the rest of the European Union. Meanwhile, the border regions of Spain and France, with Andorra, have launched a project for the development of a cross-border corridor of refuelling stations for hydrogen vehicles.

[5] Signed by the Minister of Agriculture, Food and Environment and the Secretariat-General for Industry and SMEs.

II. ALTERNATIVE ENERGY IN THE TRANSPORT SECTOR

II.1. NATURAL GAS

GENERAL DESCRIPTION

Natural gas is a non-oil fossil fuel formed by a mixture rich in light hydrocarbons whose main component is methane (CH_4). The amount of methane in the natural gas consumed in Spain varies between 75 and 97 % depending on its origin.

The application of natural gas to transport[6] can take two different forms:

- Compressed natural gas (CNG): Natural gas is used in a gaseous state, compressed to pressures of 200-220 bars to reduce its volume. This is how it is most commonly used in light vehicles and heavy urban vehicles as well as in short haul ferries.

- Liquid natural gas (LNG): Natural gas in liquid form, stored in cryogenic tanks at temperatures of about -162° C and 1 bar pressure. This is chiefly used in intercity heavy vehicles and ships for long journeys.

In all its forms, CNG or LNG, natural gas presents a smaller range per unit of volume than conventional fuels. To travel long distances, the most widely used option is LNG as it occupies a volume between 2.5 and 3 times lower than CNG. CNG, on the other hand, is the ideal choice for short journeys and means of transport in which the required range is shorter.

Table II-1. Approximate range of CNG and LNG engine running exclusively on gas mode

CATEGORY	COMPRESSED NATURAL GAS (CNG)	LIQUEFIED NATURAL GAS (LNG)
TOURISM	400[7] km	Not applicable
HEAVY VEHICLE	500[8] km	1 500 km
VESSEL	10.09 nautical miles	International routes

Source: Developed in-house from data provided by manufacturers of vehicles and ships.

One of the major conditions for the transition to LNG from a ship with a traditional engine (powered with HFO[9] or MGO[10]) is the need for double the storage volume for fuel to achieve the same range. This is an added complication to the necessary engine modifications given the restricted space on ships where load capacity is the main source of income. Nevertheless it is technically possible and economically viable depending on the distances and environmental conditions required for the solution. This also rules out the use of CNG in cargo ships. Its use is currently restricted, practically exclusively, to short distances for ferries, since the volume of space required for fuel storage would be five to six times greater than that required for marine fuel, with a corresponding loss of load capacity.

Regarding rail transport, the adoption of LNG is still in the testing phase in Spain and is focused primarily on the transformation of diesel locomotives. Some 39 % of Spanish railways are not

[6] The natural gas for transport requires specific operating protocols since CNG is kept at high pressure (200-220 bar) and LNG at very low temperatures (-162).
[7] Seat Leon 1.4 CNG.
[8] IVECO Stralis CNG.
[9] HFO: stands for Heavy Fuel Oil.
[10] MGO: stands for Marine Gas Oil.

electrified and continue to use diesel locomotives. This is because they are mostly passenger lines declared a public service obligation. Electrification of such lines is not economically or technically feasible. Therefore, there is potential to reduce the environmental impact by converting the existing fleet of diesel locomotives.

In 2013 the public company RENFE signed a collaboration agreement with the companies Cepsa, Enagas and Gas Natural Fenosa, with the support of the Ministry of Public Works, to develop a test of use of LNG in the Spanish rail network. This project aims to analyse the technical, legal and economic feasibility of LNG railway traction to assess the possibility of extending this new traction solution to the commercial sector in Spain. The advantages of LNG for rail transport include reducing air pollution (NO_X, PM, CO), greenhouse gas emissions, noise levels and operating costs (fuel, maintenance, etc.). The project involves pilot tests in Asturias in the second half of 2016.

It is also important to note the contribution of natural gas as a transition fuel to non-fossil fuels such as biogas and hydrogen. Currently the main source for large-scale production of biogas (natural gas from renewable sources) for transport in Spain[11] is the use of landfill gas for energy. Spain has one of the largest biomethanisation plants in the European Union. This plant, located in Valdemingómez (Madrid), introduces its product into the network after a cleaning process. It produces enough fuel to supply the entire fleet of refuse vehicles in the city of Madrid. The purpose of the projects developed to date has been to introduce biogas into the gas pipeline network. This requires processing by desulphurisation and methane concentration.

In addition, the gas system installations have the potential for transport and management of hydrogen. Among the demonstration projects currently being developed in this line, attention is drawn to the HyGrid,[12] based on hybrid membrane technology for the separation of hydrogen gas from natural gas in distribution networks.

PRODUCTION AND CONSUMPTION OF NATURAL GAS[13]

In 2015 natural gas consumption in Spain was 314 210 gigawatt hours (GWh), representing an increase in gas consumption after five years of decline. Domestic production stood at 699 GWh, representing a level of national supply of 0.22 %. To meet demand, strategic reserves and exports, Spain imported 364 172 GWh in the year 2015, receiving 58 % through pipelines and the remaining 42 % in the form of LNG by LNG tankers.

As in previous years, in 2015 the high degree of diversification of the Spanish system continued, with natural gas coming from eight countries. The main supply country was Algeria (59.7 %), followed by Nigeria (11.9 %), Qatar (9.3 %) and Norway (8.8 %). The diversity of countries supplying natural gas to the national gas system ensures sufficient supply security.

Depending on the use of gas made by consumers, the national gas system serves two types of consumption: conventional consumption[14] (77.6 %) and demand for power generation[15] (19.4 %). The new use of natural gas in transport has the advantage of not presenting a seasonal component as marked as that of other sectors, contributing to the sustainability of the system.

Currently, the consumption of natural gas in the transport sector is not greatly significant. It is estimated that road transport consumed[16] 1 212 GWh in 2015 which is 0.4 % of total consumption. In maritime transport only 1 357[17] m^3 of natural gas was supplied between July 2012 and August 2015. However, the boost to natural gas for transportation, and especially the use of LNG in heavy road

[11] In addition to its use in transportation, biogas is used to fuel power generation engines in the place where it occurs.
[12] www.higrid-h2.eu
[13] Source of all data in this section unless otherwise indicated: Annual Statistical Report 2015 of CORES.
[14] Conventional consumption groups the traditional consumption of gas, i.e., those supplies intended for residential consumption, the services sector and production processes in the industrial sector (including cogeneration).
[15] Within the power generation market a distinction is made between conventional and combined cycle power plants.
[16] Estimation of consumption by GASNAM.
[17] Source: Repsol, Cepsa, HAM and Molgas.

transport and in ships, could lead to significant growth in consumption and thereby help the sustainability of the gas system.

Natural gas is the fuel for which the International Energy Agency[18] (IEA) expects the greatest increase in demand over the coming decades in absolute terms. In 2035 the contribution of gas for primary energy will naturally converge with oil, assuming an annual growth of 2 % worldwide. While this growth is mainly due to the use of gas for electricity generation, the transport sector will present the highest rate of annual growth at 2.9 %.

LIQUEFIED NATURAL GAS

Spain is a world leader in knowledge and use of LNG, thanks to more than 40 years of experience. In addition, it is the head of the European Union in LNG storage capacity with 40 % of total capacity in 2016. There are a total of six operating regasification plants, and another that is already built in Gijon will be operational when the recovery of demand requires[19]. In 2015 the utilisation rate of regasification plants was around 25 %[20].

Figure II-1. Map of the natural gas regasification plants existing in Spain in September 2016

Source: ENAGAS System Technical Management.

[18] World Energy Outlook. International Energy Agency, in December 2013.
[19] In addition there is a project for the construction of a new regasification plant in Granadilla (Tenerife).
[20] Source: ENAGAS Technical System; 25 % is the ratio between the contracted and nominal capacity. Therefore, it does not include seasonal, weekly and daily modulation regasification plants (a winter day at peak hours has higher ratios).

KEY TO FIGURE:
Legend in white box in top left:
OPERATIONAL REGASIFIER
NON-OPERATIONAL REGASIFIER
ATLANTIC CORRIDOR
MEDITERRANEAN CORRIDOR
Seas and Oceans (clockwise from bottom left)
ATLANTIC OCEAN
CANTABRIAN SEA
MEDITERRANEAN SEA
Remaining names of locations and countries the same as in English except that FRANCIA is FRANCE

Currently there are 932[21] active LNG satellite plants[22] spread throughout the Spanish geographical area (both on the mainland and the islands), of which 132 are owned by the distribution companies and the rest are in the hands of individual consumers. Satellite plants provide the system enough flexibility to address potential increases in demand for natural gas without additional investment in basic gas infrastructure. These satellites plants receive LNG by tanker lorries to supply natural gas where there is no pipeline. The LNG storage capacity in satellite plants varies between 5 and 1000 m^3 depending on the size and number of deposits per plant. This capability positions Spain in third place worldwide[23], behind China and Turkey, for the number of satellite plants.

This storage infrastructure is complemented by a fleet of more than 250[24] tankers for transferring LNG from regasification plants and satellite plants, representing 90 %[25] of the total European capacity. This fleet not only services national satellite plants, but also satellite plants in Portugal, France, Switzerland, Italy and Macedonia. Worldwide, Spain has the third largest fleet of LNG tankers, behind China (4000) and Japan (600). This also allows the tanker fleet to provide the necessary service in ports where vessels powered by LNG require it.

It is noteworthy that there is currently a capacity on the mainland to supply LNG to any geographical point thanks the small-scale network in place.

Based on the above, Spain considers that it has a distribution system suitable for LNG, including loading facilities for LNG tankers, thereby meeting the requirements of Article 6(6) of Directive 2014/94/EU.

COMPRESSED NATURAL GAS

CNG can be obtained either from the LNG or from networks of gas pipelines and distribution networks supplying gas to households for domestic consumption[26] . In the latter case additional compression equipment is required to allow filling of the vehicles as it is necessary to raise the pressure to 200-220 bars.

The natural gas transport and distribution network in Spain is well-established and is known for its robustness. It is sufficiently interconnected and has over 83 830 km of pipelines both on the mainland and the islands, of which 70 120 km are for the distribution network and 13 710 km for the transport network. In addition, natural gas is available in much of the country, specifically in 1 688[27] municipalities inhabited by 79 % of the population. Therefore, expanding the use of natural gas in transport can make better use of the existing transport and distribution network which results in the minimisation of the costs incurred by users of the gas system.

[21] Source: ENAGAS Technical System.
[22] satellite plants associated with a regasification plant supply destination.
[23] Source: Journal Gasactual # 138 (January/March 2016) published by Sedigas.
[24] Source: Data provided by Enagas (March 2016).
[25] Source: Gasactual Magazine, No. 138 (January/March 2016). Sedigas.
[26] The gas for domestic consumption is distributed in the distribution network at very low pressure. To use this gas in vehicles requires a special installation to compress the gas and raise the pressure up to 200-220 bars.
[27] SG Hydrocarbons of the Ministry of Industry, Energy and Tourism.

II.2. ELECTRICITY

GENERAL DESCRIPTION

The use of electric engines is widespread in many applications. The challenge arises when using non-stationary electric motors powered with energy sources not carried on board or different from those used for combustion engines. For this reason, the National Action Framework includes only those systems powered by the electricity network which can offer a partial or complete alternative to combustion engines. These include electricity supply facilities to road transport vehicles[28], stationary aircraft and berthed ships.

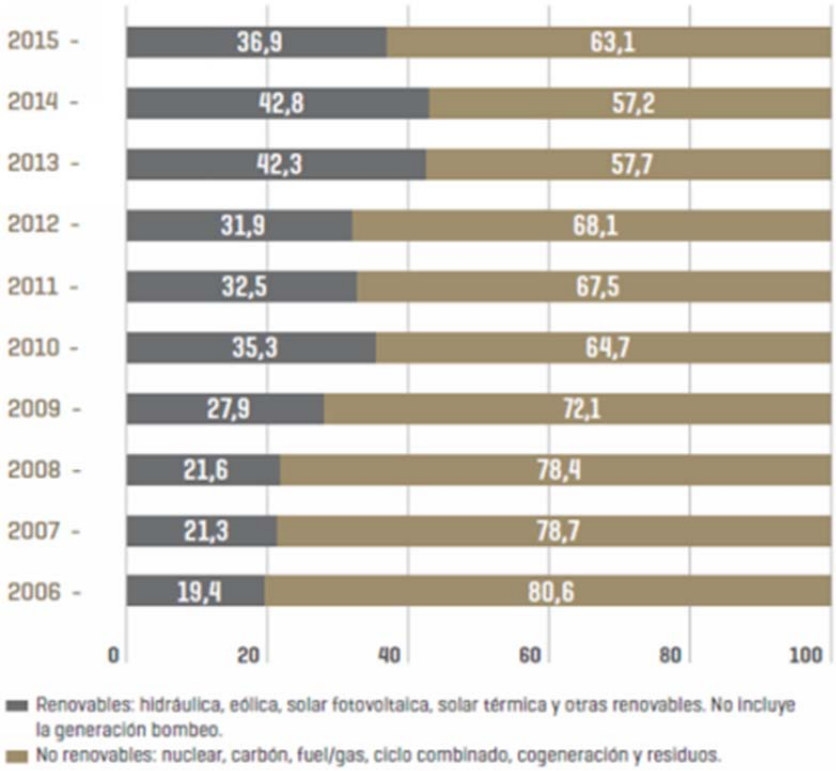
PRODUCTION AND CONSUMPTION OF ELECTRICITY[29]

In Spain there is excess electricity generation capacity, with a predicted coverage margin of over 10 % until 2020. Also, Spain has one of the highest rates of incorporation of electricity generation capacity from renewable sources in Europe. This means that electricity generation contributed to the 44 % reduction of CO_2 emissions in the electricity sector between 2005 and 2015.

[28] The National Action Framework includes only battery electric vehicles (BEV), extended-range electric vehicles (EREV) and plug-in hybrid vehicles (PHEV). Therefore, non - plug-in hybrid vehicles (HEV) are excluded.

[29] All data in this section are from the electrical system technical manager, Red Eléctrica de Spain (REE), unless otherwise indicated.

Graphic II-1 Development of renewable and non-renewable peninsular generation (2006-2015)



Source: Red Eléctrica de España (REE); in percent (%).

KEY TO FIGURE
Legend at bottom:
Renewable: hydraulic, wind, photovoltaic solar, thermal solar and other renewables. Does not include pumped generation
Non-renewable: nuclear, coal, fuel/gas, combined cycle, co-generation and waste.

Renewable energy[30] provided 36.9 % of mainland electricity production in 2015 and 42.8 % in 2014. This decrease is due to the variability of hydro and wind production driven by meteorological variables. Despite this decline, it should be noted that wind played a leading role, representing 51.4 % of the mainland's renewable production, making it the third technology in the energy-production structure, providing 19 % of the mainland total in 2015. In addition, in 2015 new records were established for instant, hourly and daily mainland wind production. The graph below presents the data for maximum and minimum coverage by the mainland system in percentage terms, with hydro, wind and solar technologies.

[30] This group includes hydropower (excluding pump-generation), wind, solar photovoltaic, solar thermal and thermal renewable.

Graphic II-2. Maximum and minimum coverage of mainland system with hydro, wind and solar technologies in 2015.

Source: Red Eléctrica de España (REE); in percent (%).

KEY TO FIGURE:
MÁXIMO – MAXIMUM
MÍNIMO – MINIMUM
EFMAMJJASOND – JFMAMJJASOND
Hidráulica – Hydraulic
Eólica – Wind
Solar - Solar

In 2015 the demand for electricity in Spain reached 262 931 GWh, according to data from *Red Electrica de España*, with growth of 1.9 % compared with the previous year. This is the first year that positive changes in electricity consumption were recorded since 2010, when demand in Spain grew by 2.8 %. Widespread use of electric vehicles would involve increased electricity consumption. This could make it possible to take advantage of the energy peaks that occur at night thanks to increased wind energy, which the system does not currently require. This would take the form of night-time recharging of electric vehicles, mainly in private garages. Furthermore, thanks to their speed of response, the use of combined cycles would make it possible to meet foreseeable peaks in demand, such as rush-hours, or indeed occasional surges in demand.

In the case of electricity supply to berthed ships or stationary aircraft between now and 2020, this is considered negligible and without impact on the Spanish electrical system.

II.3. LIQUEFIED PETROLEUM GAS

GENERAL DESCRIPTION

Liquefied Petroleum Gas (LPG), commonly known as Autogas, is a blend of propane and butane. Among other uses[31], it is used in transport. Some 60 % of world production of LPG is obtained during

[31] Other uses of LPG: 1) Petrochemical (substitute for naphtha for reasons of price, synthetic fibres, acetone, thermoplastic, manufacture of resins, etc.), 2) Residential (cylinders/channelling for kitchens and heating), 3) Agriculture (pest control, disinfecting henhouses, generating hot air in greenhouses, etc.) and 4) Industrial (casting and welding, food, crematoria, etc.).

the extraction of oil and natural gas and the remaining 40 % is produced during the refining of crude oil.

Currently, use in road transport is limited to light vehicles, primarily passenger cars and, to a lesser extent, commercial vehicles. Its application for heavy vehicles is still in development.

In maritime transport, LPG is being used experimentally both for fishing vessels up to 12 metres in length and leisure vessels up to 24 metres in length. According to data provided by the company Repsol, there are about 23 boats powered by LPG used for inshore fishing and a demonstration project is being developed in the Marina of Benalmádena (Malaga, Andalusia) where an LPG supply point for has been installed.

PRODUCTION AND CONSUMPTION OF LPG[32]

In 2015, 1 876 194 tonnes of LPG were consumed in Spain, representing an increase of 12.8 % over the previous year. Some 780 000 tonnes were imported, 21.3 % more than in 2014, and 395 000 tonnes exported, 7.1 % less than in the previous year, representing a negative trade balance of 385 000 tonnes. In addition, Spain has 23[33] bottling plants for bulk LPG, four substations[34] and eight marine terminals [35].

Among the various applications of LPG, the automotive sector consumed 43 000 tonnes, representing 2.3 % of total LPG consumption in Spain. While this percentage is still insignificant, it is noteworthy that it has doubled from 1 % in 2010.

Spain has to import LPG: between 2011 and 2015, excepting 2013, LPG imports exceeded exports. Nevertheless, a changing trend can be seen due to reduced use of butane gas cylinders (from 2003 to 2014 this market fell by 43 %) and the progressive replacement of natural gas by piped LPG. Therefore, it is expected that the reduction in LPG consumption in other areas will create an opportunity for the automotive sector to absorb the future surplus domestic production. This would improve the trade balance and strengthen the domestic industry.

Table II-2. Development of consumption of LPG in Spain (2010-2015)

	TOTAL ANNUAL						STRUCTURE (%)	Rate of change (%) 2015/2014
	2010	2011	2012	2013	2014	2015		
Bottled	1 100	997	959	928	859	864	46.1 %	0.6 %
BULK	733	636	617	575	510	516	27.5 %	1.3 %
AUTOMOTIVE (bottled and bulk)	19	21	26	31	35	43	2.3 %	21 9 %
OTHERS	ND	ND	ND	55	260	453	24 1 %	74.1 %
TOTAL	**1 852**	**1 654**	**1 601**	**1588**	**1 664**	**1 876**	**100.0 %**	**12.8 %**

Source: Annual Statistical Report 2015 Cores; Units: thousands of tonnes.

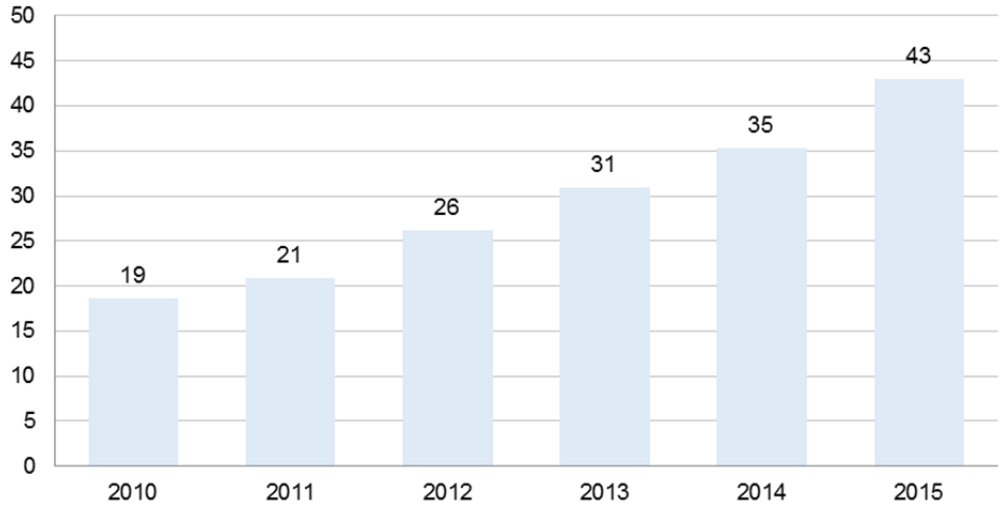
[32] The source of all data in this section is the CORES Annual Statistical Report 2015 unless otherwise indicated.

[33] Source: AOGLP. Plants for bottled and bulk LPG are located at: Bens (Coruña), Gijón (Asturias), Gajano (Cantabria), Santurce (Basque Country), Zuera (Zaragoza), Montornes del Vallés (Barcelona), Tarragona, Castellón, Paterna (Valencia), Escombreras (Murcia), Dos Hermanas (Seville), Campo de Gibraltar (Cádiz), Palos de la Frontera (Huelva), Puertollano (Ciudad Real), Onion (Toledo), Mallorca, Pinto (Madrid), Vicálvaro (Madrid), Tenerife, Gran Canaria, Fuerteventura and Lanzarote.

[34] Source: AOGLP: Navalmoral de la Mata, La Seu d'Urgell, Ibiza and Mahon.

[35] Source: AOGLP: six owned by Repsol (four specific LPG in Gijon, Tarragona, Escombreras and Alcudia and two for refining in Bens and Santurce) and two owned by Cepsa (Palos de la Frontera and Campo de Gibraltar).

Graphic II-3. Development of consumption of LPG exclusively for automotive use (2010-2015)



Source: CORES; Units: thousands of tonnes.

Table II-3. Development of gross production (2011-2015) and foreign trade of LPG (2010-2015)

	2011	2012	2013	2014	2015	Structure refinery[36] (%)	Rate of change (%) 2015/2014
PRODUCTION	1 439	1 701	1 712	1 575	1 699	2.6	7.9

	TOTAL ANNUAL						STRUCTURE (%)	Rate of change (%) 2015/2014
	2010	2011	2012	2013	2014	2015		
IMPORTS	801	569	355	326	643	780	66.4 %	21 3 %
EXPORTS	228	249	300	398	425	395	33.6 %	-7.1 %
BALANCE EXPORTS - IMPORTS	**-573**	**-320**	**-55**	**72**	**-218**	**-385**	**100.0 %**	**76.6 %**

Source: Annual Statistical Report 2015 Cores; Units: thousands of tonnes.

[36] Gross refinery production of LPG in 2015: 2.6 % Petrol: 14 %; Kerosene 14.6 %; Diesels: 42.3 %; Fuel oils: 6.1 %; Other products (refinery gas, naphtha, coke, etc.): 20.3 %. Total: 64 985 thousand tonnes.

II.4. HYDROGEN

GENERAL DESCRIPTION

With different levels of approximation, there have been experimental applications of hydrogen in all means of transport, either as the main propulsion system or in auxiliary power units (APUs).

In the maritime sector, Spain has developed several demonstration projects for hydrogen use in small leisure craft and in back-up systems of ships and submarines[37]. In the aviation sector, it has been tested for propulsion of unmanned aircraft (drones). In the case of the railway sector, the public company RENFE led a project, funded by the Connecting Europe Facility (CEF), to study the needs in rail infrastructure for the use of mobile equipment driven by fuel cells powered with hydrogen, and the technical, economic and regulatory feasibility of this. From the planned tests, the project will obtain information on the behaviour of vehicles, maintenance needs, consumption, performance, range, efficiency, points for improvement, etc., in order to optimise the design and operation of future rail infrastructure.

In any case, road transport[38] emerges as having the most potential for the use of hydrogen in the short to medium term. Among the various propulsion technologies for vehicles, the one with the best prospects to be competitive is the hydrogen-powered fuel cell in electric vehicles.

PRODUCTION AND CONSUMPTION OF HYDROGEN

Hydrogen is not an energy source but an energy carrier, which can therefore be obtained by various technologies. Technologies for hydrogen production, ranked according to the level of current implementation in Spain are:

- Reforming hydrocarbons or alcohols: Most of the hydrogen used in Spain is produced by reforming natural gas in oil refineries. It is a process with high energy efficiency (70-85 %) but uses natural gas, which is largely a fossil fuel, and generates CO_2.

- Water electrolysis: This process involves the decomposition of a water molecule into two gases - oxygen (O_2) and hydrogen (H_2) - by means of an electric current.

- Gasification of coal or biomass.

However, there are other developing production processes such as thermolysis, photocatalysis and biochemical production.

At present, the hydrogen consumed in Spain is intended for industrial uses: in particular, in the chemical and petrochemical sector. Additionally, it is used in the food industry, glassmaking, steel production, etc. Compared with that, the consumption of hydrogen in the transport sector is negligible.

Hydrogen can be stored as compressed gas, as liquid or in solid materials. The choice of one or other form of storage will depend on the intended application.

[37] In this regard , the public company Navantia is developing a system for the production of hydrogen on board by reforming bio-ethanol for the S-80 submarine.

[38] Mainly in cars and buses and, to some extent, in forklifts and small vehicles used for the provision of public services (water cleaners).

Today, storage tanks for hydrogen in gas form have largely undergone great technological development. They can store the gas by reducing considerably the volume it occupies. Therefore, this is the storage system that is being implemented in the transport sector.

The great potential of using hydrogen in transport is based on making its renewable production viable through electrolysis technology using renewable electricity. This would contribute to a twofold objective: (1) Reduce local pollutant emissions and greenhouse gases throughout the production cycle and (2) Harness surplus renewable energy (wind and solar) generated in the hours of lower electricity consumption as this allows storage of energy. In this area, Spain has undertaken the following experimental projects, among others:

- ELYGRID[39] (2011-2014) and ELYNTEGRATION[40] (2015-2018): involving implementation of a traditional alkaline electrolysis system for electricity management systems in networks with high penetration of renewable energies.

- ELY4OFF[41] (2016-2019): Improved electrolysis system for managing electricity in networks with high penetration of renewable energies.

- RENOVAGAS 'Renewable Natural Gas Generation' project based on the Power to Gas technology to develop a production plant for synthetic natural gas from biogas by methanation of hydrogen obtained from renewable sources. It is led by ENAGAS and has the participation of the Centro Nacional del Hidrógeno (CNH 2), Abengoa Hidrógeno, Gas Natural Fenosa and FCC AQUALIA, the Tecnalia Research & Innovation Foundation and the Institute of Catalysis and Petrochemistry of CSIC (ICP-CSIS).

- SOTAVENTO: Development of a system of hydrogen production from wind energy in Galicia.

- ITHER: Project for the implementation of an infrastructure for hydrogen production from renewable energy from a wind farm and a photovoltaic solar plant, for storage and use in fuel cells. In 2010 it received an award from the International Energy Agency.

- HYUNDER[42] (2012-2014): Project to study the feasibility and business models associated with the use of mass hydrogen storage underground to balance the network when large amounts of renewable generation are added to electricity mix.

- ZEROHYTECHPARK[43]: Project aims to create sustainable technology parks with practically no emissions by using hydrogen generation from renewable sources for use in sustainable mobility, and by implementing energy efficiency measures in the different infrastructures of such parks.

[39] Financed by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) and coordinated by the Foundation for the Development of New Hydrogen Technologies in Aragón with the participation of the Spanish company Ingeteam Power Technology, SA; http://www.elygrid.com/

[40] Financed by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU 2) and coordinated by the Foundation for the Development of New Hydrogen Technologies in Aragón with the participation of Instrumentation and Components SA (INYCOM); http://elyntegration.eu/

[41] Financed by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) and coordinated by the Foundation for the Development of New Hydrogen Technologies in Aragón with the participation of Instrumentation and Components SA and Epic Power Converters SL.

[42] Financed by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) and coordinated by the Foundation for the Development of New Hydrogen Technologies in Aragon.

[43] Financed by the LIFE + programme and coordinated by the Foundation for Development of New Technologies of Hydrogen in Aragón with the participation of Walqa Technological Fleet (Huesca), the Andalusia Technology Fleet and Technology Fleet of Biscay.

In addition, Spain has a unique reference installation for hydrogen which belongs to the State: the National Centre for Experimentation in Hydrogen Technology and Fuel Cells (CNH 2).

Finally, some Autonomous Communities are also engaged in regional initiatives in this regard, including:

- Under the Programme to Promote Industries for Sustainable Mobility (PIMS) of the Catalan Industrial Strategy 2014-2020, a feasibility study was conducted on the use of hydrogen in transport.

- The Canary Islands Technological Institute (ITC) has developed a demonstration project called HYDROHIBRID that involves the use of hydrogen as an energy vector for the use of photovoltaic and wind energy in mobility.

- In Murcia, there is a development project of a technological line for integrating technologies for electrical and hydrogen power based on energy of photovoltaic origin along with technologies for the intelligent management of recharging, co-funded by the ERDF programme.

II.5. BIOFUELS

GENERAL DESCRIPTION[44]

Biofuels[45] are renewable fuels used in the transport sector. They may be liquid (bioethanol, biodiesel or HVO) or gas (biomethane). They are produced from biomass, meaning the biodegradable fraction from energy crops; from products, waste and residues of biological origin from agriculture, forestry and related industries including fisheries and agriculture; and from the biodegradable fraction of industrial and municipal waste. In Spain the following five types are currently produced on an industrial scale:

- Biodiesel: An ester produced from the reaction of vegetable oils or animal fats with an alcohol. Both in Spain and in the rest of the EU the most commonly used first-use oils are palm oil[46,] rapeseed, soya and sunflower; used oils and residual animal fats are also significant. Currently, production of biodiesel from algae is being studied.

- HVO (hydrotreated vegetable oil): is produced by hydrogenation, i.e., the direct addition of hydrogen at low pressure and in the presence of a catalyst. It can be manufactured both in oil refineries and in specific plants, based on the same raw materials used for the production of biodiesel (palm, rapeseed, soya, sunflower, etc.)

- Bioethanol: Ethyl alcohol produced from the fermentation of sugars found in organic matter. The main raw materials used in its production are sugary or starchy biomass such as sugar cane, beet or cereals. The development of advanced enzymes

[44] The data in this section come from the National Commission Markets and Competition (CNMC) unless otherwise indicated. To calculate this the following densities have been used under the Resolution of December 27, 2013 of the Ministry of Energy: Biodiesel = 0.8919 tonnes/m^3; HVO = 0.7727 tonnes/m^3; Bioethanol = 0.7778 tonnes/m^3.
To calculate consumption have been used ktep energy content of the Appendix to the Order ITC/2877/2008, as amended by Resolution of December 27, 2013 of the Ministry of Energy.

[45] Biofuels primarily have two uses: transport and heating. When biofuels are used in the transport sector they are called biofuels while when liquid fuel from biomass is intended for energy uses other than transport they are called bioliquids.

[46] In 2015 65.4 % of consumption of biodiesel in Spain was obtained from palm oil, according to CNMC.

is also allowing its industrial production from lignocellulosic material present in waste from agricultural, forestry, urban and industrial sources.

- BioETBE[47] (tertbutyl ethyl ether): this is an oxygenated additive made of ethanol and isobutanol which is added to petrol to increase its octane count.

- Biogas/biomethane: Biogas is a gas composed mainly of methane (50 to 65 %) formed by degradation of organic matter in the free atmosphere (aerobic digestion process) or in the absence of oxygen (anaerobic process). Biogas refined to a methane content above 90 % is called biomethane.

In addition to these biofuels, there are others whose future application is very promising. Among these, we should note the biofuels known as BtL (Biomass-to-Liquid) produced from any biomass by gasification and subsequent liquefaction by the Fischer-Tropsch process or by isomerisation: rearrangement of atoms in molecules to resemble hydrocarbons.

The biofuels consumed in Spain meet the sustainability criteria laid down in Directive 2009/28/EC on the promotion of the use of energy from renewable sources. The Directive establishes the obligation for biofuels to reduce emissions of greenhouse gases by between 35 % and 60 % compared to fossil diesel and petrol. In addition, it is required that the raw materials used for making biofuels should not come from land with high carbon reserves or high biodiversity value, such as forests, wetlands and peatlands.

Today, biofuels are the main source of energy from renewable sources used in transport. In Spain, biofuels accounted for 3.6 % of final energy consumption for transport in 2014 while in the EU this percentage was 5.4 %[48].

Biofuels are mainly used in road transport, either completely replacing conventional fuels (petrol or diesel) or mixed with them in different proportions. Pilot projects have also been run for the use of biofuels in maritime, rail and air transport.

Their use is destined to become increasingly important in the decarbonisation of air transport, especially given the absence of other technically feasible short-and medium-term alternatives for replacing fossil [fuel] paraffin with alternative and/or renewable energies. The quality certification of biofuels for aviation is coordinated by ASTM International, which developed the ASTM D 7566 standard, thus establishing the quality parameters for aviation turbine fuels containing synthetic hydrocarbons. Since July 2011, this standard has allowed the mixing of certain percentages of biofuels in conventional paraffin. Following a review in April 2016, these are specifically as follows:

- -Biomass To Liquid- BtL obtained through gasification with subsequent lignocellulosic biomass liquefaction by the Fischer-Tropsch process (up to 50 %).

- HEFA -Hydro-processed Esters and Fatty Acids or hydrobiodiesel- produced by hydrotreating vegetable oils and animal fats (up to 50 %).

- SIP - Synthesised Iso-Paraffinic - also known as DSHC - Direct Sugar to Hydrocarbon conversion - consists of isoparaffins synthesised from fermented and hydroprocessed sugars (up to 10 %).

[47] 37 % of its energy content is considered biofuel.
[48] Source: APPA-Biocarburantes.

- ATJ - Alcohol to Jet - synthetic paraffinic kerosene is obtained from isobutanol (up to 30 %).

In July 2015 the State Aviation Safety Agency (EASA), the Ministry of Agriculture, Food and Environment (MAGRAMA), the Institute for Diversification and Saving of Energy (IDAE) and the State Company for Services and Studies for Air Navigation and Aeronautical Safety (SENASA) signed a collaboration agreement for the promotion of a 'Spanish Initiative for the production and consumption of bio-paraffin for aviation'. This collaboration agreement renews commitments in the Framework Agreement signed in 2009 which aims to achieve greater energy efficiency in the air transport sector; a more rational use of energy; and use of renewable energy sources in installations and buildings in the air transport sector. All of this is in order to reduce emissions of greenhouse gases attributable to air transport. This applies both to aircraft in operation and to airports and the necessary facilities and infrastructure, and also to support teams on land and access routes to such infrastructures.

This agreement aims to promote the development of an integrated bio-paraffin production chain for use in aviation in Spain. It covers the entire life cycle, from production of sustainable raw materials to the commercial use by aircraft. To this end, studies are under way on the effects of the production and use of bio-paraffin in various spheres, such as concerning the environment., The possibility is being assessed of analysing the entire life cycle of the product. In the economic sphere, analysis is being conducted on competitiveness, the associated job creation and economic development in the agricultural, industrial and aerospace sectors.

Finally we must include the Spanish participation in the ITAKA project led by SENASA and initiated in 2011. In Spain, the companies Repsol and Iberia are conducting pilot tests. In 2011 the first Spanish flight powered by biofuel took place - between Madrid and Barcelona.

Below are some initiatives undertaken in Spain to promote the development of biofuels in transport are as follows:

- The National Renewable Energy Centre (CENER) is a foundation established in 2002 supported by the Ministry of Economy and Competitiveness, CIEMAT, the Ministry of Industry, Energy and Tourism and the Government of Navarra. Among its main facilities is the centre for second generation biofuels. This is an installation for production processes for second generation biofuels; for tests at a semi-industrial scale for raw materials not competitive with the food industry; for the production of biofuels by different production means (thermochemical, biochemical and/or enzymatic); and for the application of biorefinery concepts.

- In the Canary Islands, a demonstration project has been set up at the Technological Institute of the Canary Islands consisting of a plant to treat waste vegetable oil to replace the fossil fuel used in the fleet of lorries belonging to the Councils of the islands of Tenerife and El Hierro.

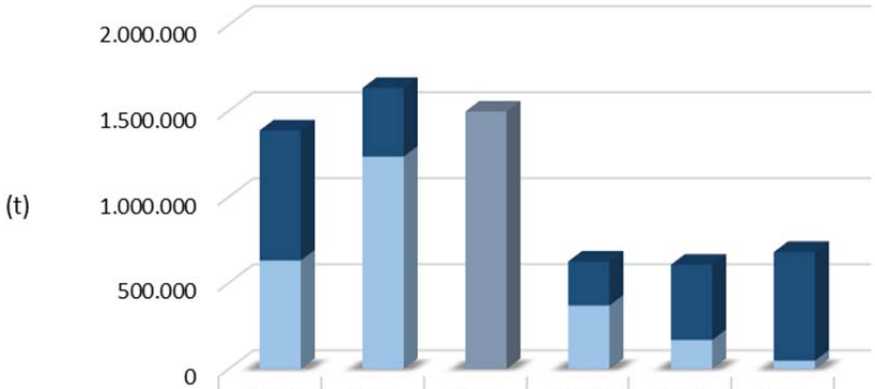
PRODUCTION AND CONSUMPTION[49]

BIODIESEL

In 2015 sales of biodiesel reached 679 810 tonnes[50]. Some 93 % of this biodiesel was manufactured in Spain, representing the largest market share for Spanish industry since 2006. The rest was imported from Germany (2.11 %), the UK (1.51 %), Italy (1.46 %) and the Netherlands (1.19 %). The biodiesel marketed in Spain was produced mainly from palm oil (65 %), soya (15 %), rapeseed oil (2 %) and frying oil (12 %). Meanwhile, the primary materials necessary to produce biodiesel originated mainly from the following countries: Indonesia (50 %), Malaysia (13 %), Spain (9.4 %), Brazil (8 %), Paraguay (5 %) and the US (2.3 %).

[49] The data in this section have been obtained from both statistics and reports of the CNMC as APPA-Biocarburantes (Association of Renewable Energy- Biofuels Section).
[50] Density = 0.8919 tonnes biodiesel/m^3 according to Resolution of December 27, 2013 the Secretary of State for Energy.

Graphic II-4. Development of annual sales of biodiesel in Spain (2010-2015)

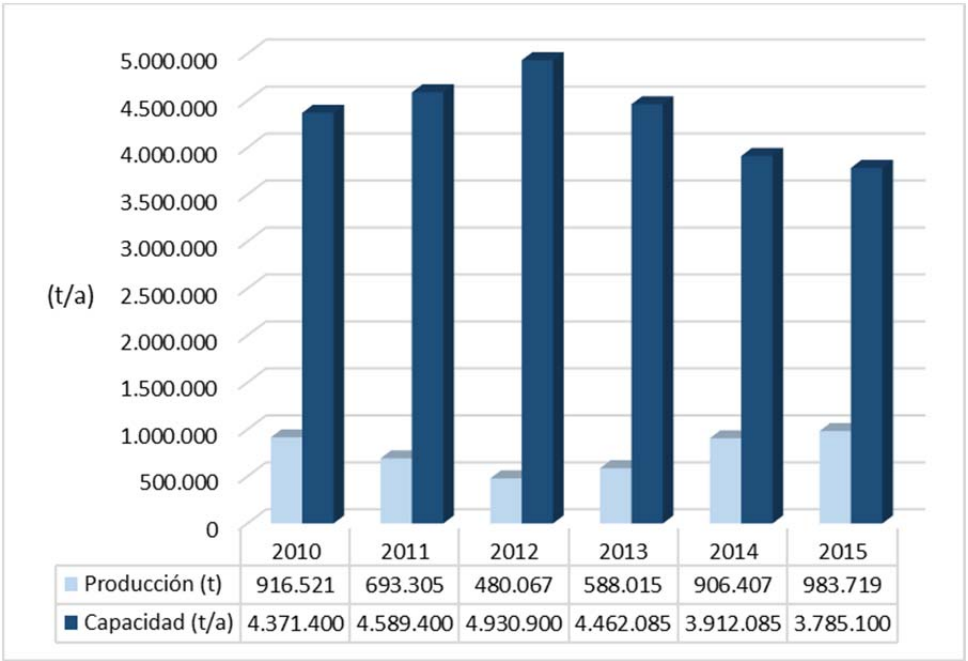


	2010	2011	2012	2013	2014	2015
TOTAL	1.386.154	1.632.900	1.495.932	624.594	605.971	679.810
Origen España (t)	756.286	399.571		256.482	438.111	631.629
Origen Otros (t)	629.868	1.233.329		368.112	167.860	48.182

Source: National Commission for Markets and Competition (CNMC). There is no source of sales for 2012.
Unit: tonnes

KEY TO FIGURE: Origin Spain (tonnes) Other Origin (tonnes)

Figure II-5. Evolution of biodiesel production and production capacity installed in Spain (2010-2015)



	2010	2011	2012	2013	2014	2015
Producción (t)	916.521	693.305	480.067	588.015	906.407	983.719
Capacidad (t/a)	4.371.400	4.589.400	4.930.900	4.462.085	3.912.085	3.785.100

Source: CNMC (production) and APPA-Biocarburantes (capacity); Units: tonnes (t) and tonnes/year (t/yr).

KEY TO FIGURE: (tonnes/year) Production (tonnes) Capacity (tonnes/year)

Since 2012 Spain has experienced a steady loss of installed capacity and also the closure of production plants. In 2015 there were 32 plants with a nominal installed capacity of 3.8 million tonnes of biodiesel per year and a ratio of use of 26 %.

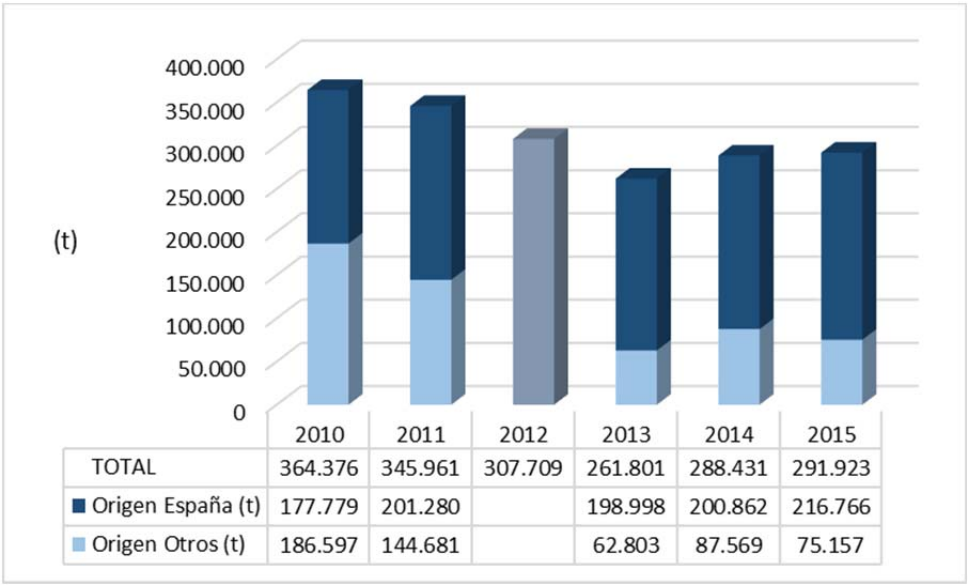
HVO

In 2015 sales of hydrotreated vegetable oil or biodiesel (HVO) were 254 904 tonnes,[51] a decrease of 7.23 % over the previous year. Some 79 % of sales were produced in Spain, with 12.3 % imported from Holland and 8.3 % from Singapore. The HVO produced in Spain came from oil refineries.

BIOETHANOL

In 2015 the 291 923 tonnes of bioethanol sold in Spain[52] was produced mainly from maize (74 %), sugar cane (19 %), beet (3 %), wheat (2 %) and grape alcohol (1 %). Some 74 % of this bioethanol was produced in Spain, representing a higher market share for the national industry than for 2014, as reflected in the graph below:

Figure II-6. Development of annual sales of bioethanol in Spain (2010-2015)



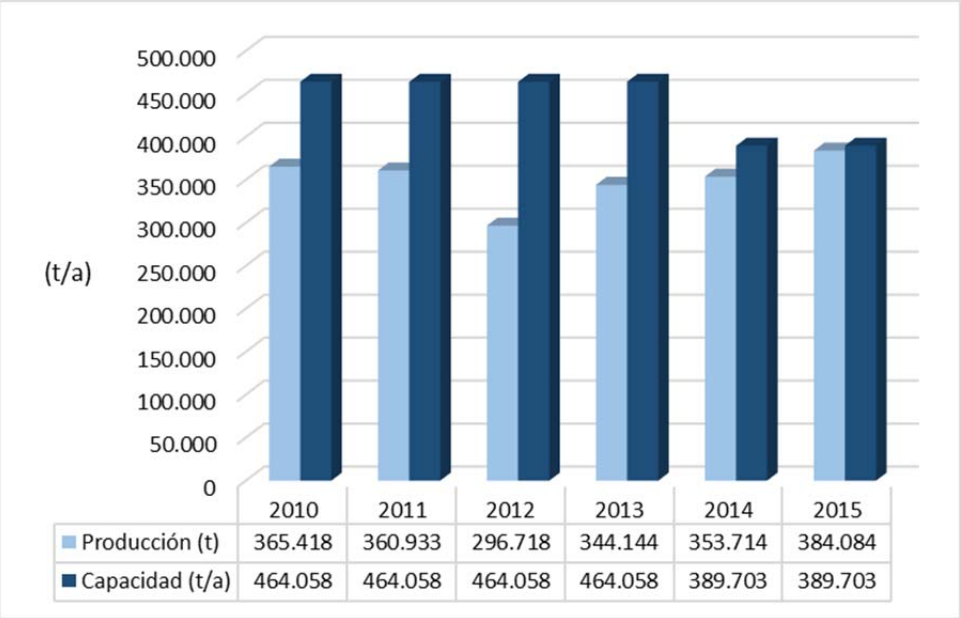
	2010	2011	2012	2013	2014	2015
TOTAL	364.376	345.961	307.709	261.801	288.431	291.923
Origen España (t)	177.779	201.280		198.998	200.862	216.766
Origen Otros (t)	186.597	144.681		62.803	87.569	75.157

Source: National Commission for Markets and Competition (CNMC). There is no information on origin for sales for 2012; Units: tonnes (t).

KEY TO FIGURE: Origin Spain (tonnes) Other Origin (tonnes)

[51] Density HVO = 0.7727 tonnes/m^3 according to the Resolution of 27 December 2013 of the Secretary of State for Energy.
[52] Density Bioethanol = 0.7778 tonnes/m^3 according to the Resolution of 27 December 2013 of the Secretary of State for Energy.

Figure II-7. Development of bioethanol production and installed capacity (2010-2015)



	2010	2011	2012	2013	2014	2015
Producción (t)	365.418	360.933	296.718	344.144	353.714	384.084
Capacidad (t/a)	464.058	464.058	464.058	464.058	389.703	389.703

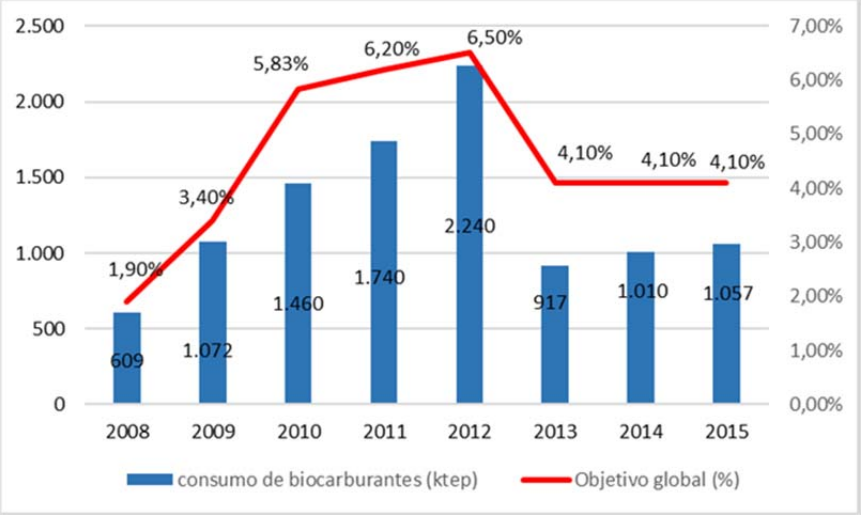
Source: CNMC (production) and APPA-Biocarburantes (capacity); Data in tonnes (production) and tonnes/year (capacity).

KEY TO FIGURE: (tonnes/year) Production (tonnes) Capacity (tonnes/year)

These plants produced 384 084 tonnes of bioethanol, which represented an increase of 9 % over the previous year. Some 56 % of this production is for the domestic market and the rest for export. Production plants recorded a rate of utilisation of installed capacity of 100 % in 2015.

The consumption of biofuels in Spain is in essence supported by the minimum mandatory targets for sale or consumption of biofuels for transport purposes, which have been legally established since 2008. Analysis of the historical development of the use of biofuels shows that it has diminished by about 50 %, from 2 240 thousand tonnes of oil equivalent (ktoe) in 2012 to 1057 ktoe in 2015. This is in line with the reduction of the minimum mandatory targets set by the Government in 2013. However, in December 2015 the Government approved a Royal Decree that raises the minimum overall mandatory target to 8.5 % of energy content in 2020.

Figure II-8. Development from 2008 to 2015 of the consumption of biofuels and of the mandatory minimum sales or consumption targets set



Source: CNMC except for the 2008 figure which comes from APPA-Biocarburantes based on data from Eurostat; Units: kilotons of oil equivalent (ktoe).

KEY TO FIGURE: consumption of biofuels (ktep) Overall target (%)

The European Environment Agency (EEA) estimates that biofuels consumed in the EU in 2014 prevented the consumption of nearly 13 million tonnes of oil equivalent (TOE) as stated in its report 'Renewable energy in Europe 2016 - Recent growth and knock-on effects' (2016). In addition, 75 %[53] of biofuels consumed in the European Union (EU) are produced inside the EU, mainly using primary materials grown or generated in Europe.

[53] Source: Renewable energy progress report of the European Commission published in 2015.

III. ROAD TRANSPORT

III.1. NATURAL GAS

III.1.1. GENERAL DESCRIPTION

The following types of natural gas vehicles are currently available on the market:

- Bi-fuel: these have two separate tanks, one for conventional fuel and other for natural gas, with individual engine supply circuits. They use one fuel or the other depending on their availability.

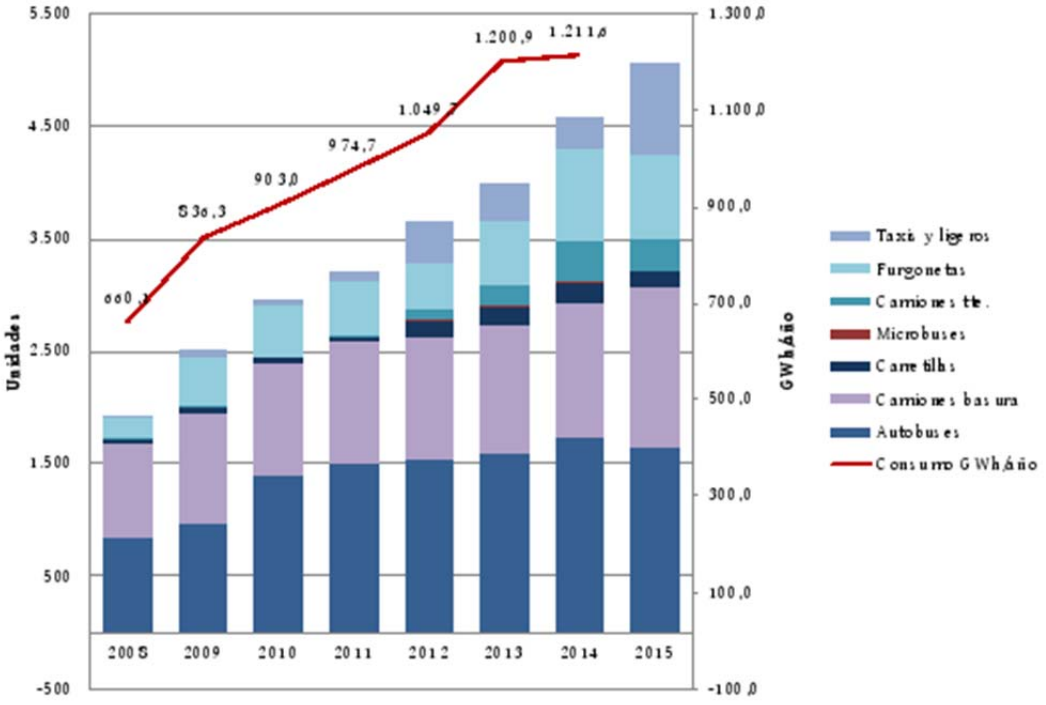
- Mono-fuel (also called 'dedicated'): these use natural gas but have a small separate conventional fuel tank in case of emergency.

- Dual: System designed for diesel engines in which the engine cannot run exclusively on natural gas, but needs to mix in a certain proportion of diesel to allow fuel ignition by pressure. This technology applies primarily to heavy vehicles.

CONSUMPTION OF NATURAL GAS VEHICLE FLEET

In 2015, consumption of natural gas in road transport was approximately 0.38 % (1 212 GWh)[54] compared to the total consumption in Spain.

Figure III-1. Development of estimated consumption of natural gas in road transport (2008-2015)



[54] Estimated natural gas consumption in the transport fleet = 1 212 GWh by 2015 (Source: GASNAM)
Natural gas consumption in Spain = 314 210 GWh in 2015 (Source: Annual Statistical Report 2015 CORES).

Source: Estimate by GASNAM.

KEY TO FIGURE:
Vertical text: Units GWh/year
Legend on right:
Taxis and light vehicles
Small vans
Lorries
Mini-buses
Light lorries
Refuse lorries
Buses
Consumption in GWh/year

Table III-1. Development of estimated consumption of natural gas in road transport (2008-2015)

	2008	2009		2010		2011		2012		2013		2014		2015	
	units	units	Consumption GWh/year	units	Consumption GWh/year	units	Consumption GWh/year	units	Consumption GWh/year	units	Consumption GWh/year	units	Consumption GWh/year	units	Consumption GWh/year
Buses	846	962.0	384.8	1 392	556.8	1 501	600.4	1 531	612.4	1 591	636.4	1 728	691.2	1 649	659.6
Refuse lorries	821	991.0	247.8	1 008	252.0	1 088	272.0	1 101	275.3	1 140	285.0	1 200	300.0	1 414	353.5
Light lorries	43	43.0	4.3	43	4.3	43	4.3	137	13.7	154	15.4	174	17.4	153	15.3
Mini-buses	2	2.0	0.2	2	0.2	2	0.2	16	1.6	18	1.8	21	2.0	3	0.3
Goods vehicles	10	10.0	4.0	10	4.0	10	4.0	91	36.4	182	72.8	364	145.6	281	112.4
Vans	180	445.0	15.6	445	15.6	475	16.6	410	14.4	574	20.1	804	28.2	753	26.4
Taxis and light vehicles	33	61.0	3.4	62	3.4	100	5.5	380	20.9	331	18.2	300	16.5	803	44.2
TOTAL	**1 935**	**2514.0**	**660.1**	**2 962**	**836.3**	**3 219**	**903.0**	**3 666**	**974.7**	**3 990**	**1 049.7**	**4 590**	**1200.9**	**5 056**	**1211.6**

Source: Estimate by GASNAM.

Regarding the average consumption by type of vehicle, a CNG passenger car consumes approximately 3.5 kg for 100 km while the average consumption of a long distance lorry powered by LNG is between 28 and 30 kg LNG per 100 km, depending on the route.

POLLUTANT EMISSIONS FROM NATURAL GAS VEHICLES[55]

Natural gas has an average emission of 55-56 tonnes of CO_2 per terajoule according to the National Emission Inventory of the Ministry of Agriculture, Food and Environment. This represents between 22-25 % less than the emissions per unit of energy for conventional fuels (diesel/petrol). The sources consulted (JRC[56], 2014; EMT Madrid; TMB Barcelona) put the average emissions of CO_2 per km at

[55] All information contained in this section was contributed by the Ministry of Agriculture, Food and Environment.
When analysing pollutant emissions from vehicles, we must distinguish two different approaches. On the one hand, the emission capacity of pollutant gases or substances inherent in the fuel itself (natural gas); and on the other, emissions caused by poor combustion of engines (the better the combustion less CO_2 per unit of energy produced). This means that the same emissions do not occur when using the same fuel in different engines because of the differences in efficiency of those engines.
[56] JRC-Joint Research Centre-EUCAR-CONCAWE 'Well-to-Wheels analysis of future automotive fuels and powertrains in the European context WELL-TO-TANK (WTT) Report' 4th Version, 2014.
The following were involved in this study: the European Commission (through the JRC), the European refining sector (represented by CONCAWE, the European association of oil companies for environmental protection and health) and European vehicle manufacturers (through the European association R & D vehicle manufacturers).

around the level of emissions from diesel, and lower than those from petrol. However, there are other sources which put the average emissions of CO_2 from natural gas at 10 % lower than diesel (INSIA, 2009). In any case, the officially established limits[57] should be consulted for the equivalence of each model.

From the point of view of climate change mitigation, the introduction of natural gas in transport also opens the way to biomethane. This is because the refuelling infrastructure, which is being installed, and the vehicles themselves can encourage future use of biomethane, with very significant reductions of greenhouse gases compared with conventional fuels.

As for local pollutant emissions, natural gas contains no sulphur so there are no emissions of SO_X. Regarding nitrogen oxides, according to the latest methodologies used by the National Emissions Inventory[58] of the Ministry of Agriculture, Food and Environment, cars powered by natural gas emit an average of 0.056 g of NO_X per km, representing a reduction of 8 % and 73 % compared with medium type passenger cars (1.4-2.0 L engine and Euro VI technology) powered by petrol and diesel, respectively. Meanwhile, emissions of particulate matter in passenger cars powered by natural gas are at 0.0011 g/km of PM2.5, which is on average 21-93 % lower than those of passenger cars powered with petrol and diesel, respectively.

The main characteristics of LNG and CNG vehicles are summarised below.

Table III-2. Main characteristics of LNG and CNG vehicles

MAIN CHARACTERISTICS OF LNG AND CNG VEHICLES	
PERFORMANCE	CNG light and heavy vehicles for urban use (around 250 hp): Performance similar to conventional fuels. LNG in long-haul lorries (over 26 tonnes): the engine power is slightly below the average achieved by diesel engines (430 hp) although the latest developments reach 400 hp, and there are planned launches for 2017 with 430 and 460 hp, which is why a large increase in the fleet is expected in the short/medium term.
RANGE	CNG: Tourism = 400km; Lorry and suburban commuter bus = 500km; Achieves sufficient independent range for transport (light and heavy) in metropolitan areas. LNG: Lorry = 1 500 km; Allows enough to achieve sufficient range for international heavy transport.
EMISSIONS	Especially advised to reduce local emissions (particulate matter, SO_X and NO_X) CO_2 emissions from natural gas are lower than for petrol but similar to diesel.
PRICE	Fuel price: The final retail price for natural gas is lower than for conventional fuels. Vehicle price: The purchase price of natural gas-powered cars can be considered to be about 5 % higher than for petrol cars and can be compared to the price of diesel vehicles. The entry into force of the Euro VI standard entails higher acquisition and maintenance costs and prices for diesel vehicles due to the filters and catalysts required for compliance with emission limits, which means a reduction in the difference in the initial investment for a CNG/LNG vehicle and a Euro VI diesel vehicle.
REFUELLING	There is no technical limitation to supplying CNG anywhere in the country thanks to the gas pipeline network. The LNG satellite plants mean that LNG can be available throughout the national territory with the potential to create supply points in places where there is demand.
OPERATION	For CNG and LNG operation, the procedure at refuelling points is similar to conventional fuel. LNG requires some special safety measures for refuelling because of its low temperature. LNG cannot be stored in the tanks of vehicles for weeks as it progressively evaporates (boil off), so it is more appropriate for long-distance heavy goods vehicles.

Source: Prepared in-house.

This study concludes that natural gas can present CO_2 emissions lower than those from petrol (between 0-30 %) but higher than fromconventional direct injection diesel engines (between 0-15 %).

[57] Regulation (EU) No 459/2012 of the Commission of 29 May 2012 amending Regulation (EC) No 715/2007 of the European Parliament and of the Council and Regulation (EC) No 692 are amended/2008 of the Commission with regard to emissions from passenger cars and light commercial vehicles (Euro 6).

[58] EMEP/EEA Guidebook 2013.

III.1.2. CURRENT SITUATION

FLEET AND REGISTRATION OF VEHICLES POWERED BY NATURAL GAS

The preceding tables presented an estimation of the fleet and its distribution by type of vehicle, compiled by GASNAM, according to data provided by the Directorate-General for Traffic (DGT). However in June 2016, the fleet of vehicles powered by natural gas totalled 4613 units: 95 % CNG and 5 % LNG.

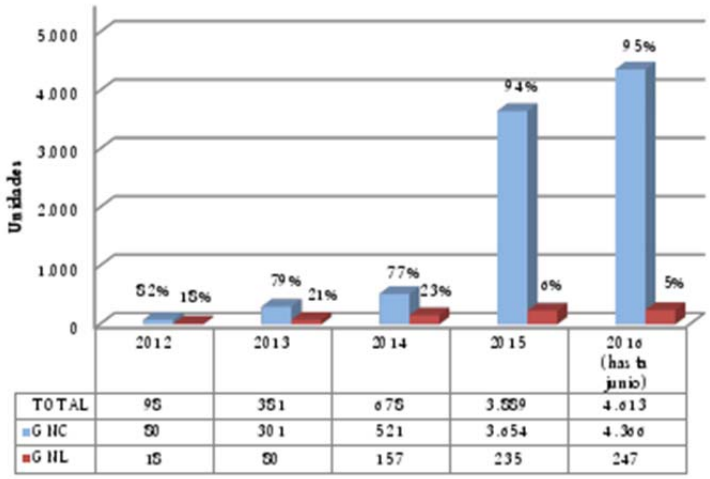
Table III-3. Development of the fleet of vehicles powered by CNG and LNG (December 2012-June 2016)

CNG FLEET	2012	2013	2014	2015	2016 (up to June)
Lorries up to 3500kg	5	11	15	173	176
Lorries over 3500kg	10	56	63	1 324	1 374
Vans	10	88	157	369	437
Motorcycles	0	0	1	1	1
Cars	4	14	107	308	792
Others	51	132	178	1 479	1 586
TOTAL	**80**	**301**	**521**	**3 654**	**4 366**

LNG FLEET	2012	2013	2014	2015	2016 (up to June)
Lorries > 3500kg	0	0	4	5	5
Others	18	80	153	230	242
TOTAL	**18**	**80**	**157**	**235**	**247**

Source: DGT from data existing at June 2016.

Graphic III-1 Development of fleet of vehicles powered by CNG and LNG (December 2012-June 2016)



Source: DGT from data existing in June 2016.

KEY TO FIGURE:
Units (until June)
TOTAL
CNG
LNG

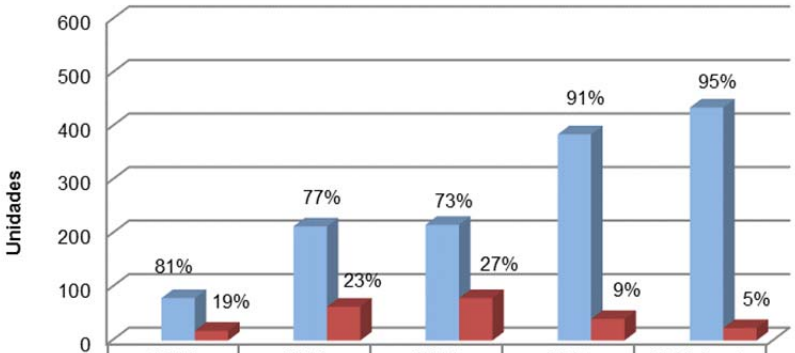
Table III-4. Development of registrations of vehicles powered by CNG and LNG (2012- June 2016)

CNG REGISTRATIONS	2012	2013	2014	2015	2016 (up to June)
Lorries to 3500	5	6	5	39	3
Lorries over 3500kg	10	42	4	37	49
Vans	10	78	69	92	51
Motorcycles	0	0	1	0	0
Cars	4	9	92	143	270
Others	50	78	4.5	74	62
TOTAL	**79**	**213**	**216**	**385**	**435**

LNG REGISTRATIONS	2012	2013	2014	2015	2016 (up to June)
Lorries> 3500kg	0	0	4	1	0
Others	18	63	75	39	2.3
TOTAL	**18**	**63**	**79**	**40**	**2.3**

Source: DGT from data existing in June 2016.

Graphic III-2. Development of registrations of vehicles powered by CNG and LNG (2012- June 2016)



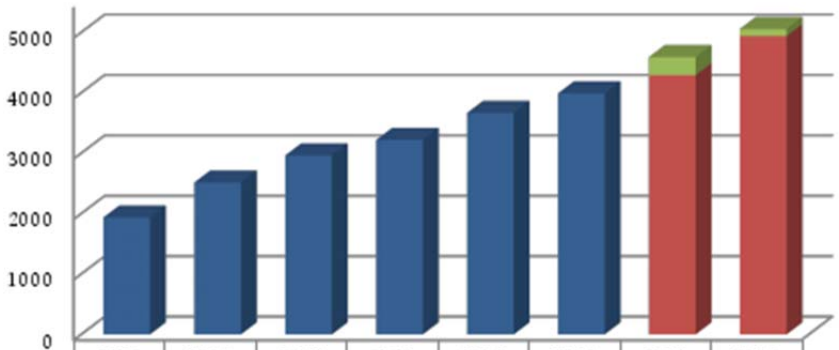
	2012	2013	2014	2015	2016 (hasta junio)
TOTAL	97	276	295	425	458
GNC	79	213	216	385	435
GNL	18	63	79	40	23

Source: DGT from data existing in June 2016.

KEY TO FIGURE:
Units (until June)
TOTAL
CNG
LNG

It should be noted that the official data of the DGT does not count all the vehicles adapted in workshops not belonging to the manufacturer. In order to know the total number of vehicles, the Iberian Association of Natural Gas for Mobility (GASNAM) conducted various analyses leading to an estimate of a fleet of 5 056 vehicles (4 938 CNG and LNG 118) in December 2015.

Graphic III-3 Estimated number of vehicles powered by CNG and LNG (December 2008- December 2015)



	2008	2009	2010	2011	2012	2013	2014	2015
Nº total vehículos GN	1.935	2.514	2.962	3.219	3.666	3.990	4.590	5.056
GNL							300	118
GNC							4.290	4.938

Source: GASNAM.

KEY TO FIGURE:
Total No. of NG vehicles
LNG
CNG

The CNG fleet consists of vehicles of different types: cars, vans and heavy urban vehicles, i.e. buses with daily itineraries of less than 300km and lorries up to 26 tonnes. LNG, on the other hand, is currently used only in lorries transporting goods over long distances and with large tonnage (over 26 tonnes).

It is particularly relevant that 90 % of CNG vehicles belong to fleets. Among these, public service fleets are notable for the use of CNG heavy vehicles, mainly buses and refuse collection lorries. According to the estimates of GASNAM, the latter represent 66 % of vehicles of this type. About 20 Spanish cities have urban and intercity buses using natural gas. Its use is particularly significant in the following cities: Madrid[59] and its metropolitan area[60], Barcelona, Seville[61], Málaga, Valencia, Palma de Mallorca, Murcia, Toledo, Salamanca, Burgos and Guadalajara. Among the cities with refuse collection lorries powered by CNG are: Madrid[62], Barcelona, Vitoria, Oviedo, Gijón, Palma de Mallorca, A Coruña and Tarragona.

In the light vehicles segment, CNG taxis are registering significant annual increases in the metropolitan areas of Madrid and Barcelona, although there are no aggregate data at the national level.

Currently long-haul LNG lorries represent a very small percentage of the total lorry fleet; however, a gradual increase is expected in the coming months, after the appearance on the market of a 400hp tractor with LNG power in June 2016. It has been announced that 460 hp LNG lorries will appear on the market in 2017/2018, which will contribute to bringing LNG lorries into line with the current average power for heavy transport vehicles in Spain (430 hp). In addition, several manufacturers are developing long-distance buses using LNG.

MANUFACTURE AND SALE OF NATURAL GAS VEHICLES IN SPAIN

In Spain two models of natural gas vehicles are manufactured: the Seat Leon and Iveco Stralis. Seat manufactures two versions of a CNG passenger car: the Seat Leon (Leon 1.4 and Leon 1.4S) in the Martorell plant (Barcelona) since 2014. In Madrid Iveco has been manufacturing its Stralis lorry in three versions (CNG only, LNG only and mixed) since 2011.

Table III-5. Models of natural gas vehicles manufactured in Spain in September 2016

BRAND	FACTORY	MODEL	VERSION	MANUFACTURING START YEAR
SEAT	Martorell (Barcelona)	Passenger car: Leon	Leon 1.4	2014
			Leon ST 1.4	
IVECO	Madrid	Lorry over 3 500 kg: Stralis	Stralis LNG	2011
			Stralis CNG	
			Stralis CNG/LNG	

Source: ANFAC.

[59] The Municipal Transport Company of the municipality of Madrid (EMT Madrid) has in operation 800 CNG buses and in late 2016 plans to buy 170 new buses which will mean that 50 % of the total fleet of buses is CNG.
[60] The concessionaire public transport company operating in the Madrid municipalities of Pinto, Valdemoro and Ciempozuelos has 25 buses powered by CNG which account for 10 % of its fleet.
[61] 47 % of the total fleet (400 units) of city buses in Seville use CNG. Source: Gasactual Magazine No. April/June 2016, Sedigas.
[62] 100 % of the fleet of refuse collection lorries in the municipality of Madrid (650 vehicles in 2015) is CNG.

In Spain more than 480[63] versions of models manufactured under nine brands are sold. It is also possible for qualified repair shops to adapt petrol passenger cars registered from 2002 to CNG, and some companies convert diesel lorries to CNG through a dual system.

EXISTING REFUELLING INFRASTRUCTURE

According to the Geoportal of the Ministry of Industry, Energy and Tourism, Spain has 39 refuelling stations accessible to the public[64], of which ten are mixed (CNG/LNG), five are LNG only and 24 are CNG. There are also 69 private refuelling stations serving CNG fleets[65].

Regarding the refuelling stations under construction or awaiting opening to the public, the Iberian Association of Natural Gas for Mobility (GASNAM) is aware that, as of June 2016, there were 20 in existence of which 11 are exclusively for CNG and 9 mixed LNG/CNG.

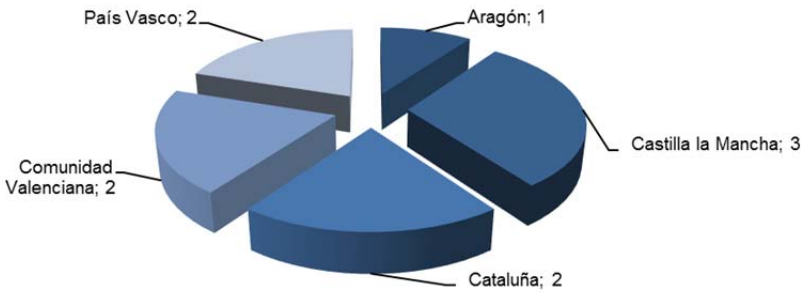
Table III-6. Mixed refuelling stations LNG/CNG accessible to the public by province in June 2016

MIXED CNG/LNG REFUELLING STATIONS			
AUTONOMOUS COMMUNITY	**PROVINCE**	**TOTAL PROVINCE**	**TOTAL AC**
Aragon	Zaragoza	1	1
Castile-La Mancha	Guadalajara	2	3
	Cuenca	1	
Catalonia	Barcelona	1	2
	Tarragona	1	
Valencian Community	Valencia	1	2
	Alicante	1	
Basque Country	Álava	1	2
	Viscaya	1	
TOTAL		**10**	**10**

Source: Geoportal of the Ministry of Industry, Energy and Tourism.

[63] Source: Catalogue of vehicles taken from the IDAE vehicle database for managing the acquisition incentives of the MOVEA Plan.
[64] Appendix B includes details of these.
[65] Source of private CNG stations: Iberian Association of Natural Gas for Mobility (GASNAM). Appendix B includes details of these.

Graphic III-4. Mixed LNG/CNG refuelling stations accessible to the public by Autonomous Community in June 2016



Key: País Vasco: Basque Country

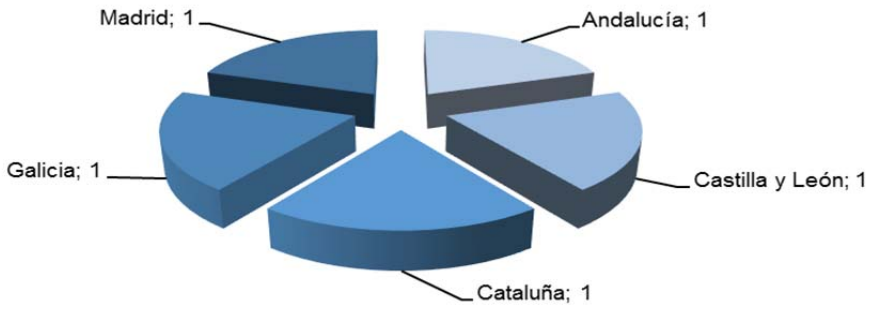
Source: Geoportal of the Ministry of Industry, Energy and Tourism.

Table III-7. LNG-only refuelling stations accessible to the public by province in June 2016

LNG REFUELLING STATIONS			
AUTONOMOUS COMMUNITY	**PROVINCE**	**TOTAL PROVINCE**	**TOTAL AC**
Andalusia	SEVILLA	1	1
Castile and Leon	BURGOS	1	1
Catalonia	BARCELONA	1	1
Galicia	A CORUÑA	1	1
Madrid	MADRID	1	1
TOTALS		**5**	**5**

Source: Geoportal of the Ministry of Industry, Energy and Tourism.

Graphic III-5. LNG-only refuelling stations accessible to the public by Autonomous Community in June 2016



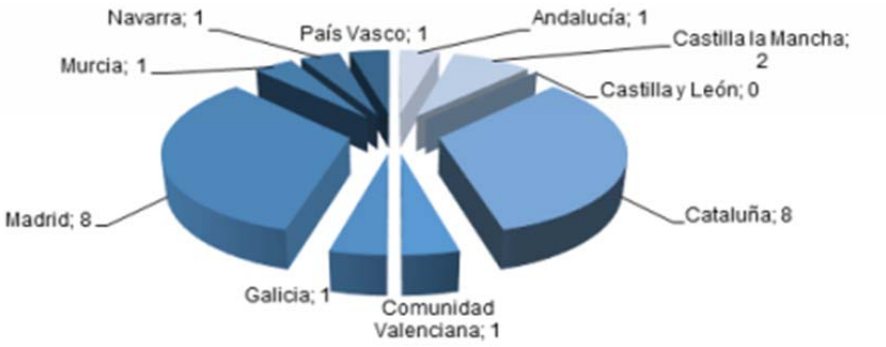
Source: Geoportal of the Ministry of Industry, Energy and Tourism.

Table III-8. **CNG-only refuelling stations accessible to the public by province in June 2016**

CNG FILLING STATION			
Autonomous Community	**Province**	**Total by Province**	**TOTAL by AC**
Andalusia	Sevilla	1	1
Castile-La Mancha	Toledo	1	2
	Guadalajara	1	
Castile and Leon	Burgos	0	0
Catalonia	Barcelona	8	8
Community of Valencia	Valencia	1	1
Galicia	Ourense	1	1
Madrid	Madrid	8	8
Murcia	Murcia	1	1
Navarra	Navarra	1	1
Basque Country	Guipúzcoa	1	1
TOTALS		**24**	**24**

Source: Geoportal of the Ministry of Industry, Energy and Tourism.

Graphic III-6. CNG-only refuelling stations accessible to the public by Autonomous Community in June 2016



Source: Geoportal of the Ministry of Industry, Energy and Tourism.

Table III-9. Natural gas refuelling stations accessible to the public under construction or pending opening in June 2016

AUTONOMOUS COMMUNITY	PROVINCE	MIXTAS LNG/CNG	LNG	CNG
Andalusia	Sevilla	1		
	Granada	1		
	Cádiz	1		
	Total Andalusia	3	0	0
Aragón	Zaragoza			2
	Total Aragón	0	0	2

Asturias	Asturias			1
	Total Asturias	0	0	1
Catalonia	Barcelona	2		1
	Girona	2		
	Total Catalonia	4	0	1
Madrid	Madrid	1		6
	Total Madrid	1	0	6
Basque Country	Álava			1
	Total Basque Country	0	0	1
Valencia	Valencia	1		
	Total Valencia	1	0	0
TOTAL		**9**	**0**	**11**

Source: GASNAM.

The main stumbling block in the development of natural gas is the significant investment necessary for the construction of refuelling stations. This is around €500 000 for CNG stations with two refuelling points, and €800 000 for LNG for mixed stations with one LNG and two CNG refuelling points.

In order to provide relevant, clear and consistent information about the location of refuelling points, as provided for in Article 7 of Directive 2014/94/EU concerning information to users, the Ministry of Industry, Energy and Tourism publishes information about the location of active CNG and LNG refuelling points[66] as well as the prices charged in real time through the Geoportal[67].

Complementarily to this, the Iberian Association of Natural Gas for Mobility (GASNAM) publishes on its website[68] the locations of refuelling stations, both CNG and LNG. Some of these refuelling stations require users to be existing customers before refuelling, meaning that there are different degrees of public accessibility. Similarly, the Catalan Energy Institute (ICAEN) publishes[69] a map with publicly accessible points for refuelling NGVs in Catalonia.

III.1.3. EXPECTED MARKET DEVELOPMENT AND OBJECTIVES

OPPORTUNITIES

The expected market trend is characterised by opportunities linked to the implementation of natural gas in road transport:

Table III-10. Opportunities for use of natural gas in road transport

OPPORTUNITIES FOR USE OF NATURAL GAS IN ROAD TRANSPORT

[66] Active means refilling stations that are not temporarily or definitively closed, and which have submitted prices of the reference products in the last two weeks. The natural gas marketing companies are not legally obliged to provide such data to the Ministry of Industry, Energy and Tourism and therefore company submission of data is a matter of recommendation.

[67] http://www.minetur.gob.es/energia/es-ES/Servicios/Paginas/consultasdecarburantes.aspx

[68] http://gasnam.es/estaciones-gas-natural-vehicular

[69] http://icaen.gencat cat/es/pice_ambits_tematics/pice_l_energia_als_transports_/pice_la_diversificacio_energetica_del_sector_transport/#FW_bloc_2ebf63f2-26d2-11e4-964f-000c29cdf219_2

INDUSTRIAL OPPORTUNITY	Encouraging the supply from manufacturers of vehicles and equipment. Future development of LNG engines over 400 hp. Positive effect on intensive industrial fabric in natural gas consumption (75 % of domestic demand) due to the reduction of road-tolls that could lead to increased consumption for transportation. Natural gas engines can consume a mixture of natural gas and 25 % hydrogen without losing performance, opening the door to the use of hydrogen in transport
ENERGY OPPORTUNITY	Allowing diversification of primary energy sources, resulting in security of supply. Increase demand for the gas system without the need to increase investment, which can increase the utilisation of facilities and therefore their sustainability. Reduce the seasonality of demand for the gas system. Reduce dependence on oil
ENVIRONMENTAL OPPORTUNITY	Natural gas greatly reduces local emissions and can lead to a reduction of CO_2 compared to petrol vehicles. In the future the natural gas fleet will use renewable biomethane

Source: Compiled in-house.

ESTIMATED FLEET

Based on the estimates[70] of the European Natural & bio Gas Vehicle Association (NGVA Europe), by 2020 there will be 8 million vehicles powered by natural gas in Europe. According to this forecast, if the Spanish market behaves similarly, the fleet would be approximately 18 000 natural gas vehicles (800 LNG and 17 200 CNG). The reasons for believing that the Spanish market will grow a at rate in line with the European market are as follows:

- The strategic position[71] of natural gas in Spain (seven regasification plants built, power and reach of the small-scale network, fleet of 250 lorries for the transfer of LNG, 932 satellite plants, etc.).
- The potential for reducing local emissions of natural gas.
- The progressive increase in supply of CNG vehicles on the market and improvements in their technical characteristics.
- The increase in LNG lorry sales as a result of the release in June 2016 of 400hp engines. A notable acceleration of the LNG market is expected from 2017 when 450hp lorries go on the market, providing adequate power to be an alternative to diesel lorries on all types of routes.
- Promotional measures implemented since 2015 as part of the strategy to promote alternative energy vehicles in Spain.
- Incentives coordinated by local authorities to improve air quality in cities (traffic and parking policies) within their Mobility Plans
- The boost from the National Action Framework itself.

ESTIMATION OF THE INFRASTRUCTURE

When estimating expected development of refuelling infrastructure in line with development of the natural gas market, it is necessary to note that, within the National Action Framework, Spain must comply with the requirements of Article 6 of Directive 2014/94/EU and ensure that there is an adequate number of refuelling points to allow circulation of:

- LNG heavy-duty motor vehicles in the basic TEN-T network in 2025. (Article 6 (4))

[70] Estimates provided by GASNAM in November 2015.

[71] The strategic position of natural gas in Spain is described in Section II.1.

- CNG motor vehicles in the basic TEN-T network in 2025. (Article 6 (8))

- CNG-powered vehicles in urban/suburban agglomerations and other densely populated areas in 2020. (Article 6 (7))

Regarding the analysis of LNG supply points, Spain currently has an advanced position, with 15[72] LNG stations in operation and accessible to the public (ten mixed LNG/CNG and five LNG only) and nine[73] under construction, all located in the core network of the TEN-T or at a minimum distance from that network. Based on this situation, future trends in the development of refuelling infrastructure will depend on the development of the market itself. The recommendation in the Directive to make LNG refuelling points available approximately every 400 km must also be taken into account. Applying this recommendation would require ten new LNG stations in the TEN-T core network, although this would be subject to market developments, technology and new vehicle-range distances in the coming years.

Furthermore, private entities have expressed real interest in investing in 31 fixed refuelling stations between now and 2020, as well as 20 joint stations for LNG/CNG and 11 CNG stations. For such investments, and in cases where there is a need to make a profit, companies could apply for aid from specific financial instruments of the European Union.

It has been made clear that private investors want the new refuelling infrastructures to be largely mixed LNG/CNG facilities, and to be located in urban agglomerations on the TEN-T network. This decision is based on the fact that such stations will be used simultaneously both by long-haul LNG heavy vehicles circulating along the basic TEN-T network and CNG vehicles whose scope is limited to urban areas. This scenario is justified based on:

- The growth of long-haul lorries powered by LNG following the launch of an engine with 400 hp power in June 2016. With the expected increase in power to 450 hp, to be launched in 2017, LNG lorries can replace diesel in all types of journeys.

- The expected technological development of long-haul buses powered with LNG in the coming years. Their implementation will significantly increase demand in major urban agglomerations located along the basic TEN-T network.

- The significant increase in the number of CNG vehicles in public service fleets (refuse lorries and buses) and professional fleets (taxis, goods vehicles, factory vehicles, etc.).

Therefore, with regard to the LNG-related obligations for heavy goods vehicles in the basic TEN-T network in 2025, we can say that with the 15 existing stations, the opening of the nine mixed stations currently under construction, and the interest expressed by private investors in building 20 new mixed stations by 2020, Spain is well-positioned for compliance with Directive 2014/94/EU.

As new LNG supply points will always be for mixed LNG/CNG, Spain would be well-positioned to have supply points for CNG[74] approximately every 400 km in the basic TEN-T network, without the need for additional investment. While it is true that the current range of some types of vehicles, particularly passenger cars running exclusively on CNG, only reaches 400 km, the additional tank of conventional fuel makes it possible to continue the journey. In any case, technological developments that increase the range of CNG vehicles are also expected by 2020.

Finally, with regard to urban agglomerations of more than 250 000 inhabitants, and taking into account the existing and planned mixed LNG/CNG stations, 24 existing CNG stations, 11 CNG stations under construction, and the interest shown by the investors in the upcoming construction of another 11 CNG stations, we can say that Spain is on track to comply with the requirement for an appropriate number of points to serve the market for CNG vehicles in urban agglomerations of more than 250 000 inhabitants by 2020.

[72] 15 filling stations existing in: Seville, Zaragoza, Cuenca, 2 in Guadalajara, Burgos, 2 in Barcelona, Tarragona, Madrid, Valencia, Alicante, Corunna, Alava, Vizcaya.

[73] 9 filling stations under construction in 7 provinces: Cadiz, Granada, Seville, 2 in Barcelona, 2 in Girona, Madrid and Valencia.

[74] Of all the LNG refuelling, stations there are just five supplying LNG exclusively and which therefore cannot be used by vehicles using CNG. However, two of them are in locations where there are also CNG points accessible to the public.

III.1. ELECTRICITY

III.2.1. GENERAL DESCRIPTION

An electric vehicle is defined as one fully or partially powered by an electric motor that uses chemical energy stored in one or more rechargeable batteries by an external power supply[75]. The National Action Framework includes only those types of vehicles that need a recharging point to power these batteries when they are parked. Currently there are three technologies for electric vehicles in the Spanish market:

- Exclusively electric vehicle/battery electric vehicle (BEV): a vehicle entirely powered by an electric motor driven by batteries that are recharged via an outlet connected to the mains. Their range is limited by the capacity of the batteries and is currently usually[76] between 120 and 200 km in cars. Recently second-generation batteries have begun appearing on the market that reach a range of 300 km.

- Extended-range electric vehicle (EREV): a plug-in electric vehicle that also incorporates a small thermal engine which drives a generator to recharge the batteries. The propulsion is exclusively electric, but the battery recharging is done through the auxiliary combustion system. It offers a range of approximately 80 km in electric mode.

- Plug-in hybrid electric vehicle (PHEV): a vehicle that combines electric propulsion, from the energy from the network, with conventional thermal propulsion. The electric range is greater than in the (non-pluggable) conventional hybrids, which significantly reduces the overall level of emissions in comparison with the conventional hybrids. It also incorporates a regenerative braking system. It offers a range of between 15-50 km in electric only mode.

CONSUMPTION OF THE ELECTRIC VEHICLE FLEET[77]

On 16 October 16 2015, the document 'Energy Planning Development Plan for the Electric Transport Network 2015-2020' was approved by Council of Ministers Agreement. This electricity forecast scenario takes into account the objectives set out in the 'Strategy to Promote Alternative Energy Vehicles, 2014-2020'.

The aforementioned planning process assumes an increase of electricity consumption in Spain, with conservative estimates, of about 1.5 Th in the annual electricity demand forecast for 2020. For mainland Spain, that demand is between 273.1 TWh and 284.9 TWh depending on the scenario taken into account. These estimates project an increased demand in 2020 of about 30 MW in the off-peak night hours and an increase in the winter peak of about 300 MW (and 0 MW in the summer peak).

The implementation of electric mobility assumes a change in the demand for electricity which can increase its time-sensitive nature and variability. To monitor and, in the future, manage this new demand in a flexible and intelligent way, Red Electrica de España (REE) is developing the Electric Vehicle Control Centre (CECOVEL). It is a global pioneer project in the development of smart energy systems, with the aim of efficient and safe integration of the demand associated with electric vehicles.

Among the benefits of integrating electric vehicles in the Spanish electricity system is achieving greater integration of renewable energy. In an ideal situation for making best use of the system, the driver would charge the vehicle at night, supported by mechanisms for smart management of recharging. However, drivers' habits are different, so it is necessary to adapt the operation of the electric system to the recharging habits of citizens in real time, and flexibly. To do this, REE has

[75] In turn all of these can be equipped with regenerative braking systems, which can charge the battery at times of deceleration and braking.
[76] There are models that reach a range of 600 km but their presence on the market in Spain is of little significance.
[77] All data provided in this section come from the General Department of Energy Planning of the Ministry of Industry and REE.

modelled a series of future scenarios based on different estimates of penetration, from which the following can be concluded:

- In energy terms, the demand for electric vehicles does not appear to be a significant element for the electric system for at least the next 15 years. It is estimated that the energy to be supplied to an assumed fleet of electric vehicles in 2030 (2 600 000 vehicles) will represent a maximum of 2.4 % of the national electricity demand. This figure is below the threshold of error in the forecast long-term demand.

- In terms of power, massive simultaneous connection for recharging electric vehicles can lead to excessive instantaneous demand, if not managed properly. Specifically, for daytime charging, and based on an assumption of 2 600 000 electric vehicles in circulation in 2030, it is estimated that with 20 % of simultaneous recharging, instant demand could represent 13 % of the total mainland demand in certain time periods.

Electric vehicles act as a management system for the demand for modulation and represent a new resource for the operation of the Spanish electricity system. Such a resource, if properly implemented, is extremely valuable because it helps reduce the cost of mobility. It would also increase the efficiency of the electricity system by flattening the curve of aggregated demand on the system, bringing stability over time, reducing the peak-trough ratio and maximising the integration of unmanaged renewable energy, such as wind and solar. It is therefore necessary to provide this new recharging function, and the associated infrastructure, with sufficient intelligence to ensure that recharging takes place during those periods when it proves most beneficial to the electricity system (distributed storage of energy, smart grids, etc.), consistent with the mobility needs of users. In this sense, it is essential to encourage all measures to strengthen the price signal in order to shift consumption peak periods to off-peak periods, such as super-off-peak night rate.

Another of the synergies of the electric vehicle with the electricity sector is the recycling of its batteries once they have ceased functioning in the vehicle. This gives them a second life in less intensive uses such as, for example, energy storage and injection of renewable electricity into the distribution network.

In terms of energy, electric vehicles have a lower energy consumption than vehicles using conventional fuel. This is because electric motors are more energy efficient than internal combustion engines, not being limited by the Carnot cycle. The Business Association for the Development and Promotion of Electric Vehicles (AEDIVE) estimates that the consumption of an electric car is between 10-16 kWh/100 km. For an electric minibus, it is about 90 kWh/100 km and for a 12m bus, around 300 kWh/100km.

POLLUTANT EMISSIONS FROM ELECTRIC VEHICLES[78]

In the case of tank-to-wheel emissions from vehicles, emissions of greenhouse gases (CO_2 equivalent) are non-existent in the case of exclusively electric vehicles (BEV)., Plug-in hybrids (PHEV) and extended range (EREV) electric vehicles depending on their range in electric mode, may have higher or lower emissions, but usually below 40g CO_2/km according to the National Emissions Inventory of the Ministry of Agriculture, Food and the Environment. Exclusively electric vehicles (BEV) do not emit local pollutants (NO_x, CO, particulates, etc.) while PHEV and EREV vehicles reduce them significantly.

When considering emissions from energy generation in the tank of the vehicle, the emissions in the Spanish electricity mix must be considered. In 2015 these were 0.30 kg CO_2/kWh according to data from the National Commission of Markets and Competition (CNMC). Calculating an average value for energy consumption factors in exclusively electric cars (BEV) of 16 kWh/100 km would give certain indirect emissions of about 50g CO_2/km, i.e. 66 % lower than tank to wheel emissions from conventional petrol or diesel cars. Meanwhile, EREV or PHEV type vehicles would not exceed 90g CO_2/km.

[78] All data are from the Ministry of Agriculture, Food and Environment unless otherwise indicated.

If recharging is done with electricity from renewable sources[79], total emissions would be zero. In any case, it should be remembered that, in the long term, the electricity generation policies in Spain will have the effect of reducing the emission factor.

Conversely, batteries can have a high environmental impact due to both the energy required to manufacture them and the risk that end-of-life batteries will pollute the subsoil or seabed. However in Spain, used batteries (lead-acid or nickel-metal hydride) are fully recyclable as required by Directive 2006/66/EC on batteries and accumulators and waste batteries and Directive 2000/53/EC on end-of-life vehicles. Transposition into Spanish law was effected by Royal Decree 106/2008, of 1 February 2008, on batteries and accumulators and environmental management of their waste (as amended by Royal Decree 710/2015).

The following summarises the main features of electric vehicles:

Table III-11. Main characteristics of electric vehicles

MAIN CHARACTERISTICS OF ELECTRIC VEHICLES	
PERFORMANCE	Greater engine efficiency compared to thermal
RANGE	The current range of most commercially available exclusively electric cars (BEV) is 150 -200km. This range can cover most urban trips (average 30 km and less than 1 hour) Although there are electric models with greater range, their presence on the market in Spain is of little significance. . Recently a second-generation battery has appeared on the market with a range of 300km.
EMISSIONS	Use of electric allows for reduction of emissions, making it possible to reduce emissions to zero in urban areas. This makes such vehicles especially suitable for mobility in big cities. Actual emissions depend on the energy mix used for electricity generation. These emissions are relatively low in Spain, at 0.30kg CO_2/kWh - 50g CO_2 per km. If recharging occurs with electricity from renewable sources, the total emissions of exclusively electric vehicles (BEV) are zero. It is necessary to ensure proper recycling of batteries.
PRICE	*Price of electricity for recharging electric vehicles:* in 2011 the electricity tariff called '*supervalle*' (super-off-peak) entered into force with the aim of promoting the slow recharging of electric vehicles in the hours of least demand on the system, from 01:00 to 07:00, with lower prices to encourage the transfer of consumption from the peak period to this time to flatten the demand curve. The cost of the slow recharging of electricity at home overnight is lower (€2/100km) than the price of conventional fuels. There is a benchmark price of electricity in the Iberian market. *Purchase price of exclusively electric vehicles (BEV)* is 30-40 % higher than their petrol or diesel counterparts, mainly due to the cost of the batteries and the small scale of their manufacturing processes. However, the cost of maintenance and of the electricity used to drive them is substantially lower.
REFUELLING	The installation of recharging points at the place of residence, in the workplace or in the tertiary sector (hotels, restaurants, shopping centres, etc.) ensures accessibility to the public. However, the architectural design of housing in Spain, with local communities in the city centre, makes installation of recharging stations in residential areas more expensive.
OPERATION	The voltage and power of slow/linked recharging points is the same as for domestic consumption, which means that no specific operating procedures are necessary at the recharging points. However, fast recharging points require power of 50kW. It should be remembered that, in a scenario of widespread us of electric vehicles in 2030, demand for instant power (due to the mass connection of vehicles for recharging) could reach up to 10 % of the power required at the national level at night time. Therefore, intelligent load management by the System Operator (REE) is considered a key factor for sustainable deployment throughout the electricity system.

Source: Created in-house.

[79] The electricity companies can certify that the energy supplied in a given recharging point is from renewable sources.

III.1.2. CURRENT SITUATION

FLEET AND REGISTRATIONS OF ELECTRIC VEHICLES

Data from the Directorate General of Traffic (DGT) indicate that the fleet in June 2016 consisted of a total of 18 187 vehicles powered by electricity[80] . By segment, passenger cars account for 37 % of all electric vehicles, followed by motorcycles (19 %), heavy quad bikes (14 %), two-wheel mopeds (10 %), vans (8 %) and other vehicles (12 %).

Regarding the type of electric motor used in Spain, the fleet consists of 87 % exclusively electric vehicles (BEV), 11 % plug-in hybrids (PHEV) and only 2 % extended range electric vehicles (EREV).

In the first half of 2016, 2 577 electric vehicles were registered: a figure equal to 90 % of all electric vehicles registered in the whole of 2015 (2 866 units). These registrations are concentrated[81] in the provinces of Madrid and Barcelona.

Table III-12. Development of the fleet of electric vehicles (BEV, PHEV and EREV) (December 2011-June 2016)

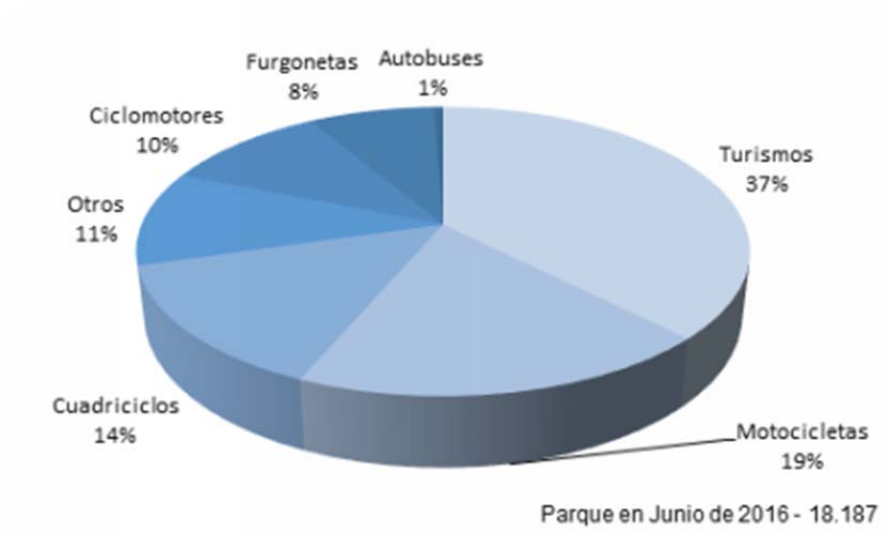
Fleet	2011			2012			2013			2014			2015			2016 (to June)		
Type	BEV	EREV	PHEV	BEV	EREV	PHEV	BEV	EREV	PHEV	BEV	EREV	PHEV	BEV	EREV	PHEV	BEV	EREV	PHEV
Passenger cars (DGT Type 40 and 25)	494	2	18	925	50	82	1 642	66	144	2 525	161	430	3 564	209	960	4 583	379	1 868
Motorcycles (DGT Type T 50 and 51)	1 114	0	44	2 162	0	44	2 880	0	44	3 213	0	42	3 342	0	39	3 393	1	39
Conversions, Vans and Pick-ups (DGT Type 0G and 20)	117	0	0	302	0	0	364	0	0	678	0	0	1 027	0	3	1 444	0	3
Quad Bikes (DGT Type 54 and 92)	491	0	1	1 633	0	2	2 062	0	2	2 333	0	3	2 508	4	5	2 550	5	5
Cyclomotors (DGT Type 90)	1 142	0	0	1 302	0	0	1 450	0	0	1 641	1	0	1 653	0	0	1 869	0	0
Buses and Coaches (DGT Type begins with 3)	32	0	22	46	0	32	53	0	31	30	6	33	58	7	34	61	7	35
Other vehicles outside these DGT Types that are reported in the electrical category (BEV/EREV/PHEV)	1 043	0	15	1 123	0	20	1 181	0	22	1 357	0	19	1 700	4	19	1 923	4	18
TOTAL	4 453	2	100	7 493	50	180	9 632	66	243	11 777	168	527	13 852	224	1 060	15 823	396	1 968
ANNUAL TOTAL	4 555			7 723			9 941			12 472			15 136			18 187		

Source: DGT from data existing in June 2016

[80] Includes exclusively electric vehicles (BEV), extended-range electric vehicles (EREV) and plug-in hybrid vehicles (PHEV) excluding hybrid vehicles (HEV) and electric bikes.

[81] Note that many company cars are registered in Madrid or Barcelona regardless of the province in which they are used. In any case, the municipalities of Madrid and Barcelona offer the greatest incentives (tax and traffic/parking) for electric mobility in Spain.

Graphic III-7. Fleet of electric vehicles (BEV, PHEV and EREV) - by type in June 2016



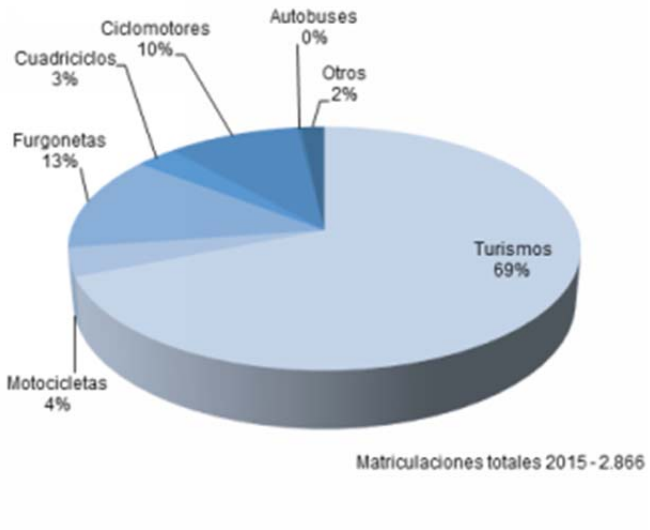
Source: DGT from data existing in June 2016
KEY TO FIGURE, clockwise from bottom left
Quad bikes, Other, Cyclomotors, Vans, Buses, Private cars, Motorcycles
Vehicle fleet in June 2016 – 18 187

Table III-13. Development of registrations of electric vehicles (BEV, PHEV and EREV) (2011- until June 2016)

Fleet	2011			2012			2013			2014			2015			2016 (to June)		
Type	BEV	EREV	PHEV	BEV	EREV	PHEV	BEV	EREV	PHEV	BEV	EREV	PHEV	BEV	EREV	PHEV	BEV	EREV	PHEV
Passenger cars (DGT Type 40 and 25)	384	2	8	440	48	64	806	20	68	1 036	105	325	1 168	48	660	858	97	822
Motorcycles (DGT Type T 50 and 51)	440	0	20	1 057	0	0	774	0	1	405	0	0	228	0	1	97	1	0
Conversions, Vans and Pick-ups (DGT Type 0G and 20)	48	0	0	197	0	0	74	0	0	313	0	0	365	0	1	326	0	0
Quad Bikes (DGT Type 54 and 92)	118	0	0	1 158	0	1	457	0	0	313	0	1	234	4	2	76	1	0
Cyclomotors (DGT Type 90)	244	0	0	325	0	0	268	0	0	313	1	0	79	0	0	248	0	0
Buses and Coaches (DGT Type begins with 3)	5	0	9	14	0	13	4	0	0	3	6	1	2	1	2	5	0	2
Other vehicles outside these DGT Types that are reported in the electrical category (BEV/EREV/PHEV)	92	0	9	75	0	6	68	0	1	92	0	0	89	0	0	44	0	0
TOTAL	1 379	2	46	3 256	48	84	2 451	20	70	2 494	112	327	2 145	53	668	1 654	99	824
ANNUAL TOTAL	1 379			3 388			2 541			2 933			2 866			2 577		

Source: DGT from data existing in June 2016.

Graphic III-8. Registrations of electric vehicles (BEV, PHEV and EREV) by type in 2015



Source: DGT from data existing in June 2016
KEY TO FIGURE, clockwise from bottom left
, Motorcycles, Vans, Quad bikes, Cyclomotors, Buses, Other, Private cars
Total registrations in 2015 – 2 866

PRODUCTION AND MARKETING OF ELECTRIC VEHICLES

In Spain 11 models of quad vehicles and electric commercial vehicles were being manufactured in September 2016, as shown in the following table. In addition, there are companies like Irizar, Merkum and Unvi that also manufacture models of buses and electric minibuses. Meanwhile, companies like Torrot, Scutum, Volta, Rieju, Bultaco and GoingGreen manufacture electric motorcycles and scooters.

Table III-14. Quad Bikes and commercial vehicles manufactured in Spain in September 2016

MARQUE	MODEL	FACTORY	VEHICLE TYPE
PSA Citroen - Peugeot	Partner Eléctric	Vigo (Since 2013)	Commercial
	Berlingo Eléctric		
Renault	Twizy 45	Valladolid (From 2012)	Quad vehicle
	Twizy 80		
Nissan	eNV200	Barcelona (Since 2014)	Commercial
Comarth	Crossrider	Murcia	Quad vehicle
	T-Truck		
	T-Bus		
	CR Sport		
	Toy Rider		
Little Electric Cars	Little 4	Pontevedra	Quad vehicle

Source: ANFAC[82] (data from PSA, Renault, Nissan) and AEDIVE (Comarth, Little Electric Cars).

[82] The Viano/Vito Mercedes electric model has not been manufactured in the plant in Vitoria since 2012.

Over 150[83] versions of models of passenger cars and commercial vehicles are on the market, manufactured by 18 companies: Renault, Audi, Porsche, Toyota, Iveco, Esogon, DFSK, BMW, VW, Microvett, Mitsubishi, Mercedes, Kia, Ford, Citroen, Smart, Nissan, Peugeot, etc. There are also some 75 models of quad bikes from manufacturers such as Berry, Teycars, Little Cars, Renault, Storm Groupil, Mega and X&Y vehicles, as well as motorcycles, buses (Irizar), minibuses and lorries for urban use.

The purchase price of exclusively electric vehicles (BEV) is 30-40 % higher than their petrol or diesel counterparts, mainly due to the cost of the batteries and the small scale of their manufacturing processes. However, the cost of maintenance and of the electricity used to power them is substantially lower.

EXISTING RECHARGING INFRASTRUCTURE

Electric recharging infrastructure is divided into three types with different characteristics: (1) the connected recharge for which each vehicle needs a recharge point; (2) the top-up recharge located in areas at medium to long-stay parking areas in the tertiary sector such as shopping centre car-parks, leisure areas, railway stations, airports and restaurants; and (3) emergency infrastructure for fast recharging located in strategic areas both in urban areas and in the road network in order to enable electric vehicles to function outside of the urban sector.

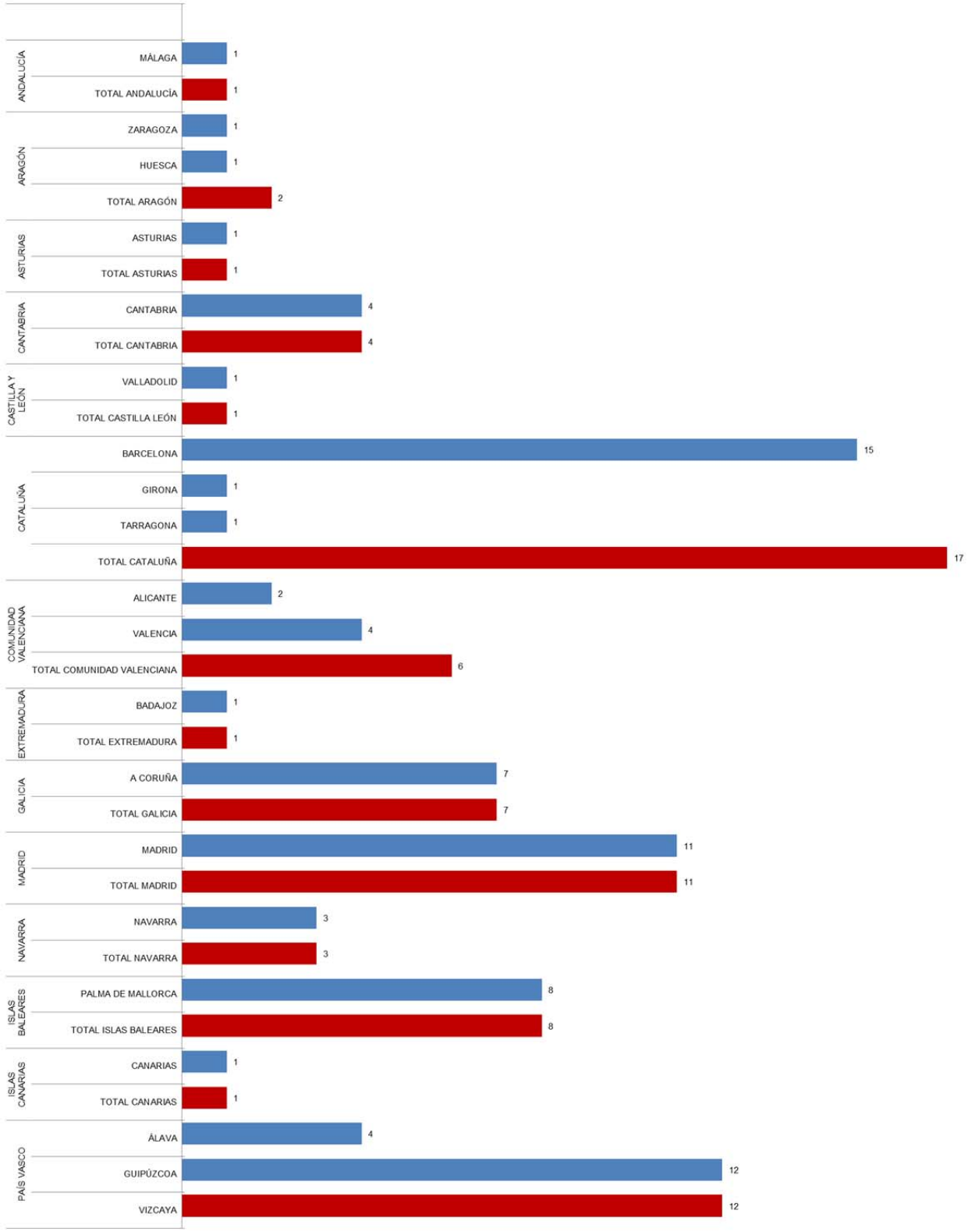
Recharging an electric vehicle has the particular characteristic of occurring, in over 90 %[84] of cases, when the vehicle is parked in the garage of a home or a business. Furthermore, it occurs mainly at night, given the price incentives. For this purpose, the user needs to install an electric vehicle powering system (SAVE) as stipulated in the Complementary Technical Instruction (CTI) BT 52 'Facilities for special purposes. Infrastructure for recharging electric vehicles,' of the Electro-technical Regulation for Low Voltage [85]. The cost of equipment for this type of recharging points for light vehicles in Spain is between €500-1 000, to which must be added the cost of the related installation.

In addition to these individual vehicle recharging points, it is necessary to install a network of recharging points accessible to the public to ensure that in case of unexpected incidents in the daily routes, vehicles will not come to a stop. This public network prevents potential psychological anxiety on the part of individual drivers regarding their range and serves to cover the logistics sector and public services (electric taxis).

In Spain, since the publication of Royal Decree 647/2011, of May 9 2011, recharging points accessible to the public which resell electricity must be managed by a recharge manager - the entity legally authorised to resell electricity for recharging for use in electric vehicles. Article 3(4) of the Royal Decree establishes that the Directorate General for Energy Policy and Mines shall transmit communications received to the National Commission for Markets and Competition (CNMC). The latter will publish the communications on its website. It will also maintain a list, updated at least monthly, that includes all the managers in the recharging network along with the facilities that they manage. Official data from CNMC indicate that Spain has 31 companies recognised as recharging managers managing 91 recharging points/locations[86] .

[83] Source: Catalogue of vehicles taken from the IDAE vehicle database for managing acquisition incentives, part of the MOVEA Plan.
[84] Source: Zem2all project promoted by the City of Malaga.
[85] This CTI has been published by the Ministry of Industry, Energy and Tourism to regulate and promote electric recharging points.
[86] Published by CNMC on its website and updated monthly.

Graphic III-9. Recharging points operated by recharging managers presented by province as of July 1 2016



Source: CNMC. Data as of 1 July 2016

Table III-15. Recharging points operated by recharging managers presented by province as of July 1 2016

RECHARGE POINTS MANAGED BY RECHARGING MANAGERS			
AUTONOMOUS COMMUNITY	**PROVINCE**	**TOTAL**	**TOTAL**
		PROVINCE	**A. C.**
ANDALUSIA	MALAGA	1	1
ARAGON	SARAGOSSA	1	2
	HUESCA	1	
ASTURIAS	ASTURIAS	1	1
CANTABRIA	CANTABRIA	4	4
CASTILE	VALLADOLID	1	1
CATALONIA	BARCELONA	15	17
	GIRONA	1	
	TARRAGONA	1	
COMMUNITY	ALICANTE	2	6
VALENCIANA	VALENCIA	4	
ESTREMADURA	BADAJOZ	1	1
GALICIA	A CORUNA	7	7
MADRID	MADRID	11	11
NAVARRE	NAVARRE	3	3
ISLANDS	PALMA DE MALLORCA	8	8
ISLANDS	CANARY ISLANDS	1	1
BASQUE COUNTRY	ÁLAVA	4	28
	GUIPÚZCOA	12	
	BISCAY	12	
TOTAL			**91**

Source: CNMC. Updated on 1 July 2016.

However, according to information provided by various business associations, there are apparently more recharging points in the process of being added to the CNMC register. These represent over 1 650 additional points with over 4 500 sockets in tertiary sector establishment where the main activity would not be the resale of electricity, e.g. shopping centres, hotels, public car-parks, supermarkets, car dealers, etc. Thus far, such establishments would not be involved in taking financial contributions against sales.

Table III-16. Recharging points by type of location existing in June 2016

TYPES	LOCATIONS	RECHARGING POINTS
In car parks	369	1483
On the street	410	941
Shopping Centre	143	489
With limited accessibility	179	408

Dealership	189	398
Hotel	131	2.3.4
Restaurant	85	172
Service station	64	144
Shop	31	143
Workshop	35	88
Campsite	14	30
Taxi rank	5	9
Airport	4	8
TOTAL	**1 659**	**4 547**

Source: Electromaps.

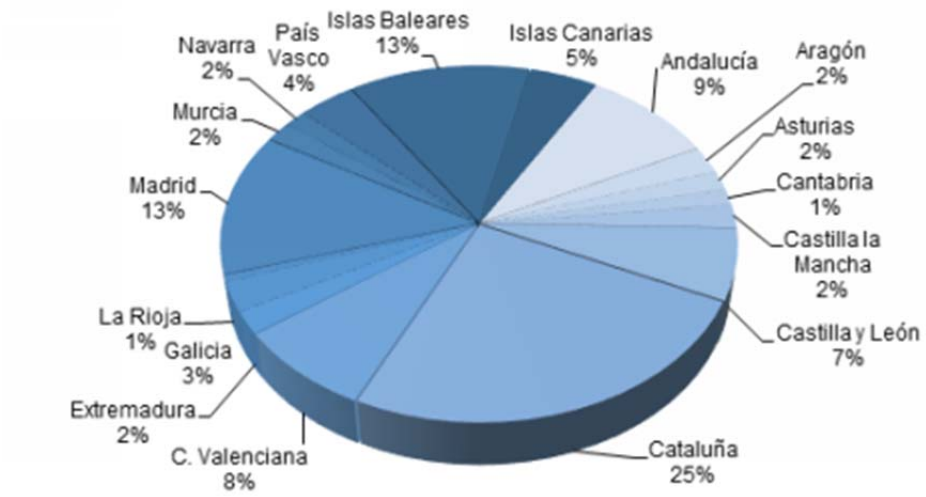
Table III-17. Recharging points by Autonomous Community and province existing in June 2016

AUTONOMOUS COMMUNITY	PROVINCE	No. of sockets	LOCATIONS	TOTAL RECHARGE SOCKETS	TOTAL LOCATIONS
Andalusia	Almería	15	9	320	154
	Cádiz	24	13		
	Cordova	22	7		
	Granada	57	30		
	Huelva	14	8		
	Jaén	6	4		
	Malaga	80	35		
	Seville	102	48		
Aragon	Huesca	9	6	119	41
	Teruel	26	9		
	Zaragoza	84	26		
Asturias	Asturias	49	29	49	29
Cantabria	Cantabria	41	24	41	24
Castile la Mancha	Albacete	21	8	85	35
	Real Ciudad	5	3		
	Cuenca	14	6		
	Guadalajara	17	7		
	Toledo	28	11		
Castile and Leon	Ávila	8	6	227	108
	Burgos	25	12		
	Leon	49	13		
	Salamanca	9	6		
	Segovia	10	6		

	Soria	13	7		
	Palencia	28	16		
	Valladolid	76	39		
	Zamora	9	3		
Catalonia	Barcelona	1257	330	1447	418
	Girona	88	45		
	Lleida	24	11		
	Tarragona	78	32		
C. Valenciana	Alicante	220	61	415	132
	Castellón	40	19		
	Valencia	155	52		
Estremadura	Badajoz	75	32	79	3.4
	Caceres	4	2		
Galicia	A Coruna	52	18	127	45
	Lugo	4	3		
	Ourense	9	5		
	Pontevedra	62	19		
la Rioja	La Rioja	19	10	19	10
Madrid	Madrid	753	216	753	216
Murcia	Murcia	61	30	61	30
Navarre	Navarre	63	26	63	26
Basque Country	Álava	2.3	9	179	66
	Viscaya	82	32		
	Guipúzcoa	74	25		
Balearic Islands	Balearic Islands	393	212	393	212
Canary Islands	Las Palmas	65	33	170	79
	Santa Cruz de Tenerife	105	46		
TOTAL		**4 547**	**1 659**	**4 547**	**1 659**

Source: Electromaps.

Graphic III-10. Recharging points by Autonomous Community existing in June 2016
.



Source: Electromaps.

Various Spanish entities are actively working on the implementation of pilot projects involving innovative recharging solutions that suit the specific needs of both users and cities. Among the projects carried out, the following are noteworthy given their potential to be extended to the whole country.

1. Widespread installation of recharging points accessible to the public in Barcelona

Barcelona has 303 recharging points for public use, of which 121 are located in public places (15 are fast recharging points that can power up to 80 % of a battery in less than 30 minutes), and 182 in underground car parks (of which 74 % of the recharging points installed are for cars and 26 % for motorcycles), according to the City of Barcelona. These are universal points, which offer the three existing systems on the market, and allow joint recharge of two vehicles. Most of these points for public use are free for users, being publicly funded by the Local Authority.

In addition, Barcelona has more than 100 recharging points in various private facilities like shopping centres, hotels, etc. which are for public use but privately run.

Regarding the metropolitan area of Barcelona, it should be noted that in 2015 the following entities signed an agreement to install five recharging stations for electric vehicles in the car-parks of the transport hubs at the railway stations of Ferrocarrils de la Generalitat (FGC) at Volpelleres, Martorell, Igualada, Sant Quirze del Valles and Sant Cugat del Valles: FGC, SIMON, DTES, RAILGRUP, VOLTOUR, ICAEN, IMESAPI and EMPARK.

2. Fast Recharging Car Club (e-Car)

Endesa has launched a network of six fast recharging points strategically located throughout the island of Mallorca to ensure that any electric vehicle can travel around the island without any concerns regarding range. These refuelling points can charge 80 % of the battery in less than 30 minutes, with the current cost per recharge being €6. The points are located at an average distance of 35 kilometres apart.

This initiative aims to increase range, peace of mind and savings for users with each recharge. In addition an application for mobile devices makes it possible to locate the nearest points, reserve them, find the best route and calculate the travel time. Furthermore, the recharging points incorporate the three types of connectors currently available on the market so that they can charge all types of

electric vehicles regardless of the vehicle manufacturer. This initiative has received co-financing from the ERDF programme.

3. Project Zero Emissions Mobility To All (ZEM2ALL)

This initiative ended in January 2016 after four years in operation. The aim was to test the operation of electric vehicles and their acceptance by citizens in a real environment - the city of Malaga and its area of influence (Marbella and Fuengirola). It was the largest demonstration project on electric mobility implemented to date in Spain. A fleet of 200 electric vehicles, 220 conventional recharging points and 23 fast recharging points were deployed in nine locations. The initiative covered more than 4.6 million kilometres of travel, performing more than 100 000 recharges and preventing emission into the atmosphere of 330 tonnes of CO_2. The project was supported by the Town Hall of Malaga, the CDTI and Endesa, and included participation by the Japanese government through NEDO.

With regard to industrial development of recharging points, it is noteworthy that there are eight companies with manufacturing capacity in Spain for normal and fast recharging points, exporting to countries such as Russia, Norway, Netherlands and the United Kingdom.

III.2.3. EXPECTED MARKET TRENDS AND OBJECTIVES

OPPORTUNITIES

The expected market trends are marked by opportunities linked to the introduction of electricity in road transport:

Table III-18. Opportunities related to the use of electricity in road transport

OPPORTUNITIES RELATED TO THE USE OF ELECTRICITY IN ROAD TRANSPORT.	
INDUSTRIAL OPPORTUNITY	Increased supply of vehicle and equipment manufacturers, promoting their development and Spain's leading role in the manufacture of new EAV vehicles and components New business development of sustainable mobility in the urban environment. This makes it possible to provide recharging points in cities as well as changing the forms of ownership and use of vehicles. Fleet renewal occurs more frequently than for private vehicles. Development of new businesses and specialisms such as battery recycling. Once their use in the electric vehicle is finished, they can be used as fuel elements in electricity distribution networks and facilitate the management of renewable electricity.
ENERGY OPPORTUNITY	It allows the diversification of primary energy sources. Increases demand for the electrical system in the off-peak period (overnight recharge) which produces an effect of flattening the demand curve. Improves the efficiency of the electricity system without increasing investment. Allows the system to input wind energy over night. Can leverage the capabilities of combined cycle generation to meet occasional increases of demand with output operations, etc.
ENVIRONMENTAL OPPORTUNITY	Electric vehicles eliminate local CO_2 emissions. Taking the whole cycle from generation to use, electric vehicles also allow a drastic reduction in CO_2 emissions due to the national energy mix, which will help in meeting our European and international commitments.

Source: Developed in-house.

ESTIMATION OF THE FLEET OF ELECTRIC VEHICLES

Although registration figures for electric vehicles are still rather insignificant compared to the overall volume of registrations (electric vehicles in 2015 accounted for 0.3 % of total registrations in Spain), they are increasing gradually. This is due to the remarkable momentum of the Strategy to Promote Alternative Energy Vehicles 2014-2020. In this regard, in the first half of 2016, 2 577 electric vehicles were registered, 90 % of the number of all such vehicles registered in 2015.

Assuming that the trend continues, if the number of registrations followed the same annual development pattern that has characterised the market since 2010, with an average annual increase of about 20 %, the number of vehicles registered in 2020 would reach 38 000 units. However, thanks to the incentive effect to electric mobility created both by the Strategy to Promote Alternative Energy Vehicles 2014-2020 and by the measures contained in this National Action Framework, market forecasts reasonably estimate that the Spanish fleet in 2020 will be about 150 000 electric vehicles.

DEVELOPMENT OF RECHARGING POINTS AVAILABLE TO THE PUBLIC

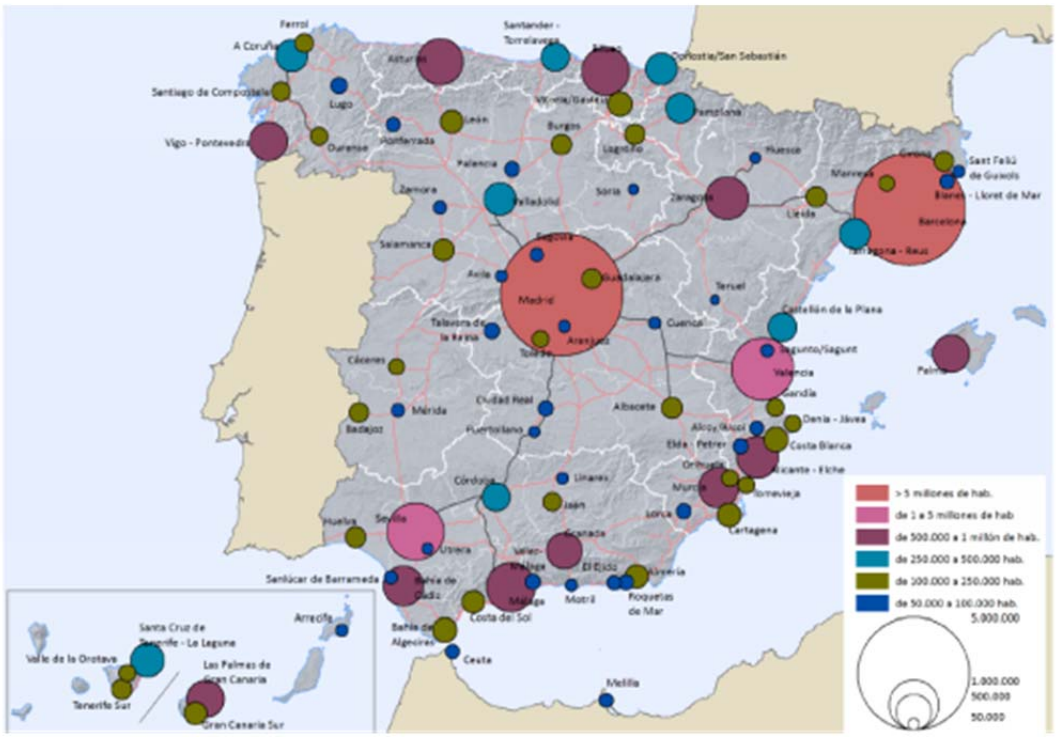
When estimating the future development of recharging infrastructure, we have taken into account the provisions of Article 4 of Directive 2014/94/EU concerning the need to ensure the circulation of electric vehicles by 2020 both for urban/suburban agglomerations and other densely populated areas and for certain Spanish networks that remain to be identified.

Within the urban sector, Spain currently has recharging points operated by recharging managers in 91 locations[87] distributed throughout 14 Autonomous Communities. Additionally, as has been stated, there are probably more than 4 500 recharging points/sockets accessible to the public in more than 1 650 locations in the process of registration in the list of the CNMC. Such points are associated with tertiary sector establishments distributed throughout the entire national territory, for which resale of electricity would not be the main activity.[88] Taking this situation as a starting point, future developments of publicly accessible recharging points will be conditioned by developments in the vehicle market, and by the combined efforts of regional and especially local authorities.

Regarding the requirement of Article 3(1) of the Directive on the designation of agglomerations, densely populated areas and networks in which publicly accessible recharging points will be located, this National Action Framework believes that at least metropolitan areas of more 250 000 inhabitants must have an adequate number of recharging points available to the public to address market developments. Currently Spain already has a significant recharging infrastructure in metropolitan areas of more than 5 million (Madrid and Barcelona) and between 1 and 5 million inhabitants (Seville and Valencia). There are also specific plans for several metropolitan areas of between 500 000 and 1 000 000 inhabitants (e.g. the e-Car in Palma de Mallorca). Following these trends, the recharging infrastructure will continue to expand, starting from the metropolitan areas listed in the following figure, prioritising areas depending on their size.

[87] See Appendix B.
[88] See Appendix B.

Table III-19. Large metropolitan areas in Spain



Source: National Statistics Institute

KEY TO FIGURE
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> 5 million inhabitants
From 1 to 5 million inhabitants
From 500 000 to 1 million inhabitants
From 250 000 to 500 000 inhabitants
From 100 000 to 250 000 inhabitants
From 50 000 to 100 000 inhabitants

In any case, the role of local authorities is key in promoting recharging infrastructure in these urban agglomerations. They are responsible for authorising the installation of points on public roads, establishing mobility policies (regulated parking fees, access to restricted areas, actions against pollution protocols, etc.) as well as bonuses in road tax (IVTM).
Collaboration between Autonomous Regions and municipalities has encouraged the development of recharging infrastructure accessible to the public in various metropolitan areas such as Madrid, Catalonia, Castile and Leon, Basque Country, Andalusia and Valencia. For example the Autonomous Community of Madrid and the Madrid City Council are working on a map of the areas where it should place recharging stations in its area of competence to meet the target that they should never be more than ten minutes' drive away. Meanwhile, Catalonia has created the Mesa Catalana of electric recharging infrastructure to encourage its development (TIRVEC). This initiative aims to be a forum for dialogue to strengthen cooperation of both public and private Catalan agents and the actual installation of recharging points in his motorways and main roads.

In addition to regional and local initiatives, the implementation of the following state measures will encourage the development of accessible recharging points in all urban agglomerations that decide to commit to electric mobility:

- The MOVEA Plan set out a specific line of aid for the implementation of fast and semi-fast recharging points in areas with public access. The aid is intended for private companies, local authorities and Autonomous Communities.

- The Operational Programme for Sustainable Growth (POCS) under the European Structural and Investment Funds (EIE) 2020 includes funding intended for local authorities or supra-municipal bodies deploying recharging infrastructure.

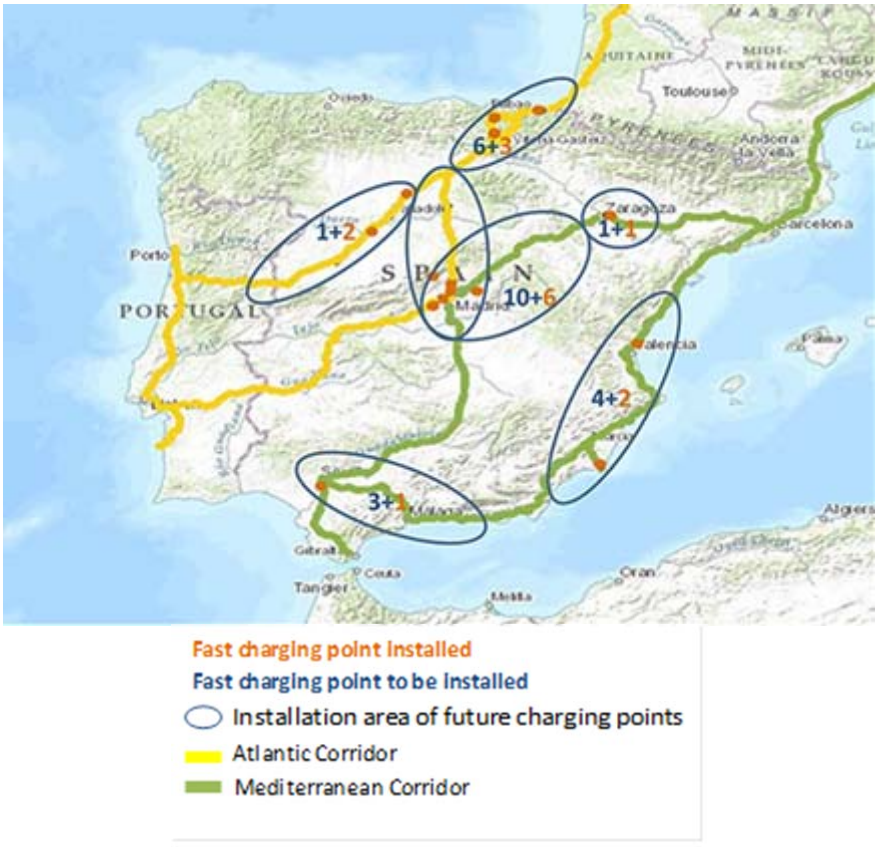
- The Area Management of RENFE stations is preparing an action plan to provide the existing car parks of some of its stations with recharging points. This measure complements the compulsory incorporation of recharging points established by ITC BT-52 for construction projects for new public car parks.

- AENA SA, the body responsible for the installation of recharging stations at airports, is studying alternatives to exploit these points while ensuring their economic viability.

Outside the urban area, the governments of Spain (through the Ministry of Industry, Energy and Tourism and the Ministry of Development) and Portugal have promoted the establishment of a consortium of eight partners[89] for the implementation of fast recharging points along the Atlantic and Mediterranean corridors. Implementation will make it possible to study the business model with real parameters to install recharging infrastructure in the basic TEN-T network and thus connect the Iberian Peninsula with the other countries of the EU.

This project, called 'Iberian Infrastructure Corridors for Fast Recharging of Electric Vehicles' (CIRVE), provides for the installation in Spain of 25 new pilot fast recharging points and adaptation of 15 existing points at strategic points of the Iberian corridors. The investment associated with the project in Spain will be financed through the 2015 call for proposals of the Connecting Europe Facility (CEF).

Figure III-2. Map of recharging points of the CIRVE project



Source: Report on CIRVE project presented to the CEF-2015 Mechanism.

[89] IBIL, Iberdrola, Endesa, GIC, EDP, AEDIVE, CEIIA and Renault.

Depending on the results obtained by this project, future revisions of the National Action Framework will update the estimate of recharging points needed to boost circulation throughout the country and particularly in the core network of TEN-T.

III.3. LIQUEFIED PETROLEUM GAS

III.3.1. GENERAL DESCRIPTION

CONSUMPTION OF LPG FLEET

In 2015 the consumption of the LPG fleet[90] stood at 43 000[91] tonnes (approximately 500 GWh).

It should be noted that LPG vehicles consume more fuel than their counterparts with traditional fuels. The average consumption of a passenger car using LPG is 9.5 litres per 100 km compared to 8 litres of petrol in an equivalent version or 6.5 litres[92] of diesel.

New technologies are being developed, such as direct injection, intended to extend the benefits of LPG carburetion to cars in order to improve fuel consumption and therefore reduce CO_2 emissions.

LPG EMISSIONS [93]

According to the National Emissions Inventory of the Ministry of Agriculture, Food and Environment, liquefied petroleum gas has emissions per unit of energy of 65 tonnes of CO_2/terajoule, which is between 12 and 15 % lower than the figure for conventional fuels (petrol/diesel).

According to the sources considered (JRC, 2014[94]; EMT Madrid and TMB Barcelona) emissions of CO_2 per km are on average equivalent to or higher than those for diesel vehicles and lower than for petrol vehicles.

[90] Approximately 50 000 vehicles according to AOGLP.

[91] Source: CORES.

[92] Tanks used for storing LPG can mean a 5 % increase in vehicle weight relative to the weight of vehicles with conventional fuels. This weight gain leads to an increase in consumption and therefore in pollutant emissions.

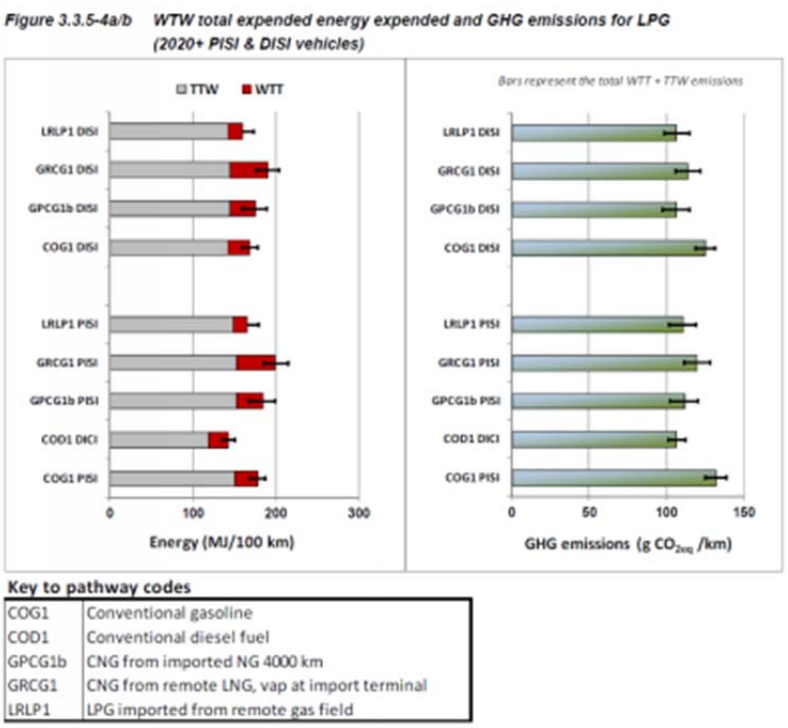
[93] All information contained in this section has been provided by the Ministry of Agriculture, Food and Environment unless otherwise indicated.

In all cases, the limits officially established for the approval of each model should be consulted.

[94] JRC-Joint Research Centre-EUCAR-CONCAWE collaboration 'Well-to-Wheels analysis of future automotive fuels and powertrains in the European context WELL-TO-TANK (WTT) Report' 4th Version, 2014.

The European Commission (through the JRC), the European refining sector (represented by CONCAWE, the European association of oil companies for environmental protection and health) and European vehicle manufacturers (through European R & D association of vehicle manufacturers) have participated in the preparation of this study.

Figure III-3. Comparison of CO_2 emissions of LPG vehicles compared to conventional fuel vehicles (diesel/petrol)



Source: JRC v4. a, 2014.

It should be clarified that emissions from the process of extraction and subsequent refining are similar to those for conventional fuels (diesel and petrol) and, therefore, have been discounted in this analysis.

As for local air pollutants, particulate emissions are significantly reduced: on average 21 % and 27 % less than those for petrol and diesel-powered passenger cars, respectively. Also, passenger cars powered by LPG reduce NO_X emissions by between 8 and 73 % compared with average passenger cars (1.4-2 litre engine and Euro VI) powered by petrol and diesel, respectively. Therefore LPG is positioned as an alternative enabling a C-segment vehicle to comply with the Euro VI regulations on emissions of NO_X at a competitive price.

The following summarises the main characteristics of LPG in road transport.

Table III-20. Main characteristics of LPG vehicles

MAIN CHARACTERISTICS OF LPG VEHICLES	
PERFORMANCE	It achieves the same performance as conventional fuels.
RANGE	Exclusively LPG mode has range comparable to that of conventional vehicles.
EMISSIONS	Reduces local pollutants (NOx and particulates) which improves air quality in large population centres CO_2 emissions are lower than those of petrol and similar to those for diesel.
PRICE	*Price of manufacture of LPG vehicles:* similar to conventional diesel vehicles and between 700 to 1000 euros more expensive than petrol vehicles. Conversions vary between 1000 and 2500 euros depending on the engine capacity. *Fuel Price:* The price of LPG in international markets is linked to oil prices, although, unlike oil, the price of LPG is influenced by the price of naphtha for petrochemical use and local situations of over- or undersupply. Currently in Spain the price is lower than for conventional fuels.
REFUELLING	Refuelling infrastructure is already established over the entire country (468 service stations in all regions). In 2017, the existing infrastructure made it possible to service a fleet of 200 000 vehicles (current fleet in Spain

	about 50 000 vehicles) Refuelling time similar to conventional fuels.
OPERATION	No changes of habits are necessary for users

Source: Created in-house.

III.3.2. CURRENT SITUATION

FLEET AND REGISTRATION OF VEHICLES POWERED BY LPG

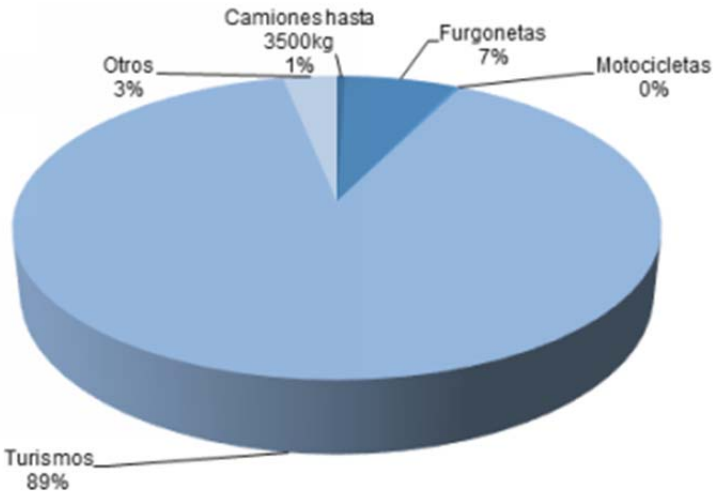
Data from the General Directorate of Traffic (DGT) indicate that, by June 2016, the fleet consisted of a total 8 133 LPG vehicles. Registrations have shown an average annual growth rate of 200 % since 2012[95] as shown in the following table. By segment, passenger cars account for 89 % of total LPG vehicles, followed at considerable distance by vans (7 %). Heavy goods vehicles still need to address technological developments, mainly related to the engines, in order to adapt them for their purposes. The Spanish HGV fleet is proof of this.

Table III-21. Development of the fleet of vehicles powered by LPG (December 2012-June 2016)

LPG FLEET	2012	2013	2014	2015	2016 (until June)
Lorries to 3500 kg	6	25	25	39	40
Vans	17	55	182	413	539
Motorcycles	5	6	14	21	22
Cars	250	895	1 994	4 883	7 274
Others	18	44	93	221	258
Total	**296**	**1 025**	**2 308**	**5 576**	**8 133**

Source: DGT from data existing in June 2016.

Graphic III-11. Fleet powered by LPG by type of vehicles in June 2016



Source: DGT from data existing in June 2016.

KEY TO FIGURE

Clockwise from bottom left: Private Cars, Other, Lorries up to 3500kg, Vans, Motorcycles

[95] The DGT has no data broken down for LPG prior to 2012.

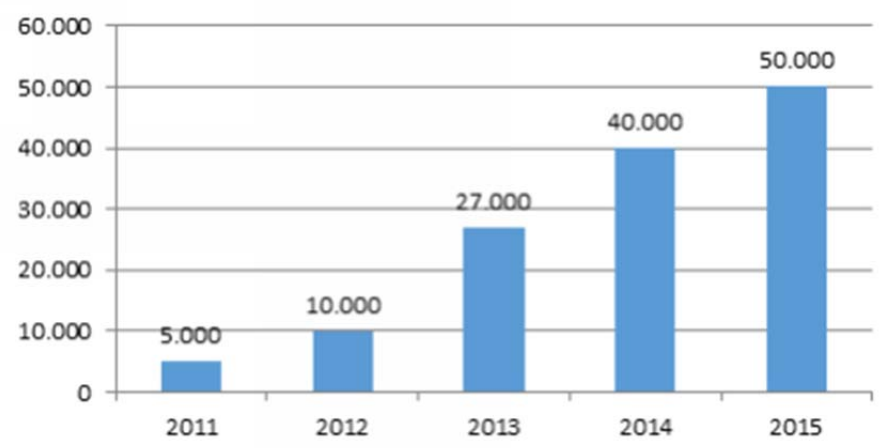
Table III-22. LPG vehicle registrations by type (2012- until June 2016)

LPG REGISTRATIONS	2012	2013	2014	2015	until June 2016
Lorries to 3500 kg	6	19	0	9	0
Vans	16	36	125	222	73
Motorcycles	5	2	8	3	2
Cars	215	556	1 109	2 339	796
Others	8	1	0	1	1
TOTAL	**250**	**614**	**1 242**	**2 574**	**872**

Source: DGT from data existing in June 2016.

Note that the above figures do not fully account for vehicles converted in the workshops of mechanics not affiliated to the manufacturers where conversion took place before March 2015. In order to know the total number of vehicles powered by LPG[96], the Spanish Association of Operators of LPG (AOLPG) makes various estimates[97]. These produce estimated figures of a fleet of 50 000 cars in 2015, representing 0.22 % of the total passenger car fleet[98] in Spain. Since 2011 the estimated AOLPG fleet has recorded a cumulative growth of 58 %[99].

Graphic III-12. AOLPG estimate of the development of the LPG vehicle fleet (December 2011 – December 2015)



Source: AOLPG.

The AOLPG estimated that 50 % of the LPG fleet is dedicated to professional use, mainly taxis, cars used by company sales representatives and vehicles used by driving schools, while the remaining 50 % is for private use. In relation to LPG vehicles used in public services, it is estimated that there are approximately 8 000 LPG taxis in Spain, mainly in Madrid (4 000 taxis), Barcelona (1 200 taxis), Valencia, Palma de Mallorca, Sevilla, Malaga, Vigo and Zaragoza. Regarding the urban bus fleet, note that the city of Valladolid has about 100 vehicles with engines manufactured by MAN with power of 330hp.

It is estimated that the current fleet of LPG heavy goods vehicles represents only 2 % of the LPG fleet (1 000 units). It is principally involved in the last mile distribution of goods (or urban distribution).

[96] Foreign vehicles in transit through Spain were also recorded.

[97] The calculation methodology is based on analysis by operators of LPG from the actual consumption data recorded in service stations and subsequent cross-checking with databases of their customers in order to avoid duplication of vehicles.

[98] According to the DGT the fleet of passenger cars in 2015 was 22 355 022 units.

[99] Fleet: 2011 (5 000), 2012 (10 000), 2013 (27 000), 2014 (40 000) and 2015 (50 000).

MANUFACTURE AND MARKETING OF LPG VEHICLES IN SPAIN

Currently three models of LPG vehicles are manufactured in the Opel plant in Figueruelas: Mokka, Meriva 1.4 and Corsa (versions 1.2 and 1.4).[100]

Over 1000[101] versions of vehicles from 14 manufacturers (Alfa Romeo, Citroen, Dacia, Fiat, Ford, Lancia, Opel, Renault, Ssangyong, Subaru, Seat, Suzuki, Piaggio and Skoda) are known to be on the market in Spain. There are also over 250 workshops certified to convert vehicles from petrol to LPG.

The purchase price of LPG vehicles ex-works is between 700 and 1000 euros higher than the equivalent petrol model and in the same range as diesel models. In addition, it is possible to transform conventional petrol vehicles to LGP power in workshops not affiliated to the manufacturers. In this case, the cost of conversion depends on the engine capacity. Conversion of a vehicle with a 4- 6-cylinder engine costs around €1 000-1500 (excluding VAT) while an 8-cylinder conversion costs between €2 000 and 2 500 (excluding VAT).

EXISTING REFUELLING INFRASTRUCTURE

In June 2016 Spain had 468[102] LPG refuelling stations accessible to the public which represents 4.5 % of all service stations. In addition it is estimated that some 500 companies have fleets of LPG vehicles and also have private LPG supply points. The number of stations accessible to the public has seen an average cumulative growth of around 60 %[103] over the last 5 years: 2011 to 2015. Some 600 service stations with LPG are forecast for the end of 2017 based on investments announced by LPG merchants.

Table III-23. Existing LPG refuelling stations by Autonomous Community and province in June 2016

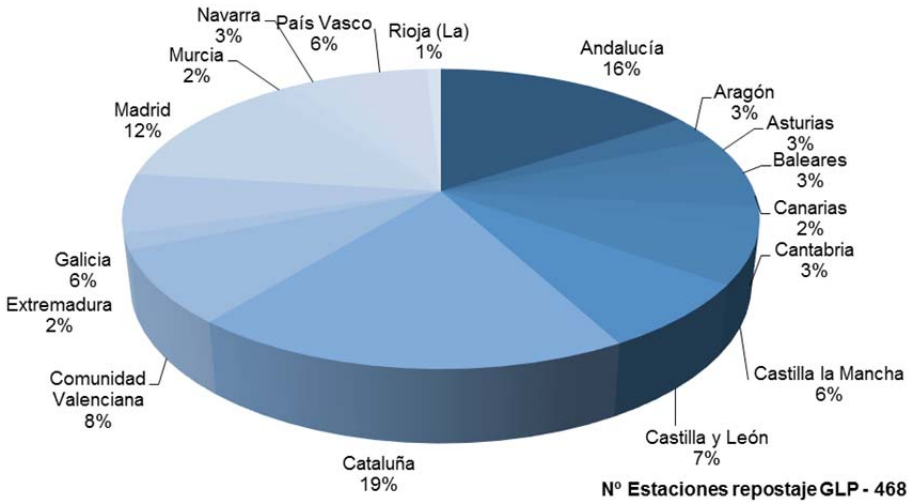
LPG STATIONS			
AUTONOMOUS COMMUNITY	**PROVINCE**	**TOTAL PROVINCES**	**AUTONOMOUS COMMUNITY TOTAL**
Andalusia	ALMERIA	7	74
	CADIZ	10	
	CORDOVA	4	
	HUELVA	5	
	JAEN	6	
	MALAGA	15	
	SEVILLE	20	
Aragon	HUESCA	2	14
	TERUEL	3	
	SARAGOSSA	9	
Asturias	ASTURIAS	12	12
Balearics	Balearic Islands	14	14
Canary Islands	LAS PALMAS	7	11

[100] In the past, PSA produced the C-Elysee, Volkswagen manufactured the Polo LPG in Pamplona and Seat made the Altea LPG in Martorell.
[101] Source: Catalogue of vehicles taken from the IDAE vehicle database for managing acquisition incentives under the MOVEA Plan.
[102] Source data: Geoportal of the Ministry of Industry, Energy and Tourism.
[103] Source: AOGLP.

	SANTA CRUZ OF TENERIFE	4	
Cantabria	CANTABRIA	12	12
Castile la Mancha	ALBACETE	5	26
	REAL CITY	5	
	BASIN	5	
	GUADALAJARA	2	
	TOLEDO	9	
Castile and Leon	AVILA	2	3.4
	BURGOS	5	
	LION	5	
	PALENCIA	4	
	SALAMANCA	4	
	SEGOVIA	3	
	SORIA	2	
	VALLADOLID	5	
	ZAMORA	4	
Catalonia	BARCELONA	56	88
	GIRONA	15	
	LLEIDA	7	
	TARRAGONA	10	
Ceuta	CEUTA	0	0
Valencian Community	ALICANTE	19	37
	CASTELLON	5	
	VALENCIA	13	
Estremadura	BADAJOZ	3	8
	CÁCERES	5	
Galicia	A CORUNA	16	30
	LUGO	2	
	OURENSE	3	
	PONTEVEDRA	9	
Madrid	MADRID	56	56
Melilla	MELILLA	0	0
Murcia	MURCIA	9	9
Navarre	NAVARRE	12	12
Basque Country	ÁLAVA	6	27
	GUIPÚZCOA	13	
	BISCAY	8	
Rioja (La)	RIOJA (LA)	4	4
TOTAL		**468**	**468**

Source: Geoportal of the Ministry of Industry, Energy and Tourism.

Graphic III-13. LPG refuelling stations existing in June 2016 by autonomous communities



Source: Geoportal of the Ministry of Industry, Energy and Tourism.

KEY TO FIGURE: Legend at bottom right: No. of LPG refuelling stations - 468

Table III-24. Development of the number of LPG refuelling stations (December 2011- December 2015)

	2011	2012	2013	2014	2015
Number of LPG refuelling stations	50	155	265	375	455

Source: AOLPG.

The following table shows the top traders of LPG in Spain and the number of service stations operated by each of them.

Table III-25. Share of LPG refuelling stations by company, June 2016

AGENT	SHARE OF STATIONS (%)
REPSOL	77 %
CEPSA	8 %
VITOGAS	5 %
DISA	2 %
GALP	1 %
OTHERS	7 %
TOTAL	**100 %**

Source: Geoportal of the Ministry of Industry, Energy and Tourism.

The existing LPG refuelling infrastructure accessible to the public is considered reasonably well-distributed throughout the national territory.

To help users to locate LPG refuelling stations, the Ministry of Industry, Energy and Tourism publishes their locations and the prices charged[104] on its Geoportal (http://geoportalgasolineras.es). Additionally, the Spanish Association of Operators of LPG (AOLPG) has created a software tool available both through its website[105] and on mobile devices. For its part, the Catalan Institute of Energy (ICAEN) publishes[106] a map with LPG refuelling points in Catalonia on its website.

III.3.3. EXPECTED MARKET TRENDS AND OBJECTIVES

MARKET OPPORTUNITIES

The future development of LPG in Spain is considered positive, the following opportunities being identified:

Table III-26. Opportunities for the use of LPG in road transport

OPPORTUNITIES FOR THE USE OF LPG IN ROAD TRANSPORT	
INDUSTRIAL OPPORTUNITY	Encouraging increased supply by manufacturers of light vehicles and equipment. The future development of LPG heavy vehicles is anticipated.
ENERGY OPPORTUNITY	Provides a use for the propane and butane (LPG is a mixture of both) resulting from refining, consumption of which has decreased in the domestic environment due to the introduction of natural gas in the municipalities.
ENVIRONMENTAL OPPORTUNITY	CO_2 emissions equal to diesel and lower than petrol. Significantly reduces local emissions. The technology is available, mature and accessible without large investments.

Source: Created in-house.

ESTIMATED LPG FLEET AND REFUELLING POINTS IN 2020

It is estimated that the increase in the number of LPG vehicles through market development will put the LPG fleet at 200 000-250 000 vehicles in 2020, given the measures contained in both the Strategy to Promote Alternative Energy Vehicles (AEV) in Spain from 2014 to 2020 and in this National Action Framework.

This increase in the number of LPG vehicles assumes that private enterprise will have sufficient incentive to increase the LPG refuelling points and, in turn, this general availability of supply infrastructure will make the purchase of LPG vehicles an attractive alternative for new users, which will in itself feed back into the development of the fleet and refuelling points.

The infrastructure provided by the private sector by the end of 2017 (about 600 stations according to AOLPG) is expected to meet the needs of a fleet of 200 000 vehicles. In addition, in order to extend the network so that potential users have refuelling points near their usual routes, it would be reasonable to aim for between 800 and 1 000 refuelling stations in 2020.

III.4. HYDROGEN

III.4.1. GENERAL DESCRIPTION

Hydrogen has two main applications as an energy vector in the automotive sector: fuel cells and alternative internal combustion engines (ICM). The latest developments show fuel cells are gaining

[104] The Order ITC/2308/2007 of 25 July, which determines the form of provision of information to the Ministry of Industry, Tourism and Trade on the activities of supply of petroleum products, obliges operators of LPG refuelling points to submit this data.
[105] http://www.aoglp.com/que-es-autogas/donde-repostar/
[106] https://www.google.com/maps/d/edit?hl=ca&authuser=0&mid=z4xnIt9uT66s. kuGVFWgWagXU

ground in comparison with internal combustion engines because of their greater efficiency[107] . A fuel cell is an electrochemical device that produces electricity (and water) from stored hydrogen (and atmospheric air). In addition, fuel cells have no moving parts, so they do not generate noise or vibration and their maintenance is easier.

Spain has developed several demonstration projects with fuel cell electric vehicles (FCEV) that demonstrate the great future potential of hydrogen in road transport. A passenger car stores enough fuel to travel 500 to 600[108] km while the range of a city bus is about 350[109] km. Its refuelling time is similar[110] to that for conventional vehicles. Despite significant effort in RDI, and progress achieved in the transport and storage of hydrogen at high pressures (350-700 bar), today the biggest limitation is the high cost[111] of the systems involved. However, mass sales will result in economies of scale that will reduce costs significantly.

Among the regional initiatives to promote hydrogen, it should be noted that the Government of Aragon has been strongly committed to this technology since 2003. That was when it adopted the agreement to be part of the Foundation for the Development of New Hydrogen Technologies in Aragon as a founding member. This support has resulted in the following: the 2nd Regional Plan for Research, Development and Knowledge Transfer; the Aragonese Strategy for Climate Change and Clean Energy (EACCEL); the Aragonese Strategy of Competitiveness and Growth; the Aragonese Strategy for Research and Innovation for smart specialisation RIS3 Aragon; the Aragon Energy Plan 2013-2020; the Strategy for Spatial Planning of Aragon; the Aragon 2014-2020 ERDF Operational Programme (OP); and in separate comprehensive strategies. The 3rd Master Plan 2016-2020 for hydrogen in Aragon is currently in force as a continuation of the Master Plans of 2007-2010 and 2011-2015. It encompasses the activities of the region in hydrogen technologies through the development of five lines of work. Meanwhile, Andalusia, through both the Andalusian Energy Agency and the Agency for Innovation and Development of Andalusia (IDEA) has the following lines of work relating to the use of hydrogen in road transport: the Development Strategy for Hydrogen in Andalusia in the field of RIS3[112] (November 2015); the Planning for deployment of the hydrogen refuelling stations needed to facilitate the use of this gas as fuel in Andalusia[113] (November 2015); and Opportunities for the Hydrogen Economy for SMEs in Andalusia [114] (November 2015). Finally, hydrogen is one of the energy sources covered in the Energy Strategy of Andalusia 2020[115].

Eleven Autonomous Communities have included hydrogen in their smart specialisation strategies (Ris3): Basque Country, Catalonia, Andalusia, Murcia, Valencia, Aragon, Castile la Mancha, the Canary Islands, Extremadura, Balearic Islands and Castile and Leon.

EMISSIONS FROM FUEL CELL ELECTRIC VEHICLES (FCEV)

Hydrogen can also be used in internal combustion vehicles. In this case, on a tank-to-wheel analysis, vehicles produce certain emissions of NOx, but zero emissions of CO_2 and particulates. On a well-to-wheel basis, emissions could increase depending on the source of hydrogen production. Therefore, from the environmental point of view, hydrogen is much more interesting for use in fuel cell vehicles (FCEV).

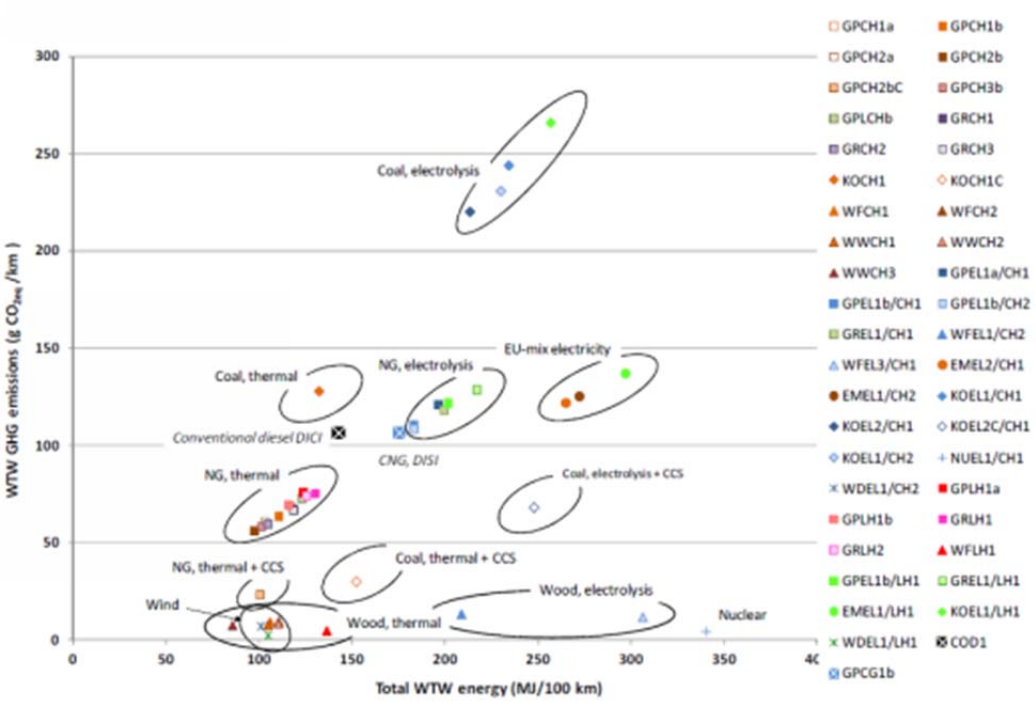
[107] Operating electrochemically, rather than by internal combustion, the energy efficiency is superior, as it is not limited by the Carnot cycle.
[108] Approximate ranges for passenger cars: Toyota Mirai = 550 km; Hyundai ix35 = 590 km according to NECD (New European Driving Cycle).
[109] Fuel Cells and Hydrogen Joint Undertaking (FCH JU).
[110] The filling time for a full tank in a passenger car (5kg) is 3 minutes if performed at 700 bar.
[111] Cars have an average price of €50 000-60 000 (excluding VAT) and hydrogen plants might require investments of up to 1.4 million euros, depending on whether they have on-site hydrogen production and the daily capacity of the production. Source: Development Strategy for Hydrogen in Andalusia Agency of Innovation and Development of Andalusia.
[112] http://aeh2.org/images/stories/PDF/estrategia %20del %20hidrogeno %20en %20andalucia.pdf
[113] http://aeh2.org/images/stories/PDF/planificacion %20del %20despliegue %20de %20las %20estaciones %20de %20servicio % 20 of % 20hidrgeno.pdf
[114] http://aeh2.org/images/stories/PDF/AeH2_PYMES %20Andalucia_def.pdf
[115] https://www.agenciaandaluzadelaenergia.es/EEA/

The fuel cell electric vehicle (FCEV) has zero pollutant emissions during use (from tank to wheel) since it only emits water vapour and heat. Their total well-to-wheel emissions depend solely on the method used for the production and distribution of hydrogen.

Currently, hydrogen is mainly produced by reforming natural gas through a thermal process. Even so, it can have a smaller carbon footprint than conventional fuels. The use of hydrogen in vehicles is even more attractive if the production of hydrogen is performed by electrolysis, since in this case emissions depend on the national power generation mix. The ideal solution would be exclusive use of electricity produced from renewable sources during electrolysis, to achieve zero total emissions.

The following graph shows the values for total emissions from different processes for obtaining hydrogen:

Figure III-4. Comparison of CO_2 emissions from hydrogen vehicles and vehicles using conventional fuels (diesel/petrol) for different processes for obtaining hydrogen



Source: JRC Report[116] v4.a, 2014.

TAXATION OF HYDROGEN USED IN VEHICLES

Hydrogen is subject to taxation when used in vehicles with internal combustion engines (ICE), either pure or mixed with other fuels. However, at present it is not subject to taxation when used as fuel in fuel cell electric vehicles (FCEV).

The main characteristics of fuel cell electric vehicles (FCEV) are shown below:

[116] JRC-Joint Research Centre-EUCAR-CONCAWE collaboration 'Well-to-Wheels analysis of future automotive fuels and powertrains in the European context WELL-TO-TANK (WTT) Report' Version 4.a, 2014.
The following were involved in preparing this study: the European Commission (through the JRC), the European refining sector (represented by CONCAWE- European association of oil companies for environmental protection and health-) and European vehicle manufacturers (represented by EUCAR- European Association R & D vehicle-manufacturers).

Table III-27. Features of hydrogen fuel cell vehicles (FCEV)

FEATURES OF FUEL CELL VEHICLES (FCEV)	
PERFORMANCE	Unlike battery electric vehicles, the performance of FCEV does not depend on battery technology to power the engine. The fuel cell is an electrochemical device whose efficiency is not subject to the Carnot cycle. Therefore, it is possible to increase the efficiency from 20 % (conventional passenger car) to 60 % (FCEV).
RANGE	Similar to petrol/diesel passenger cars - 550-600 km. City buses have a range of 350km.
EMISSIONS	Zero tank-to-wheel emissions. If we talk about the total generation cycle through to use on the road, emissions depend on the source of the hydrogen, although even using reformed natural gas instead of electrolysis can result in lower total emissions than with conventional fuels
PRICE	The price of the fuel is not indexed to the oil price. The main drawbacks are that the selling price of hydrogen varies greatly depending on the production process (reforming natural gas, electrolysis, etc.), and logistics. The price in the current hydrogen plants in Spain is competitive with conventional technologies. Cars are known to have a high sale price (€50 000-60 000)
REFUELLING	Refuelling time similar to conventional vehicles (3 minutes to deposit 5kg capacity) for a passenger car. Spain has six hydrogen plants.
OPERATION	Hydrogen can be kept in storage for weeks without deterioration, leakage or loss of qualities Vehicles store hydrogen at pressures between 350 and 700 bar, while in the hydrogen plants it can be stored at slightly higher pressures.

Source: Produced in-house.

III.4.2. CURRENT SITUATION

FLEET OF HYDROGEN POWERED VEHICLES

The Spanish fleet of vehicles powered by hydrogen is limited to demonstration projects[117], of which 11 vehicles were authorised to circulate on public roads in June 2016 according to data from the DGT.

Table III-28. Development of fleet of hydrogen-powered vehicles (December 2012-June 2016)

HYDROGEN FLEET	2012	2013	2014	2015	2016 (until June)
Lorries to 3500 kg	0	0	1	0	0
Vans	0	0	1	0	0
Motorcycles	0	0	1	0	0
Cars	1	2	2	2	3
Others	0	0	33	8	8
Total	**1**	**2**	**38**	**10**	**11**

Source: DGT from data existing in June 2016.

MANUFACTURE AND SALE OF HYDROGEN-POWERED VEHICLES

Currently, Asian carmakers are the only ones to mass-produce hydrogen powered cars. In 2013 Hyundai launched the ix35 model which was followed by Toyota with its Mirai model and, in late 2015, Honda introduced the Clarity Fuel Cell. Meanwhile European manufacturers including (BMW, Mercedes, Volkswagen and Audi, and American manufacturers, i.e. General Motors, have announced that vehicles will appear on the market between 2017 and 2020.

[117] The principal demonstration projects realised; CUTE, ECTOS, HyChain, Hércules, Delfín and ExpoAgua.

EXISTING REFUELLING INFRASTRUCTURE

Spain has six hydrogen plants in different operating states whose locations and technical characteristics are given in the following tables.

Table III-29. Existing hydrogen refuelling stations in June 2016

AC	LOCATION	OPENING YEAR	TYPE ACCESS	STATION OPERATOR
Andalusia	Sanlúcar la Mayor (Sevilla)	2010	Accessible to the public	Abengoa
	Puerto de Sevilla (Sevilla)	2015	Accessible to the public	Abengoa
Aragon	Valderespartera (Zaragoza)	2008	Restricted use	Expo Zaragoza Empresarial, SA
	Walqa Technology Park Ctra Zaragoza-Huesca 75 km (Huesca)	2010	Accessible to the public	Aragon Hydrogen Foundation
Castile la Mancha	La Torrecica (Albacete)	2012		AJUSA
	Puertollano (Ciudad Real)	2016	Accessible to the public	CNH 2

Source: AeH2.

Table III-30. Technical characteristics of existing hydrogen refuelling stations in June 2016

LOCATION	OUTFITTED FOR CARS	OUTFITTED FOR BUSES	OUTFITTED FOR OTHER VEHICLES	NO. REFUELLING POINTS	TYPE H_2 PRODUCTION	SOURCE OF H_2	DELIVERY FORM	PRESSURE[118] (BARS)
Sanlúcar la Mayor (Sevilla)	Yes	Yes	Yes	1	It supports supply under pressure, but has production 'in situ' using renewable electrolysis	Renewable electrolysis	Under pressure	350
Puerto de Sevilla (Sevilla)	Yes	Yes	Yes	1	It supports supply pressure, but has production 'in situ' using renewable electrolysis	Renewable electrolysis	Under pressure	350
Valderespartera (Zaragoza)	Yes	Yes	Yes	2	Supplier and in situ production.		Under pressure	200-350
Walqa Technology Park (Huesca)	Yes	Yes	Yes	2	In situ production from solar/wind energy through electrolysis	Renewable electrolysis	Under pressure	200-350
La Torrecica (Albacete)	Yes	Yes			Supplier and in situ production.			350
Puertollano (Ciudad Real)	Yes	Do not	according tank	1	In situ production from solar energy through	Solar	Under pressure	350

[118] The new international technical standards of the Society of Automotive Engineers (SAE) for hydrogen stations require hydrogen to be stored at 700 bar.

					electrolysis			

Source: AeH2.

In the second half of 2016 the H2PiyR project will start: funded by the Spain, France, Andorra Cross Border Cooperation Programme POCTEFA INTERREG V-A created by the European Commission to promote sustainable development of border territory between the three countries. This project will develop a cross-border corridor of hydrogen plants, connecting the regions of the POCTEFA area (Spain, Andorra and France).

Under this project four hydrogen plants will be built in Spain (Zaragoza, Huesca capital, Fraga-Huesca, Tarragona), one in Andorra and one in France (Palmiers). These six new hydrogen plants will join the two already built in Aragon (Ctra. Zaragoza-Huesca km 75 and Zaragoza Valdespartera) and the two that are currently being built in southern France (Rhodez and Albi). Additionally at least sixteen fuel cell vehicles (six cars, eight lorries and two buses) will be demonstrated. The project's promoters foresee the extension of this corridor into Spanish national territory, and so could seek support through co-financing under other European programmes (Horizon 2020/FCH-JU and CEF Mechanism).

III.4.3. EXPECTED MARKET TRENDS AND OBJECTIVES

MARKET OPPORTUNITIES

The future development of fuel cell electric vehicles (FCEV) in Spain is considered positive, the following opportunities being identified:

Table III-31. Opportunities for the use of hydrogen fuel cells in road transport

OPPORTUNITIES FOR USE OF HYDROGEN FUEL CELLS (FCEV).	
INDUSTRIAL OPPORTUNITY	Impetus for increased offer from manufacturers for supply of vehicles and components/equipment (1) hydrogen storage tanks, (2) electrolysers (3) fuel cells (4) industrial equipment for renewable energy, etc. Exploiting synergies with battery electric vehicles as the propulsion system is similar.
ENERGY OPPORTUNITY	It can have a renewable source and be produced locally. Hydrogen generation through renewable sources: (1) reduces the external dependence on the energy sector, (2) improves intermittency management (wind and solar) and (3) allows local and renewable hydrogen production by electrolysis. In Spain the traditional system of producing hydrogen is by reforming natural gas, but to ensure the sustainability of production it should be produced by electrolysis with electricity from renewable sources.
ENVIRONMENTAL OPPORTUNITY	Zero emissions from tank to wheels. If renewable energy is used for the production of hydrogen, there will also be zero emissions from generation to wheels.

Source: Developed in-house.

DEVELOPMENT OF HYDROGEN REFUELLING INFRASTRUCTURE IN SPAIN

Spain recognises hydrogen as an excellent alternative for steering the transport sector towards the use of renewable energy, local fuel production, energy efficiency and sustainability.

In promoting hydrogen in Spain, both local authorities and the private sector have a key role. On the one hand, the councils of the municipalities where there is a high level of pollution are interested in promoting use of hydrogen in fleet renewal and particularly in their public services. Moreover, the high amount of initial investments in refuelling infrastructure requires seeking synergies in the production of hydrogen (either 'in situ' or in plants) among habitual industrial consumers of hydrogen and future managers of hydrogen plants.

Spanish deployment will start from the six existing hydrogen plants with four additional plants planned for construction as part of project H2PiyR of the POCTEFA-INTERREG initiative. Gradual expansion is expected from the areas of greatest demand, in which private initiative has already expressed interest in investing in order to achieve the desired national coverage. The ten hydrogen plants already planned facilitate the implementation of demonstration projects in real environments, as well as a feasibility study regarding connection with the other EU countries via France. The intention is to serve specific market niches (public transport buses, taxis, company fleets, etc.) that will serve as a model to determine future actions associated with a deployment strategy for hydrogen infrastructure nationwide.

For this purpose, work is currently under way on creating a multidisciplinary working group to prepare the starting points for the future deployment. It is anticipated that this group will start work in the autumn of 2016. Its intended composition is as follows: private companies representing the entire value chain of hydrogen; technology centres; the Ministry of Industry, Energy and Tourism; the Ministry of Development; along with local entities and regional stakeholders. As part of its programme, this working group should encourage the creation of a consortium to create a project for the deployment of infrastructure by private investors. The latter could seek the support of co-financing mechanisms of the European Union (FCH-JU and/or CEF).

Based on the above, the preliminary estimates to date suggest that it is feasible to achieve a fleet of approximately 500 FCEV vehicles by 2020, with 20 hydrogen plants in Spain.

III.5. BIOFUELS

III.5.1. GENERAL DESCRIPTION

EMISSIONS FROM VEHICLES POWERED BY BIOFUELS[119]

Regarding pollutant emissions, we must make a clear distinction between biofuels from agricultural crops (also known as first generation) and those who do not come from agricultural crops but from waste or other raw materials such as algae that do not occupy agricultural land (commonly called advanced).

The use of biofuels instead of fossil fuels produces a reduction throughout the life cycle of greenhouse gas emissions. However, an accurate analysis must take into account extraction, direct land use change, indirect land use change (commonly known as ILUC emissions), use of agrochemicals, transport, refining, etc. Thus, first-generation biofuels can involve very significant emissions in the extraction and production processes. The following table shows the values for the main types of biofuels excluding emissions from indirect land use changes (ILUC).

Table III-32. Typical values for reducing GHG emissions for biofuels compared to conventional fuels (Directive 2009/28, on the promotion of renewable energy)

TYPE OF BIOFUEL	TYPICAL VALUES
Sugar beet ethanol	61 %
Wheat ethanol (natural gas as fuel in a conventional boiler)	45 %
Sugar cane ethanol	71 %
Rapeseed biodiesel	45 %
Sunflower biodiesel	58 %

[119] All information contained in this section was contributed by the Ministry of Agriculture, Food and Environment unless otherwise indicated.

Soya biodiesel	40 %
Wasteoil biodiesel	88 %
Biogas from municipal organic waste as compressed natural gas	80 %

Source: Ministry of Agriculture, Food and Environment from Directive 2009/28/EC on the promotion of the use of energy from renewable sources.

As shown in this table, biofuels from agricultural raw materials have typical greenhouse gas reductions of between 40 and 70 % compared to conventional fuels (diesel/petrol). Biofuels from oils, fats or animal organic waste achieve reductions of at least 80 %. These reductions do not take into account potential net carbon emissions due to indirect land use change (ILUC).

If we take into account the net carbon emissions due to indirect land use change (ILUC), first generation biodiesel offers hardly any net reductions. In some cases, it could even represent net emissions. Conversely first-generation bioethanol offers net reductions of between 30 to 45 %. However, there is still much scientific uncertainty in the assessment of this ILUC effect.

The following table lists the ILUC values for the first generation biofuels covered by Directive (EU) 2015/1315 of 9 September 2015 amending Directive 98/70/EC, relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources.

Table III-33. ILUC emissions of first-generation biofuels (Directive 2015/1315)

TYPES OF RAW MATERIALS	MEDIA (GR CO_2/MJ) *	VARIABILITY RANGE **
Cereals and starch-rich crops	12	8 to 16
Sugars	13	4 to 17
Oilseeds	55	33-66
* The values of total emissions per unit of energy from conventional fuels are approx 90 g CO_2/MJ. * Percentile values between the 5th and 95th percentile		

Source: Ministry of Agriculture, Food and Environment from the Directive (EU) 2015/1315.

Most greenhouse gas emissions from first generation biofuels are produced outside Spain in crops located in Latin America or Asia.

Directive 2009/28/EC, in the version amended by Directive 2015/1315, provides in Article 17 that biofuels produced in facilities that were operational before 5 October 2015 must reduce their greenhouse gas emissions by at least 35 % until 31 December 2017, and by at least 50 % from 2018. Meanwhile, biofuels produced in installations that began to be operational after 5 October 2015 must reduce their emissions by at least 60 %.

As for emissions of air pollutants, biofuels considerably reduce emissions of particulate matter (up to 47 %) and carbon monoxide (up to 20 %). Bioethanol reduces emissions of nitrogen oxides (NO_X) but biodiesel can also increase them (up to 9 % depending on the operating conditions), although this can be counteracted by adjusting engine tuning[120].

[120] Lapuerta M, et al. Effect of biodiesel fuels on Emissions diesel engine; Progress Energy Combust Sci, 2007.

Additionally, the addition of bioethanol increases the octane rating of petrol and improves engine efficiency, making it possible to replace other additives commonly used for this purpose but which contain carcinogens, for example benzene[121].

Biofuels consumed in the European Union meet strict sustainability criteria that ensure emission reduction and full respect for the environment.

ENERGY CONSUMPTION IN VEHICLES POWERED BY BIOFUELS

Biofuels have a lower energy content than conventional fuels (petrol and diesel). Therefore, in order to cover the same distance it is necessary to use a larger quantity of biofuels. This means that the energy content of petrol is 0.7643 tep/m^3 and 0.8598 diesel tep/m^3, while the values for ethanol and biodiesel are 0.5016 tep/m^3 and 0.7882 tep/m^3 respectively

TAXATION OF BIOFUELS

Since 1 January 2013, biofuels have no longer been subject to tax advantages (type 0 %) in the Special Tax on Hydrocarbons, as the 10 year period established has now passed. Biofuels are now subject to the same tax rate as the fossil fuels they replace or with which they are mixed (diesel and petrol).

The following summarises the main features of the vehicles using biofuels:

Table III-34. Features of vehicles using biofuels

FEATURES OF VEHICLES USING BIOFUELS	
PERFORMANCE	The performance parameters are the same as for the fossil fuel with which biofuel is mixed or which it replaces. The uses for which it is appropriate will be the same as for the fuel with which it is mixed or which it replaces.
RANGE	The range of vehicles powered by biofuels is the same as that provided by the conventional fuels with which it is mixed or which it replaces.
EMISSIONS	It reduces particulate and carbon monoxide (CO) emissions. The use of biofuels made from potentially polluting waste (used cooking oils, industrial waste fats or solid waste) allows their use for energy and prevents their release into the environment. However, to reduce net emissions it is necessary to control the level of GHG emissions associated with the biofuel manufacturing process. As it does not naturally reduce the emission of NO_X, additional catalytic reduction systems are required. Biogas from municipal waste has a high sulphur content and low methane concentration so additional desulphurisation processes and concentration are required.
PRICE	According to the CNMC, in 2015 the average differential between the price of sustainable biodiesel and the price of diesel was $ 318/tonne and the average differential between the price of bioethanol and the price of petrol was $ 202.9/tonne. For the end user, the retail price of blends low in biofuels is similar to the price of conventional fuels.
REFUELLING	Biofuel does not require the creation of specific refuelling infrastructure, as the most appropriate way to provide it is mixed with petrol or diesel. No change of refuelling habits for users. Currently only 0.9 % of service stations offer blends with high biofuel content (87 for biodiesel and only 13 for bioethanol)
OPERATION	The operation procedures are the same as used for the fuel it replaces or with which it is mix for supply.

Source: Produced in-house.

[121] Meta-analysis for an E20/25 technical development study - Task 2: Meta-analysis of E20/25 trial reports and associated data; Technische Universität Wien & IFA, 2014.

III.5.2. CURRENT SITUATION

CURRENT FLEET AND REGISTRATION OF VEHICLES POWERED BY BIOFUELS

Generally all diesel engine vehicles marketed in Spain are guaranteed to run on a blend of up to 7 % of biodiesel by volume (B7). Meanwhile, vehicles with petrol engines manufactured before 2000 are usually only guaranteed to run on a blend of up to 5 % bioethanol by volume (E5, also called protection petrol) while those manufactured from the year 2000 support petrol blends with up to 10 % bioethanol by volume (E10).

Many manufacturers offer vehicles that can use fuel with a higher proportion of biodiesel or bioethanol, so it is always necessary to consult the manufacturer's technical specifications.

Currently there are no official data[122] that show either the fleet of vehicles that could use blends above E10 and B7 or the number registered.

EXISTING REFUELLING INFRASTRUCTURE

All suppliers at Spanish service stations offering the usual diesel fuel can supply blends with up to 7 % biodiesel by volume (B7), so that whenever a vehicle is refuelled with diesel, some biodiesel is being consumed. Additionally, in 87 service stations[123], petrol blends are offered with a higher content of biodiesel or pure biodiesel. These fuels with higher proportions of biodiesel have specific labelling at service stations indicating the presence of biodiesel (with the letter B) and the percentage contained in the blend.

Also, the usual automotive petrol sold in Spain can contain up to 5 % bioethanol by volume, so that some bioethanol is being consumed whenever a car is refuelled with petrol. Furthermore, at 13[124] stations it is possible to refuel with petrol blends with up to 85 % bioethanol by volume. This fuel with a higher proportion of bioethanol has a specific labelling at service stations indicating the presence of bioethanol (with the letter E) and the percentage contained in the blend.

Suppliers must indicate the content of biofuels in the blend to be used for refuelling. Although the proportions are not standardised, the possible options are given below:

Table III-35. Possible blends of biofuels used in motor vehicles

BIOETHANOL		BIODIESEL	
E5	Up to 5 % bioethanol and 95 % petrol	**B7**	Up to 7 % biodiesel and 93 % diesel
E10	10 % bioethanol and 90 % petrol	**B10**	10 % biodiesel and 90 % diesel
E15	15 % bioethanol and 85 % petrol	**B30**	30 % biodiesel and 70 % diesel
E85	85 % bioethanol and 15 % petrol	**B100**	100 % biodiesel

Source: Created in-house.

Regarding development of the number of service stations that sell blends with higher biofuel content (E5 and B7), there has been a significant decrease: from 500 in 2011 to 100 today, representing[125]

[122] The Directorate General of Traffic (DGT) is the body responsible for publishing statistics on motor vehicles.
[123] Source: Geoportal of the Ministry of Industry, Energy and Tourism. Data updated to 1 July, 2016.
[124] Source: Geoportal of the Ministry of Industry, Energy and Tourism. Data updated to 1 July, 2016.
[125] In 2015 Spain had 10 947 fuel outlets (petrol and diesel) according to the CORES Annual Statistical Report 2015 compiled from data from AOP, UPI and sector companies.

0.9 % of all outlets in Spain[126]. This decrease is a result of two factors: the abolition, in late 2012, of the exemption for biofuels in the tax on hydrocarbons; and the downward revision of the mandatory targets for biofuels in motor fuels, which fell from 6.5 % fixed for 2012 to 4.1 % in 2013, 2014 and 2015, both figures calculated in energy terms.

Order ITC/2308/2007 of 25 July 2007, establishes how information must be submitted to the Ministry of Industry, Tourism and Trade on activities related to the supply of petroleum products. The Order obliges companies operating refuelling points for biofuels to submit their data. Through the Geoportal database of the Ministry of Industry, Energy and Tourism, Spain ensures that users have relevant, clear and consistent information about the geographic location and prices of all refuelling and recharging points for biofuels as provided for in Article 7(7) of Directive 2014/94/EU. In addition, the Andalusian Public Energy Agency has published[127] a map of the biofuels service stations in Andalusia.

III.5.3. EXPECTED MARKET TRENDS AND OBJECTIVES

MARKET OPPORTUNITIES

The future development of biofuels in Spain is considered positive with the following opportunities being identified:

- It is currently the main source of energy from renewable sources used in transport: It contributes to the objective set by Directive 2009/28/EU for 2020, that fuels used in transport should use 10 % of energy from renewable sources.
- Compatibility with engines using petrol and diesel: All vehicles that make up the Spanish fleet can use blends B7 and E5. Many manufacturers guarantee that vehicles will function with blends using higher proportions, so it is always necessary to consult the vehicle specifications.
- Compatibility with existing refuelling infrastructure and distribution for petrol and diesel: Can be supplied at existing service stations and therefore does not require building new infrastructure for distribution and supply.
- Can reduce net greenhouse gas emissions; but it is necessary to take into account the complete cycle of extraction as well as direct and indirect land use changes.
- Regarding air quality in large urban agglomerations, reduces particulate emissions and CO. Specifically bioethanol reduces NO_X.
- Obtaining fuel from biomass also allows the use of waste (used cooking oil, municipal solid waste, etc.).
- In 2015 Spain had 36 industrial plants that manufacture biofuels (32 for biodiesel and 4 for bioethanol) with ratios of utilisation of installed capacity of 26 % and 100 % respectively.
- The growth of the biofuels industry can generate investment and employment, especially in rural areas, by encouraging the creation of different agricultural industries[128].
- Same range and refuelling time as vehicles powered by conventional fuels.
- High biodegradability: an accidental spill is eliminated naturally in an average time of 21 days, thus reducing the hazards and toxicity to the environment.

[126] The low number of service stations that sell blends high in biofuels contrasts with the situation in other countries such as France, Germany, Sweden (where 10 % of the vehicle fleet is powered by biofuel) or Finland. Appendix B includes detail of the 100 service stations that sell blends containing more biofuels than E5 and B7.

[127] https://www.agenciaandaluzadelaenergia.es/ciudadania/energia-andalucia/cartografia-energetica/mapa-suministro

[128] 75 % of biofuels consumed in the European Union (EU) are produced using mainly raw materials grown or generated in Europe. Source: Renewable energy progress of the European Commission, published in 2015.

Table III-36. Opportunities for the use of biofuels for road transport

OPPORTUNITIES FOR THE USE OF BIOFUELS FOR ROAD TRANSPORT	
INDUSTRIAL OPPORTUNITY	Increasing demand will make it possible to consolidate the associated production of biofuels, which currently already has sufficient capacity (4.1 million tonnes per year) to meet the current and projected consumption from industry. There are 36 industrial plants (32 for biodiesel and 4 for bioethanol) that combine experience and competitiveness. Development of technologies for producing advanced biofuels, with a great future.
ENERGY OPPORTUNITY	Allows increased use of renewable energy in transport, contributing to compliance with Directive 2009/28/EU.
ENVIRONMENTAL OPPORTUNITY	Reduces emissions of greenhouse gases, particulates and CO. Bioethanol reduces NO_x. Make use of waste in their production. Renewable sources.

Source: Developed in-house.

MANDATORY MINIMUM TARGETS FOR SALES AND/OR CONSUMPTION

The consumption of biofuels in Spain is supported primarily by the legally established minimum mandatory targets for sale or consumption of biofuels for transport purposes. Those targets which are currently set for the period 2016-2020 by Royal Decree 1085/2015, of 4 December 2015, on the promotion of biofuels. It is estimated that those targets will be achieved through:

- The incorporation of 7 % by volume of biodiesel in fossil diesel (B7) and 5 % by volume of bioethanol in fossil petrol (E5), since the entire Spanish fleet is guaranteed to work with these blends without any need for adaptations in the engines. Therefore, Spain does not foresee growth in the use of labelled blends with biofuel content greater than E5 and B7 as technical specifications for motor fuels with higher contents of biofuels are not being developed.

- The use of biofuels made from raw materials with double counting listed in Annex IX of Directive 2009/28/EC.[sic]

- The use of hydrotreated vegetable oil (HVO).

Therefore, this National Action Framework maintains the quantitative targets established by Royal Decree 1085/2015, of December 4 2015, to promote biofuels, as listed below.

Table III-37. Market development until 2020 according to the mandatory minimum targets for biofuels

	2016	2017	2018	2019	2020
Mandatory minimum targets for sales and/or consumption of biofuels (%)	4.3 %	5 %	6 %	7 %	8.5 %

Source: Royal Decree 1085/2015, of December 4 2015, on the promotion of biofuels.

Attention is drawn to Article 7(a) of Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce of greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC. The aforementioned article established the obligation to reduce life cycle greenhouse gas emissions per unit of energy supplied by fuels to 6 % by 2020. To this end, Directive 2015/652 of the Council of 20 April 2015 laying down the calculation methods and requirements in accordance with Directive 98/70/EC cited above, must be transposed before April 21, 2017.

Indeed, one of the alternatives for achieving such emission reductions, along with the use of alternative fuels and upstream emissions reduction (UER) or reduction during production, is the incorporation of biofuels in amounts that may result in penetration percentages even higher than

indicated. This depends on the technical solutions chosen by operators and by the transposition of the Directive, currently in progress.

III.6. MEASURES AT STATE LEVEL

In order to implement the Strategy to Promote Alternative Energy Vehicles through specific measures, **three Priority Areas** have been defined**:**

- **Area I. -Market.** Actions to drive demand to facilitate increased supply and economies of scale.
- **Area II. -Infrastructure.** Actions to promote a network infrastructure to meet the mobility needs of users.
- **Area III. –Industrial production.** Actions to promote the industrial production of alternative energy vehicles and the associated supply points, with the aim of placing Spain at the forefront of driving these technologies.

The above three areas have in common the **Crosscutting Priority. - Regulatory Framework** under which the established rules and tax incentives give continuity and stability to all the actions, making it possible to provide certainty to the market, to investors in infrastructure and to industry leaders. Within the Priority Areas, **six** specific **action areas** have been defined**:**

In Area I. -Market.
- Area I: Acquisition of Vehicles with Alternative Energies.
- Area II: Dissemination and awareness of alternative energy.

In Area II. -Infrastructure.
- Area III: Refuelling Infrastructure.

In Area III. Industrial production.
- Area IV: Promoting Industrial production and RDI

In the Regulatory Framework crosscutting priority
- Area V: Regulations
- Area VI: Tax Incentives

In total, there are 38 **Promotional Measures** developed at state level, to promote the use of alternative energy in road transport. Their relation to the priority areas and areas of operation are set out below.

MARKET	**ACQUISITION OF VEHICLES WITH ALTERNATIVE ENERGY SOURCES**	
	MK-1	MOVEA-Acquisition Plan
	MK-2	Convention for improvement in financing conditions in purchasing AEVs
	MK-3	Climate projects
	MK-4	PIMA plans
	DISSEMINATION AND AWARENESS ON ALTERNATIVE ENERGY SOURCES	
	DC-1	MOVEA web platform
	DC-2	Zero, Eco, C and B labels
	DC-3	Participation in the European Monitoring EAFO
	DC-4	Practical training in driving alternative energy vehicles

	DC-5	Vocational transport sector training in alternative energy vehicles
INFRASTRUCTURE	IFR-1	MOVEA-Infrastructure Plan
	IFR-2	Boost participation in the INTERREG Cooperation Programme
	IFR-3	Boost participation in projects of common interest in the trans-European networks (TEN-T)
	IFR-4	Financial support for the deployment of supply infrastructure to municipalities
	IFR-5	Installation of recharging stations for electric vehicles at train stations and airports
	IFR-6	Spanish-Portuguese-French initiative to encourage electric vehicle
	IFR-7	Installation obligations for recharging infrastructure, ITC-BT-52
INDUSTRIAL PRODUCTION	FIDI-1	Programme of Innovative Business Groups (AEIs).
	FIDI-2	Lines of RDI linked to alternative energies
	FIDI-3	Encouraging participation in JTIs and PPPs at European level.
	FIDI-4	National Plan for Smart Cities.
	FIDI-5	Boosting Technology Platforms for the development of AEVs
	FIDI-6	Boosting centres and research infrastructure for the development of AEVs
	FIDI-7	Programme of Reindustrialisation and Development of industrial competitiveness.

REGULATORY FRAMEWORK	**REGULATIONS**	
	NR-1	Role of recharging manager. Analysis of adaptation of this role to market requirements.
	NR-2	'Supervalle' (super-off-peak) electricity tariff.
	NR-3	Technical instruction for the infrastructure for recharging electric vehicles (ITC BT-52).
	NR-4	Analysis of tolls for recharging points.
	NR-5	Authorisation to install recharging stations in residential buildings.
	NR-6	Exemption in compliance with the terms for licences to hire out vehicles with drivers.
	NR-7	Vehicle registration with recognition in the approval of a higher maximum authorised mass.
	NR-8	Traffic lanes for high-occupancy vehicles – HOV
	NR-9	Minimum mandatory targets for biofuels.
	NR-10	Inclusion of environmental criteria in tendering for public passenger transport services.
	NR-11	Inclusion of AEVs in the catalogue of the Framework Agreement for renewal of state-run fleets
	NR-12	Participation in Technical Committees for Standardisation (ISO, CEN/CENELEC and AENOR).
	TAX INCENTIVES	
	IF-1	Relief on vehicle tax (IVTM)
	IF-2	Relief on registration tax (IESDMT)
	IF-3	Income tax reduction applicable to employment income in kind

MARKET AREA

ACQUISITION OF ALTERNATIVE ENERGY VEHICLES

MK-1	MARKET	ACQUISITION OF VEHICLES WITH ALTERNATIVE ENERGY SOURCES	
MOVEA-Acquisition Plan		Royal Decree 1078/2015, of 27 November, for the MOVEA Plan and successive measures	MINETUR-DGIPYME

OBJECTIVE: Aid for the **purchase of vehicles** with alternative energy.

DESCRIPTION: The Plan to Promote Sustainable Mobility with Alternative Energy Vehicles (Plan MOVEA) boosts the market by granting aid directly for acquiring alternative energy vehicles (AEV). There are incentives for all types of vehicle, in particular the purchase of commercial vehicles in order to facilitate the incorporation of AEV in the fleets of both public and private companies, particularly SMEs and freelance operators. The aim is that companies can better understand the benefits of these vehicles both in terms of total cost of use but also in terms of institutional image.

This new plan launched in 2016 unifies existing state aid up to the MOVELE Programme and the PIMA-Air Plan representing continuation of the Spanish commitment to sustainable mobility. The Programme Promoting Demand for Electric Vehicles (MOVELE), framed within the Comprehensive Strategy to Promote Electric Vehicles in Spain 2010-2014, was operational until 2015 and granted approximately 37 million euros for the purchase of electric vehicles. For its part, the Plan to Promote the Environment (PIMA-Air) aimed to reduce emissions of air pollutants, primarily particulates and emissions of CO_2, by replacing the commercial vehicle fleet with models available in the Spanish market that are more efficient and have lower environmental impact. This Plan was in effect for four cycles and the associated budget was 54 million euros.

For 2016, the MOVEA Plan has a total budget of 16.6 million euros for the purchase of AEVs. The beneficiaries of this aid may be individuals, independent operations, private companies, local authorities, Autonomous Communities and agencies of the AGE. The categories of vehicles eligible for such aid are: quad bikes, passenger cars, large and small vans, coaches, buses, lorries and motorcycles. The amount of aid depends on the vehicle category and the technology driving it.

Maintaining this Plan in the future, as well as its budget, depends on the budgetary stability targets, along with constant assessment of its necessity and economic impact.

IMPACT: Increases the number of vehicles with alternative energy for all types of beneficiaries and vehicle categories.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

MK-2	MARKET	ACQUISITION OF VEHICLES WITH ALTERNATIVE ENERGY SOURCES	
Convention for improving financing conditions for the purchase of alternative energy vehicles		Collaboration agreement	MINETUR-DGIPYME- CERSA
OBJECTIVE: Promoting the purchase of vehicles with alternative energy by improving funding			
DESCRIPTION: In 2013 the Spanish company Reafianzamiento, SA, CERSA, a state enterprise under the Ministry of Industry, signed a cooperation agreement with business associations linked to the automotive sector (ANFAC, ANIACAM, FACONAUTO and GANVAM) to improve funding conditions for independent operators and small and medium-sized Spanish enterprises for acquisition of passenger and commercial vehicles. This agreement facilitates the financing of alternative energy vehicles under the conditions of the 23 mutual guarantee schemes (*Sociedades de Garantía Recíproca* - SGR).			
IMPACT: Renewal of fleets of SMEs and independent operators with EAVs			
Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

MK-3	MARKET	ACQUISITION OF VEHICLES WITH ALTERNATIVE ENERGY SOURCES	
Climate projects		Annual calls for expressions of interest	MAGRAMA
OBJECTIVE: Aid to promote low-carbon growth, consolidating a sustainable and innovative economy			
DESCRIPTION: The Climate Projects are initiatives in diffuse sectors (agriculture, transport, residential and waste) to encourage low-carbon activities. The Carbon Fund for a Sustainable Economy (FES-CO_2) acquires the verified reductions achieved by approved projects, thus contributing to their financial viability. The aim of FES-CO_2 is to promote low-carbon growth, consolidating a sustainable and innovative economy that creates jobs and wealth in sectors associated with action for climate change, where activity is not regulated by Law 2/2011 on a Sustainable Economy. Among the projects, there is a specific programme for mobility activities with electric vehicles. In the 2016 call for interest, a total budget of 20 million euros is available and the amount of each tonne of CO_2 reduction is quantified at €9.70. A specific programme has been created to promote the deployment of the recharging points infrastructure.			
IMPACT: Replacing conventional vehicles by electric vehicles and recharging points in the fleets of companies or municipal authorities			
Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

MK-4	MARKET	ACQUISITION OF VEHICLES WITH ALTERNATIVE ENERGY SOURCES
PIMA plans	Royal Decrees for annual call for interest Royal Decree 1007/2015 Royal Decree 1081/2014	MAGRAMA- MFOM- Private initiative

OBJECTIVE: Aid for the scrapping of vehicles and promotion of their renewal.

DESCRIPTION: The Plans to Promote the Environment, known as PIMA, are a tool for promoting a set of concrete measures that contribute to improving environmental conditions. The different proposed PIMAs also have a positive effect on economic development and job creation. They are:

- PIMA Company Plan: The Plan to Promote the Environment *PIMA Empresa* (PIMA Company) is an initiative aimed at reducing direct emissions of greenhouse gases (GHGs) in the business sector. The beneficiaries of this incentive are companies committed to the carbon footprint scheme and entered in the Register for carbon footprint, compensation and CO_2 absorption projects. The PIMA Company Plan finances 15 % of investments raised to reduce CO_2 emissions by companies registered in the carbon footprint Register, with a limit of 150 000 euros.

- PIMA Transport Plan: The Ministry of Agriculture, Food and Environment provides direct aid for the renewal of buses and heavy goods vehicles. The current situation of the ageing of the professional fleet of heavy goods vehicles and passenger buses makes it advisable to establish aid so that older vehicles are withdrawn. The plan includes incentives for the scrapping of buses and freight vehicles with their own traction capacity of more than 3.5 tonnes maximum authorised mass (MAM) which are more than eight years old. Its objective is to shift goods or passengers being transported to heavy vehicles with lower emission levels of CO_2 and air pollutants, such as alternative energy vehicles.

IMPACT: Replacing conventional vehicle fleets for companies and independent operators with AEVs, with special attention to goods vehicles in the Pima Transport plan.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

DISSEMINATION AND AWARENESS OF ALTERNATIVE ENERGY SOURCES

DC-1	MARKET	DISSEMINATION AND AWARENESS OF ALTERNATIVE ENERGY SOURCES	
MOVEA web platform		Strategy to Promote Alternative Energy Vehicles (AEV) in Spain 2014-2020.	MINETUR-DGIPYME MINETUR-IDAE

OBJECTIVE: To encourage institutional communication on AEVs

DESCRIPTION: Spain has developed a Plan of Institutional Communication on Alternative Energy Vehicles including the following activities:

- Design of the 'VEA' and 'MOVEA' brands. Both brands come with a manual for application to different supports, which serves as a guide for manufacturers and associations.
  - 'VEA' has been designed as an umbrella-term branding all vehicles with alternative energy, with variations corresponding to each of the technologies (electric, NG, LPG, hydrogen and biofuel).
  - 'MOVEA' includes plans to boost sustainable mobility.

- The MOVEA web platform has been created (http://www.moveaplan.gob.es/). It aims to provide a complete overview of each alternative fuel to potential users, including technical aspects such as the complete catalogue of vehicles, the location of recharging and/or refuelling points for alternative fuels, the current fleet, etc.

- Different communication strategies are being put into effect on incentives for alternative fuels through participation in day-long events targeting the various stakeholders in sustainable mobility (public authorities at local and regional level, professional associations, clusters and the general public). Different strategies have been created according to the needs of each agent.

IMPACT: The development of the MOVEA web platform makes it possible to present the benefits of alternative energy vehicles to society, as well as giving visibility to the different measures to boost AEVs.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

DC-2	MARKET	DISSEMINATION AND AWARENESS OF ALTERNATIVE ENERGY SOURCES	
Zero, Eco, C and B labels		Resolution of 13 April 2016 of the Directorate General of Traffic.	DGT

OBJECTIVE: To facilitate the identification of Alternative Energy Vehicles

DESCRIPTION: Under Resolution of 13 April 2016 of the Directorate General of Traffic (published in the Official State Gazette on April 21 2016) four identifying marks have been created for environmental classification based on the environmental impact of local pollutant emissions of the vehicles. These environmental marks classify and grade 50 % of the fleet.

The purpose of fleet classification is positive discrimination in favour of vehicles that are more respectful with the environment. It is also intended to be an effective tool for municipal policies both to restrict traffic in high pollution periods, and to promote new technologies through tax benefits or benefits for mobility and the environment.

Displaying the identifying mark is voluntary. However, since it facilitates the rapid identification of the least polluting vehicles, it is recommended that the mark be displayed in the lower right corner of the front window, for vehicles that have them, or failing that, at any visible place on the vehicle. The marks come in the form of stickers of different colours depending on the category and amount of local emissions. They include a QR code with information about the registration year, make, model, fuel, category and electric range, EURO emissions and rating for tax purposes. The label number, registration number and vehicle power source are all indicated.

Since April 2015 the owners of vehicles with 'zero local emissions' have received environmental ZERO labels. This category is applicable for vehicles L, M1, N1, M2, M3, N2 and N3 classified in the Register of Vehicles with the following classification:

- BEV (Battery Electric Vehicle)
- REEV (Range Extended Electric Vehicle)

- PHEV (Plug in Hybrid Electric Vehicle): plug-in hybrid with a minimum range in electric only mode of 40 km
- FCEV (Fuel Cell Electric Vehicle)
- HICEV (Hydrogen Internal Combustion Engine Vehicle)

From the second half of 2016 this is also extended to the following categories:

ECO:

- M1 and N1 vehicles classified in the Register of Vehicles as plug-in hybrids with range <40km, non-plug-in hybrids (HEV), powered by compressed natural gas (CNG) or liquefied petroleum gas (LPG). In all cases, they must meet the criteria of the label C.
- Vehicles M2, M3, N2 and N3 classified in the Register of Vehicles as Plug-in hybrid with range <40km, non-plug-in hybrids (HEV), powered by compressed natural gas (CNG) or liquefied petroleum gas (LPG). In all cases, they must meet the criteria of the label C.

C:

- M1 and N1 vehicles classified in the Register of Vehicles as petrol EURO 4/IV, 5/V and 6/VI or diesel EURO 6/VI.
- M2, M3, N2 and N3 vehicles classified in the Register of Vehicles as petrol Euro VI/6 or diesel Euro VI/6.

B:

- M1 and N1 vehicles classified in the Register of Vehicles as petrol EURO 3/III or diesel Euro 4/IV or 5/V.
- Vehicles M2, M3, N2 and N3 classified in the Register of Vehicles as petrol Euro IV/4 and V/5 or diesel Euro IV/4 and V/5. ‘

IMPACT: The labels allow the identification of AEVs, and a very useful tool for implementing boosting actions.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

DC-3	MARKET	DISSEMINATION AND AWARENESS OF ALTERNATIVE ENERGY SOURCES	
Participation in the EAFO European Observatory			DIGIPYME-MINETUR DGT IDAE

OBJECTIVE: Creating an information platform for monitoring alternative energy in the EU

DESCRIPTION: The European Monitoring Centre for Alternative Energy was created by the European Commission to be the central point of reference for statistical data, information and news about alternative energy in transport in Europe. The Observatory helps support market development in the European Union and is a key tool for the implementation of Directive 2014/94/EU on the deployment of alternative fuels infrastructure.

In the current phase, the Observatory is integrating all relevant statistical data on vehicles and infrastructure, legislation, support and incentive programmes, regularly presenting analysis and general information, such as news and publications. To this end, the DGT with the General Directorate of Industry and SMEs have formed a working group to respond in coordination with the information provided to it by Spain.

IMPACT: The EAFO allows grouping and consolidation of statistical data from the Member States of the EU

Natural gas	Electricity	LPG	Hydrogen	Biofuels

DC-4	MARKET	DISSEMINATION AND AWARENESS OF ALTERNATIVE ENERGY SOURCES

Practical training for driving with alternative energy vehicles		DGT
OBJECTIVE: To inform future drivers about the technology of vehicles with alternative energies		
DESCRIPTION: The Directorate General of Traffic (DGT), through driving schools, is promoting the development of practical training in driving alternative energy vehicles (AEV) and in efficient driving.		
IMPACT: This training access to AEVs for younger drivers more likely to adopt new technologies.		

Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

DC-5	MARKET	DISSEMINATION AND AWARENESS-RAISING OF ALTERNATIVE ENERGY SOURCES
Professional training in the transport sector in alternative energy vehicles		MFOM
OBJECTIVE: Improve the training of professionals in the road transport sector		
DESCRIPTION: In the area of support schemes for professional training in the passenger and goods transport sector, the Ministry of Public Works has a specific line of aid for road transport which is intended to support courses and seminars on topics of interest to the road transport sector with the aim of improving the training of professionals in the sector. As of 2016, courses and seminars on the use of alternative energy in road transport are considered are issues of interest to the sector and therefore fall within the scope of the aid.		
IMPACT: This measure makes it possible to develop specific training for the road transport sector, in particular in the field of alternative energy		

Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

INFRASTRUCTURE AREA

REFUELLING INFRASTRUCTURE

IFR-1	INFRASTRUCTURE	REFUELLING INFRASTRUCTURE	
MOVEA-Infrastructure Plan		Royal Decree 1078/2015, of 27 November 2015, on the MOVEA Plan and successive measures	MINETUR-Private Initiative
OBJECTIVE: Promotion for the implementation of fast and semi-fast recharging points for electric vehicles in areas of public access, in order to promote the necessary infrastructure for the expansion of electric vehicles and related recharging points in private homes and businesses.			
DESCRIPTION: The MOVEA Plan introduces the granting of aid for the implementation of fast and semi-fast recharging points for electric vehicles in public access areas. The grants are intended for private companies, local authorities and Autonomous Communities. The plan also requires vendors to facilitate the installation of recharging points specifically for the buyers. The future of this plan, and its budget, will depend on the objectives of budgetary stability as well as ongoing assessment of its necessity and economic impact.			
IMPACT: The Movea Plan boosts installation of EV recharging points.			
Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

IFR-2	INFRASTRUCTURE	FUELLING INFRASTRUCTURE	
Boost participation in the INTERREG Cooperation Programme		INTERREG	MINHAP-DGFONDOS
OBJECTIVE: The Directorate General of Community Funds promotes the participation of Spanish entities in the EUROPE INTERREG programme.			
DESCRIPTION: This is a programme for the exchange of experiences and knowledge with the aim of improving regional development policies, mainly European regional programmes for Investment in Growth and Jobs. To this end, the programme has prioritised four thematic goals, focusing on: promoting research and innovation; competitiveness of SMEs; the transition to a low carbon economy; and environmental protection and efficient use of resources where the Spanish regional initiatives to support alternative energy can obtain financing.			
IMPACT: H2PiyR project. In the second half of 2016, the H2PiyR project will start as part of the call for interest for the INTERREG V Spain-France Andorra European Territorial Cooperation programme (POCTEFA 2014-2020), created to promote sustainable development of border territory between three countries (Spain, Andorra and France). The project is for the installation in Spain of six new hydrogen plants that will generate hydrogen from renewable energy sources. Four of them will be located in Spain (Zaragoza, Huesca capital Fraga-Huesca, Tarragona), one in Andorra and one in France (Palmiers). These six new hydrogen plants will join the two already built in Aragon (Huesca- Walqa Technology Park and Zaragoza-Valdespartera) and the two that are currently being built in southern France (Rhodez and Albi). Additionally at least sixteen fuel cell vehicles (six cars, eight lorries and two buses) will be demonstrated to validate the optimal routes and FCEV technology in the area of the Pyrenees., The promoters expect this corridor to be extended within the framework of other European initiatives. The project is coordinated by the Foundation for the Development of New Hydrogen Technologies in Aragon, which will develop a cross-border corridor of hydrogen plants, connecting the regions of the POCTEFA area to connect with the vehicular hydrogen supply infrastructure established through the development of strategies for sustainable mobility by countries of central and northern Europe where mobility with hydrogen is more widespread. This project has an estimated budget of 3.8 million euros (65 % cofinanced) and has received institutional support from the regional governments of Aragon and Catalonia.			
Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

IFR-3	INFRASTRUCTURE	FUELLING INFRASTRUCTURE	
Boost participation in projects of common interest of the trans-European transport networks (TEN-T).		CEF mechanism	MINETUR-MFOM

OBJECTIVE: The State Secretariat for Infrastructure, Transport and Housing of the Ministry of Development and the General Secretariat of Industry and SMEs of the Ministry of Industry jointly promoted the participation of Spanish private initiatives in the planning and development of the Trans-European Transport Network.

DESCRIPTION: In particular, the implementation of projects with European added value and significant social benefits that do not receive adequate financing from the market are promoted through the following actions:

- Promote the dissemination of relevant information in Spain:
  - All information relating to public calls for interest to access European funds is published on the website of the Ministry of Public Works.
  - Specific information days are organised.
  - The e-mail inbox buzontent@fomento can be used to respond to requests for specific information from interested parties.
  - Distribution list, comprising mostly private companies that have shown interest or have previously worked with TEN-T programmes, to which all information of interest is sent directly and regularly.
  - Support in the preparation and submission of applications for aid through the organisation of meetings and relations with the European Commission.
  - Monitoring and subsequent supervision of projects that have received funding.

IMPACT: To date, many Spanish institutions have participated in projects to develop infrastructure for the deployment of vehicles powered by alternative energy, among which are:

- The project 'Iberian Infrastructure Corridors for Fast Recharging of Electric Vehicles' (CIRVE): Installation in Spain of 25 new pilot fast recharging points and adaptation of another 15 existing points at strategic locations in the Iberian corridors of the TEN-T network (Mediterranean and Atlantic). Assessing the feasibility of implementing fast recharging points for electric vehicles along the Atlantic and Mediterranean corridors that connect Spain and Portugal with the EU.
- Repsol-Butano Project: Installation in Spain of 51 LPG refuelling points in the Iberian corridors of the TEN-T network.
- Ham Project: Installation in Spain of a mixed LNG/CNG gas plant as part of a European project in Mediterranean regions.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

IFR-4	INFRASTRUCTURE	FUELLING INFRASTRUCTURE	
Financial support for the deployment of supply infrastructure to municipalities and Supra-municipal entities		More than 20 000 inhabitants: Order HAP/2427/2015, of 13 November Less than 20 000 inhabitants: Call pending publication by IDAE	MINHAP-DGFONDOS MINETUR-IDAE

OBJECTIVE: To finance lines of action for Sustainable and Integrated Urban Development (DUSI, for its acronym in Spanish), including infrastructure deployment initiatives for alternative fuels.

DESCRIPTION: European Structural and Investment Funds (ESIFs) for the period 2014-2020, in Spain, include the Operational Programme for Sustainable Growth (POCS) dedicated to financing lines of action for Sustainable and Integrated Urban Development (DUSI). This programme is aimed at municipalities or supra-municipal entities that submit DUSI Strategies and therefore may also include initiatives for infrastructure deployment for alternative fuels.

- Supra-municipal entities of more than 20 000 inhabitants: In the case of municipalities or supra-municipal entities of more than 20 000 inhabitants, these funds are managed by the Ministry of Finance and Public Administrations (MINHAP). By Order HAP/2427/2015, of 13 November 2015, MINHAP approved the bases and the first call for the selection of strategies for Sustainable and Integrated Urban Development. In 2016 a second call was launched by Order HAP/1610/2016 of October 6 2016.
- Supra-municipal entities of less than 20 000 inhabitants: For municipalities or supra-municipal entities of less than 20 000 inhabitants, a specific line has been established in the area of mobility which, in Spain, is managed by the IDAE as an intermediate body of ERDF funds. The aid budgeted for 2016 amounts to 336 million euros.

IMPACT: This financial support makes it possible to develop lines of action for Sustainable and Integrated Urban Development in municipalities and supra-municipal entities, development plans which may include the deployment of alternative energy vehicles and the associated supply infrastructure.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

IFR-5	INFRASTRUCTURE	FUELLING INFRASTRUCTURE	
Installation of recharging points for electric vehicles at train stations and airports			MFOM-AENA MFOM-ADIF-RENFE

OBJECTIVE: Deployment of infrastructure for recharging points for electric vehicles in airports and train stations.

DESCRIPTION:

- AENA currently has a fleet of 13 electric vehicles for the airports of Madrid-Barajas, Palma de Mallorca and Lanzarote. The use of these vehicles is estimated to reduce CO_2 emissions by 5 200 kilos, and represent a cost saving of 5 100 euros/year.

  These vehicles are used to service airports in the activities of the departments of operations, environment and engineering, among others.

  The supply of electric power to cars comes from specially designed recharging infrastructure. In this regard, 53 recharging points are installed, provided by Endesa, of which 18 are located in Madrid-Barajas; 15 in Barcelona-El Prat; 10 in Palma de Mallorca and 8 in Lanzarote. The vehicles are charged in off-peak or night hours when the airport has less demand for electricity, so that the impact on the existing electricity system is minimal. Putting this fleet of electric vehicles into operation represents the continuation of the AENA's commitment to electric mobility after pilot tests of short duration carried out in 2010 at the airports of Madrid-Barajas and Barcelona-El Prat. The tests showed positive results for use in the field of airport activity.

- The authorities responsible for managing Renfe stations, the Ministry of Development and Adif (Railway Infrastructure Administrator), are planning to install recharging points in stations. Some of the stations will make use of the energy generated by the braking of trains. On this subject, the Ferrolinera 3.0 project was launched by the Ministry of Development and Adif to place recharging points for electric vehicles in train stations.

IMPACT: To date, Spain has planned authorisation of:

- A total of 53 recharging points for company vehicles, distributed across four national airports.
- Developed recharging points at train stations.

Natural gas	**Electricity**	LPG	Hydrogen	Biofuels

IFR-6	INFRASTRUCTURE	FUELLING INFRASTRUCTURE	
Spanish-Portuguese-French initiative to promote electric vehicles.			MINETUR-SGIPYME MAGRAMA

OBJECTIVE: Promotion and coordination to promote the development of electric vehicle use

DESCRIPTION: In November 2015 representatives of the governments of Spain (the Minister of Agriculture, Food and Environment and the General Secretariat of Industry and SMEs) Portugal and France signed a joint declaration for the promotion of electric vehicles.

The Spanish-Portuguese-French initiative to encourage electric vehicles identifies ten actions to encourage the development of electric vehicle use and launch a working group to implement an infrastructure project of public recharging points in the Iberian Peninsula:

Demand management:

1. Implementation of information campaigns and awareness-raising reporting on existing measures to facilitate the development of electric mobility and publicise the reliability of this type of vehicle.

2. Promoting training actions aimed at different target groups such as the staff of workshop and dealership networks, as well as other users of electric vehicles and electrical mobility infrastructures.

3. Development of advantages for users of electric vehicles based on identification of such vehicles using certificates, license plates or labels recognisable by the competent authorities. The purpose is to facilitate the adoption of measures such as reducing tariffs on public parking, tax breaks, preferential access to central areas, etc.

4. Maintaining policies to boost demand intended to allow the output to reach maturity.

5. Support for public and private vehicle renewal, which plays a key role in the introduction of these vehicles on the market.

Research, development and innovation

6. Research and development in the field of new, more competitive batteries: supporting industry efforts in RDI through public instruments developed by States.

7. Managing recharging on the move through the interoperability of services and recharging networks.

8. Innovative solutions for the implementation of recharging infrastructure.

Boost infrastructure

9. Development of basic public infrastructure to boost the market.

10. Deployment of international corridors. This infrastructure development must be standardised across joint projects in order to work on interoperability.

IMPACT: Coordination among Member States in the development of infrastructure for AEVs

Natural gas	**Electricity**	LPG	Hydrogen	Biofuels

IFR-7	INFRASTRUCTURE	FUELLING INFRASTRUCTURE	
Installation obligations for recharging infrastructure ITC-BT-52		Royal Decree 1053/2014, of December 12 2014	MINETUR

OBJECTIVE: Promoting the recharging infrastructure

DESCRIPTION: Royal Decree 1053/2014 requires new collective residential buildings with private parking to have pre-installed for electric recharging facilities with the cost included in the building cost. In addition, new public parking places (shopping centres, public buildings, etc.) must have a recharging point for every 40 spaces. For all new buildings or car-parks, the following minimum facilities for recharging electric vehicles are required:

- In new single-family homes with parking or an area to accommodate an electric vehicle, an exclusive circuit for recharging electric vehicles will be installed.
- In car parks or collective parking areas in buildings with co-ownership schemes, there must be main pipeline for communal areas (using pipes, channels, trays, etc.) to make it possible to channel electricity to recharging points located in the parking areas. In addition, in the place where the meters are located, at least one spare slot will be added so that a main meter can be fitted for the recharging apparatus; and space will be reserved for devices that protect against current surges associated with the meter.
- In car parks or parking areas for private, cooperative or company fleets, and for office vehicles for staff and associates, and in municipal vehicle parks, the installations necessary to supply a recharging station for every 40 parking spaces will be included.
- In car parks or permanent public car-parks, it will be necessary to supply a recharging station for every 40 parking spaces.

Also, on public roads the necessary facilities must be installed to supply recharging stations located in places intended for electric vehicles, as included in sustainable mobility plans at municipal and supra-municipal level.

As for existing buildings, when the first recharging point is installed, common elements must also be installed so as to enable the infrastructure in order to accommodate new points in future.

IMPACT: Development of recharging infrastructure in new buildings

Natural gas	Electricity	LPG	Hydrogen	Biofuels

AREA PROMOTING INDUSTRIAL PRODUCTION AND RDI

FIDI-1	INDUSTRIAL PRODUCTION	PROMOTING INDUSTRIAL PRODUCTION AND RDI	
Programme of Innovative Business Groups (AEI).		Order IET/1009/2016 of 20 June 2016 and subsequent measures	MINETUR-DGIPYME

OBJECTIVE: Boosting the creation of clusters and funding for their innovation projects, with the aim of promoting the collaboration of the principal stakeholders of the value chain for vehicles powered by alternative energy.

DESCRIPTION: The Ministry of Industry, Energy and Tourism promotes the creation of clusters as agents capable of promoting collaboration between the productive sector, universities and R & D in order to improve competitiveness. Clusters increase both technical and financial capabilities for technological innovation projects with greater range, in order to develop industrial solutions relating to mobility with alternative energy, where execution of such projects by each entity individually would not be feasible.

Once formally established, clusters can be beneficiaries of this support policy developed by the central government through the Programme of Innovative Business Groups (AEI) of the General Secretariat of Industry and SMEs, as well as other similar regional initiatives.

IMPACT: At the current date Spain has the following Association of Innovative Enterprises (AEI) active in alternative energy transport:

- AEDIVE (Business Association for Developing Electric Vehicle Promotion): includes stakeholders present throughout the entire value chain of electric mobility. It has received public funding to support its strategy of innovation and

competitiveness in the following areas: (1) Development of recharging infrastructure, (2) Boosting demand for vehicles and promoting demand in urban environments, (3) Finding synergies along the entire value chain (4) Encouraging the development and industrial production of vehicles, components and equipment in Spain and (5) Establishment of an Observatory for Technological Oversight of electric vehicles.

- AEI-NTH (Innovative Business Grouping for New Hydrogen Technologies): It represents 66 public and private entities from different sectors related to hydrogen in transport.
- LPG national cluster: Constituted in September 2016 to promote innovative projects.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

FIDI-2	INDUSTRIAL PRODUCTION	PROMOTING industrial production and RDI	
Lines of RDI related to alternative energies			DGIC-CDTI-MINETUR

OBJECTIVE: Specific support for the promotion of RDI linked to alternative energies.

DESCRIPTION: The Ministry of Economy and Competitiveness through both the Directorate General for Innovation and Competitiveness (DGIC) as the CDTI, encourages support lines in which projects are evaluated that, particularly by their driver effect on the rest of the supply chain, enable the development and manufacture of modes of transport with alternative fuels in Spain. The main initiatives that support projects related to alternative fuels for transport are cited below:

- RIS3: Support and coordination of the Smart Specialisation Strategy (RIS3) orientated on focusing the productive/entrepreneurial capacity of the Autonomous Communities on potentially competitive areas that can generate development, such as those linked to alternative fuels, in order to maximise performance and avoid overlaps.
- Financial Mechanism of the European Economic Area (EEA Grants): Within the scope of environmental performance and climate change, including funding for projects related to alternative fuels.
- Lines of support for RDI on an international level: to develop projects in partnership with organisations and companies, such as the programmes managed by the CDTI, Eureka and Iberoeka; such programmes support bilateral projects with countries with which there is agreement, and international projects with Unilateral Certification and Monitoring with countries where CDTI is present.
- Collaboration Challenges Programme: an opportunity for companies and R & D agents to execute innovative projects in cooperation and with outcomes relevant to the market. Both in the transport-related challenge and in the challenge of energy and climate change, there is support for projects focused on developing alternative fuels.
- Innovative Public Purchase (CPI): public policy that combines improving public service with promotion of business innovation through procurement of goods, works or services not available at the time of bidding and which are developed through the efforts of the public body issuing the tender. This policy is promoted through the General Directorate of Innovation and Competitiveness that supports public buyers and the CDTI that supports bidding companies.
- Other programmes in this area: R & D Projects (PID), Direct Innovation Lines (SCI), Global Innovation Lines (LIG), the CIEN programme and the NEOTEC programme.

In addition, attention is drawn to participation of the Ministry of Industry, Energy and Tourism in the following actions:

- Strategic Action for Digital Economy and Society (AEESD): seeks to drive technologies with low maturity and high potential for transformation of the ICT sector through the implementation of projects with high technological risk. In addition there is support for large experimental R & D projects based on technologies that fit in the thematic priority for industries of the future, such as those associated with alternative fuels.
- Specific annual calls for interest: each year there is a call for interest intended solely to incentivise projects related to the priority thematic areas included in the State Plan for Scientific-Technical Research and Innovation. These include, inter alia, hydrogen and fuel cell technologies, covering: (1) hydrogen production; (2) research and development of hydrogen technologies and fuel cells; (3) hydrogen storage and distribution, and (4) portable and stationary uses of hydrogen.

IMPACT: Improve the supply of creators of modes of transport and their specific components; knowledge exchange between research institutions and enterprises; infrastructure for refuelling/recharging; and solving problems related to safety, recycling at end of use, etc.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

FIDI-3	INDUSTRIAL PRODUCTION	PROMOTING industrial production and RDI	
Incentive for Spanish Participation in the Joint Technology Initiatives and Public Private Partnership Contracts in Europe.		H2020	DGIC-CDTI-DGIPYME

OBJECTIVE: To promote participation in initiatives in the private sector, the European Union and Member States undertake to support and jointly promote the development and implementation of a programme of research and innovation, aimed at achieving industrial leadership and tackling specific social challenges for the development of alternative energy vehicles.

DESCRIPTION: In particular, the promotion of participation is highlighted in the following joint initiatives at European level:

- GEAR2030: A high level international working group created to ensure a coordinated approach to the challenges that the European car industry is facing in the next 15 years. By participating, Spain seeks to promote the contribution of Spanish entities in activities and international working groups to thereby position itself as a key player in the development of alternative fuels for transport and attract new investment.
- Green Cars Initiative: This Public-Private Partnership Contract, with a focus on energy efficient vehicles and alternative propulsion systems, aims to accelerate research, development and demonstration of technologies that allow the efficient use of clean energy in road transport.
- European Joint Technology Initiative - Hydrogen and Fuel Cells (JTI-FCH): Spain encourages the submission of hydrogen and fuel cell projects by publicising calls for interest from the CDTI across the Spanish hydrogen sector.

IMPACT: Participation of the private sector, companies and associations in European technology development projects in alternative energy vehicles

Natural gas	Electricity	LPG	Hydrogen	Biofuels

FIDI-4	INDUSTRIAL PRODUCTION	PROMOTING INDUSTRIAL PRODUCTION AND RDI	
National Plan Smart Cities.			MINETUR SETSI

OBJECTIVE: The National Plan for Smart Cities in Spain seeks to promote the *Smart Cities* technology industry, particularly industry linked to mobility with alternative fuels, to help local authorities in the process of transformation to Smart Cities and Tourist Destinations. So, its goal is to improve the effectiveness and efficiency of local authorities in providing public services through the use of ICT and to advance the governance of the Smart City and Tourist Destination system.

DESCRIPTION: The plan is coordinated through the Secretary of State for Telecommunications and the Information Society of the Ministry of Industry through the creation of the Smart Cities Advisory Council. The plan was initially provided with a total budget of 153 million Euros, which will co-finance investment through the European Regional Development Fund (ERDF) and the contributions of other governments and the private sector will be added.

IMPACT: This plan allows the development of initiatives for improving energy efficiency in cities

Natural gas	Electricity	LPG	Hydrogen	Biofuels

FI D i-5	INDUSTRIAL PRODUCTION	PROMOTING INDUSTRIAL PRODUCTION AND RDI	
Technology Platforms			MINECO-MINETUR-Private Initiative

OBJECTIVE: Promoting technological and strategic cooperation in the field of technologies related to Alternative Energy Vehicles.

DESCRIPTION: Spain has the following national Technology Platforms:

- Spanish Technology Platform for Automotive and Mobility (M2F-move to future): The Ministry of Economy and Competitiveness finances this platform, with the aim of establishing a forum for discussion related to new technologies with application to alternative energy vehicles, by which it will be possible to achieve the reduction of pollutant emissions into the atmosphere, as well as sustainable mobility. It seeks to promote R & D and to establish strategic links between companies, research centres and universities, in order to direct and align their efforts in R & D so as to achieve these objectives.
- Spanish Technology Platform of the Road (PTC): The Ministry of Economy and Competitiveness supports this meeting forum for all actors in the science-technology-enterprise system with an important role in promoting employment, competitiveness and growth in the road infrastructure sector in Spain. Its activities include: defining policies and priorities for R & D related to the AEV, as well as promoting and encouraging cooperation with national, international and inter-company agencies for such development.
- Integrated Logistics, Intermodality and Mobility (LOGISTOP): The Ministry of Economy and Competitiveness supports this platform with the goal of boosting cooperation and energising all key staff in the Science-Technology-Company system who are working within its scope, encouraging the formation of consortia intended for scientific and technological research,
- Spanish Technological Platform for Sustainable Chemistry (SUSHEM): groups together all stakeholders in the field of Chemistry and Industrial Biotechnology, promoting activities in cooperation, exchange of knowledge and experiences with the ultimate aim of proposing and implementing innovative and competitive actions of a strategic nature to help solve social challenges, including the promotion of technologies in the sector for use in alternative energy vehicles for the sustainability of road transport.
- The Spanish Technology Platform for Hydrogen and Fuel Cells (PTE-HPC): Since 2005, Spain has had this platform, which serves as a discussion forum to bring together the experiences and efforts of the 175 member organisations representing over 300 participants. 52 % of its members are companies, 21 % are technology centres and universities, 17 % government bodies and the remaining 10 % associations and non-profit entities. The activities of its participants are as follows: 33 % linked to the production of hydrogen, 18 % to storage and distribution of hydrogen, another 18 % to vehicles and infrastructure and the remaining percentage to uses of hydrogen. It is an initiative promoted by the Spanish Hydrogen Association and overseen by the Ministry of Economy and Competitiveness.
- Spanish Biomass Technology Platform (BIOPLAT): Pursues the development of technological and business strategies for promoting sustainable use of biomass in Spain and its applications in biofuels. Since its inception in 2006, the number of participating entities amounts to a total of 317, among which there are 34 universities, 55 technology centres and foundations, 27 public entities, 4 research organisations, 23 businesses and 174 cooperative associations.
- Inter-platform Working Group on alternative fuels: this was created with the aim of combining the efforts of the different thematic platforms of alternative energies in the transport sector.

IMPACT: There are already a total of six technology platforms and one inter-platform working group, addressing the identification of key technologies and the promotion of research projects to accelerate progress in the field of vehicles powered by alternative energy.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

F IDi- 6	INDUSTRIAL PRODUCTION	PROMOTING industrial production and RDI	
Research centres and infrastructure			MINECO

OBJECTIVE: Provide adequate research infrastructure for the development of new technologies, including those with application in the field of alternative energy vehicles.

DESCRIPTION: Spain has the following Unique Scientific-Technical Infrastructures (ICTS) linked to the development of technologies related to vehicles powered by alternative energy:

- The **National Centre for Experimentation on Hydrogen and Fuel Cell Technology** (CNH 2): This is the research centre of reference for hydrogen in Spain. It was created in 2007 as a public consortium, between the then Ministry of Education and Science and the Regional Government of Castile-La Mancha, with 50 % each. It acts as an executive agent of the Spanish Science, Technology and Innovation system and is currently attached to the General State Administration. It is based in Puertollano (Ciudad Real). This centre contributes to the implementation of scientific advances achieved by national and international research groups, the diffusion of scientific knowledge adapted for application in useful technological development and research, along with demonstration of transformation processes using hydrogen as an energy carrier and its final application in possible uses.
- The **Solar Platform of Almeria** (PSA): Belonging to the Centre for Energy, Environment and Technology Research (CIEMAT) which is the largest research, development and testing centre in Europe dedicated to solar concentration technologies. In addition to electricity production, it has a research group dedicated to RDI in the integration of solar energy into large-scale hydrogen production. The main fields of action in this regard are the development of processes and technologies for decarbonisation and recovery of fossil fuels of low quality, as well as dissociation of water for hydrogen production using thermochemical cycles with concentrated solar energy.
- The **National Institute for Aerospace Technology** (INTA): This is an autonomous agency attached to the Ministry of Defence, a pioneer in conducting R & D in hydrogen technology in Spain, which has a centre for certification and approval of automobiles. It has notable experience in: (1) characterisation of low and medium temperature prototype fuel cells (power range up to 30 kW), (2) the design, installation, monitoring and evaluation of demonstrators based on energy systems using hydrogen and fuel cells, (3) national projects (Hercules) for adaptation of conventional vehicles for use with hydrogen fuel cells, (4) other European projects (FEBUS, FCTESTNET and FCTESQA) for the development of standards and procedures for testing and characterisation of fuel cells in their application to vehicles (cars and buses), (5) development of standards for type approval of refuelling stations for hydrogen through the European project HyAPPROVAL, in order to standardise approval in the EU, (6) European HyWays project dedicated to establishing a roadmap for deployment of hydrogen as a transport fuel, (7) European EIHP project (European Integrated Hydrogen Project) which laid the foundation for the development of Directive 2007/46/EC of the European Parliament and of the Council of 5 September 2007 establishing a framework for the approval of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, as amended by the current Regulation (EC) No 79/2009 of the European Parliament and of the Council of 14 January 2009 on the approval of hydrogen-powered motor vehicles.
- **National Renewable Energy Centre** (CENER): The CENER-CIEMAT Foundation began its activity in 2002 and its Board is formed by the Ministry of Economy and Competitiveness, CIEMAT, the Ministry of Industry, Energy and Tourism and the Government of Navarre. This is a specialist technology centre in applied research and development and promotion of renewable energy.

IMPACT: This research infrastructure enables projects to conducted on the technological development of vehicles powered by alternative energy.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

FIDI-7	INDUSTRIAL PRODUCTION	PROMOTING INDUSTRIAL PRODUCTION AND RDI	
Reindustrialisation and Development Programme for industrial competitiveness.		Annual calls for interest. Order IET/10/2015, of 12 January, published in the Official Gazette of January 16, 2015.	MINETUR-DGIPYME

OBJECTIVE: Financial support for industrial investment to help strengthen the competitiveness of enterprises and promote the development of industry, and particularly industry involving partial or full manufacture of alternative energy vehicles and components.

DESCRIPTION: The programme of financial support for industrial investment managed by the General Secretariat of Industry and SMEs of the Ministry of Industry, Energy and Tourism financed by loans of 10 years, with a three-year exemption period, for

investment in manufacturers of vehicles and components working towards industrial production of technologies in Spain for vehicles powered by alternative energy, along with their components and additional parts, among other objectives.
IMPACT: This programme provides support for industrial enterprises which are improving their competitiveness in the production of vehicles powered by alternative energy, along with their additional parts and components.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

REGULATORY FRAMEWORK AREA

NORMATIVE

NR-1	REGULATORY FRAMEWORK AREA	NORMS	
Figure of recharging manager. Analysis of this figure's adaptation to market requirements.		Royal Decree 647/2011, of May 9	MINETUR
OBJECTIVE: Analysis of the figure of recharging manager and its activity			
DESCRIPTION: The Royal Decree Law 6/2010 of 9 April on measures to boost economic recovery and employment, in Article 23, reforming Law 54/1997, of November 27, the Electricity Sector, to include in the regulatory framework of the sector a new subject called system recharging manager. Its operation was then regulated through the Royal Decree 647/2011 by which the activity of the system recharging manager for performing energy recharge services is regulated. This Royal Decree defines the activity of recharging managers consistent with providing energy recharge services for electric vehicles and to specify and develop the rights and obligations of system recharging managers. Also, the procedure and requirements necessary for the exercise of this activity are regulated, considering that this new subject is twofold: it is a consumer, but also has a commercial character and supplies to end customers, so it resembles the figure of the marketer.			
IMPACT: 5 years after its creation, it is being analysed if there is the need to amend the legislation to encourage the development of this figure, especially in the various segments of the tertiary sector (hotels, car parks, shopping centres, etc.).			
Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

NR-2	REGULATORY FRAMEWORK AREA	NORMS	
Supervalle electricity tariff.		Royal Decree 647/2011, of May 9	MINETUR
OBJECTIVE: Promotion of recharging electric vehicles in the system's hours of lowest demand.			
DESCRIPTION: This is the establishment of a lower price for consumption in the hours of the system's lowest demand, from 1 am to 7 am, with lower prices that encourage the transfer of consumption from the peak period to this time to flatten the demand curve. It is available to consumers at low voltage with contracted power up to 10 kW.			
IMPACT: This measure helps reduce the cost of recharging EVs and encourages their recharge at off-peak hours of low electricity demand.			
Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

NR-3	REGULATORY FRAMEWORK AREA	NORMS	
Technical Instruction for the infrastructure for recharging electric vehicles (ITC-BT-52).		Royal Decree 1053/2014, of December 12	MINETUR
OBJECTIVE: To regulate the efficient and safe powering of recharging stations.			
DESCRIPTION: Royal Decree 1053/2014 approves a supplementary technical instruction (ITC) added to those already included in the Regulation for Low Voltage Electricity called ITC BT-52 'Facilities with special purposes. Infrastructure for recharging electric vehicles,' whose purpose is to regulate the safe and efficient powering of recharging stations. This complementary technical instruction, in terms of equipment and materials, requires that recharging stations should be used with connection elements that are standardised and technically safe. Currently, work is being done on the development of its technical implementation guide in order to identify those aspects that require specific indications.			
IMPACT: ITC-BT-52 regulates the technical framework necessary to facilitate the installation of recharging linked to electric vehicles.			

Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

NR-4	REGULATORY FRAMEWORK AREA	NORMS	
Analysis of payments for recharging points			MINETUR
OBJECTIVE: Analysis of the adequacy of payments for these consumers.			
DESCRIPTION: Analysis of the adequacy of the payments by these consumers to their load curve respecting the principles of sharing the costs of the electrical system and the economic sustainability of the same.			
IMPACT: To be determined			

Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

NR-5	REGULATORY FRAMEWORK AREA	NORMS	
Authorisation to install recharging stations in residential buildings (without authorisation by the homeowners).		Law 49/1960, of July 21 Law 8/2013, of June 26	MFOM
OBJECTIVE: Simplifying the installation of recharging stations for electric vehicles in Communities of Owners.			
DESCRIPTION: Given the type of housing in Spain, it has been necessary to amend the Condominium Act to simplify and facilitate the installation of electrical recharge points so that there is no need to submit the installation of recharging points to approval by a board of owners. This modification is contained in the third article of Law 19/2009 with measures for procedural streamlining of rental and energy efficiency of buildings.			
IMPACT: It favours the installation of recharging points located in Communities of Proprietors			

Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

NR-6	REGULATORY FRAMEWORK AREA	NORMS	
Exemption from compliance with the limits for lease authorisations for vehicles with drivers.		Amendment of Royal Decree 1211/1990, of 28 September	MFOM
OBJECTIVE: To exempt vehicles using alternative energy sources from compliance with minimum power and length requirements, in order to achieve their deployment.			
DESCRIPTION: Regulation of the Law on Land Transport, for the authorisation of vehicles for lease with driver, exempting them from compliance with the minimum power and length requirements to vehicles using alternative energy sources.			
IMPACT: Allows the approval and use of alternative energy vehicles			

Natural gas	Electricity	LPG	Hydrogen	Biofuels

NR-7	REGULATORY FRAMEWORK AREA	NORMS	
Registration of vehicles for urban public services and short journeys with recognition in the approval of a higher maximum permissible mass.		Instruction pending publication by the DGT	MINETUR-DGT
OBJECTIVE: Minimising the impact of excess weight on certain road vehicles through the possibility of increasing their weight by the incorporation of alternative fuel technologies up to a maximum of one tonne.			
DESCRIPTION: The use of alternative propulsion systems for heavy vehicles (and specifically buses) results in excess weight. Such excess weight should not be counted as part of the payload of the vehicle, since this would economically penalise vehicles with alternative energy. In this perspective, the Directive (EU) 2015/719 of the European Parliament and of the Council of 29 April 2015 amending Directive 96/53/EC laying down for certain road vehicles circulating within the Community the maximum authorised dimensions in national and international traffic and the maximum authorised weights in international traffic, provides certain vehicles with the possibility of increasing their weight by the incorporation of alternative fuel technologies up to one tonne. Following this line, the DGT is working to establish an exceptional framework allowing specific vehicles for public services in an urban environment to exceed the maximum mass authorised under the authorisation referred to in Article 14 of Royal Decree 2822/1998, of 23 December, approving the approved General Vehicle Regulations. This measure prevents any competitive disadvantage that would penalise companies that incorporate clean vehicles into their fleets. In this framework and in accordance with Royal Decree 2822/1998, of 23 December, approving the General Vehicle Regulations, the Ministry of Industry, Energy and Tourism may give exceptions to certain vehicles in their compliance with some of the technical conditions provided, including the maximum authorised masses for the same.			
IMPACT: Allows the approval and use of alternative energy vehicles			

Natural gas	Electricity	LPG	Hydrogen	Biofuels

NR-8	REGULATORY FRAMEWORK AREA	NORMS	
Traffic lanes for high-occupancy vehicles - HOV			DGT

OBJECTIVE: Authorisation for circulation of vehicles powered by alternative energy in lanes reserved for high occupancy vehicles, in order to grant advantages of use to enable the deployment of this type of vehicles.

DESCRIPTION: The reserved lanes for movement of high‑occupancy vehicle (HOV) existing in Spain allow vehicles with the new environmental mark 'zero local emissions' of the DGT to circulate when they are only occupied by the driver if the variable signalling makes this possible. They affect the following:

- The lanes belonging to the central carriageway of the A-6, between kilometres 6 to 20 corresponding to the Community of Madrid.
- The left lanes of both directions of the road, between km 0 + 115 to 1 + 410 in ascending order and between km 0 + 105 to 1 + 530 in decreasing order of GR-3211 in Granada.

IMPACT: This positive discriminatory measure allows cities to facilitate the deployment of HEVs.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

NR-9	REGULATORY FRAMEWORK AREA	NORMS	
Minimum mandatory targets for biofuels.		Royal Decree 1085/2015, of December 4	MINETUR

OBJECTIVE: To achieve the targets for renewable energy use established in the regulations of the European Union, the Spanish Government has regulated sales or consumption targets for biofuel for transport purposes. Furthermore, the Government is entitled to modify both the regulated targets, and to establish additional objectives, taking into account the development of the fuels and biofuels sector and progress in electricity consumption from renewable sources in transport.

DESCRIPTION: Royal Decree 1085/2015, of 4 December, to promote biofuels provides that by 2016 the minimum mandatory target for biofuels is 4.3 % on a yearly basis, a result of weighting a target of 4.1 % during the first half of 2016 and the target of 4.5 % during the second half of 2016, this being for the following years:

	2017	2018	2019	2020
Minimum mandatory targets for biofuels **(%)**	5 %	6 %	7 %	8.5 %

IMPACT: Increased use of biofuels in road transport

Natural gas	Electricity	LPG	Hydrogen	Biofuels

NR-10	REGULATORY FRAMEWORK AREA	NORMS	
Inclusion of environmental criteria in tendering for public passenger transport services.			MFOM- Communities Autónomas- Local entities

OBJECTIVE: Positive assessment of environmental efficiency measures in the public passenger transport, including alternative energy vehicles.

DESCRIPTION: In the field of public service concessions for passenger transport, reductions in energy consumption and pollutant emissions associated with the introduction of vehicles with alternative energy (AEV) will be taken into consideration.

Regarding the Ministry of Development, in the specifications of the management contracts of public services for regular passenger transport by general use roads it is assessed that the tenderer should propose the inclusion of measures aimed at optimising energy efficiency. Within this criterion, an explicit reference to vehicles using alternative energies will be incorporated in the specifications that will be used in the future.

IMPACT: The inclusion of environmental criteria in public tenders favours proposals for public service vehicles using alternative energies.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

NR-11	REGULATORY FRAMEWORK AREA	NORMS	
Including alternative energy vehicles (AEV) in the catalogue of the Framework Agreement for fleet renewal for Public Administrations		Law 2/2011 of March 4	MPRESIDENCIA

OBJECTIVE: To promote the use of AEV fleets by Public Administrations.

DESCRIPTION: The government, in renewing its own fleet and fleets of public services, will encourage tender criteria that prioritise alternative energy vehicles. In this regard, the Directorate General of Streamlining and Centralising procurement has already included electric, hybrid and other vehicle subtypes in the Framework Agreement for Passenger Cars. In addition, in the valuation criteria for other vehicles, it has included minimising CO_2 emissions and energy label classification of vehicles of the IDAE.

In addition, governments have at their disposal the Sustainable Economy Act (Law 2/2011), transposing Directive 2009/33, which internalises the energy and environmental costs in tenders for purchase of vehicles, so that higher scores will be awarded to suppliers with lower energy and environmental costs.

IMPACT: The inclusion of AEVs in the catalogue of the Framework Agreement allows Public Administrations to renew their fleets with vehicles of this type

Natural gas	Electricity	LPG	Hydrogen	Biofuels

NR-12	REGULATORY FRAMEWORK AREA	NORMS	
Participation in Technical Committees for Standardisation (ISO, CEN/CENELEC and AENOR).			MINETUR
OBJECTIVE: Identifying and overcoming barriers to the deployment of alternative fuels linked to infrastructure.			
DESCRIPTION: The Ministry of Industry, Energy and Tourism will continue to encourage the active participation in technical committees for standardisation in the framework of relevant standardisation organisations (ISO, CEN/CENELEC, AENOR, etc.) in order to identify and overcome barriers hampering the deployment of alternative fuels linked to infrastructure. It also coordinates the development of various infrastructure-related regulations with other European countries, and local and regional administrations.			
IMPACT: Standardisation to facilitate the deployment of AEV infrastructure			
Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

TAX INCENTIVES

IF-1	REGULATORY FRAMEWORK AREA	TAX INCENTIVES	
Bonus vehicle tax (IVTM)		Royal Legislative Decree 2/2004 of 5 March, approving the revised text of the Law Regulating Local Tax Authorities	MINHAP local entities
OBJECTIVE: To promote the acquisition and use of alternative energy vehicles			
DESCRIPTION: Most Spanish municipalities apply the facultative relief under the Law Regulating Local Tax for vehicles with alternative energy to mechanical vehicle tax (IVTM), better known as Traffic Tax. In order to systematise the bonus criteria a Working Group has been established for analysis and subsequent incorporation into the Act.			
IMPACT: This measure will reduce the cost of acquisition and/or maintenance for an AEV and thus boost demand			
Natural gas	**Electricity**	**LPG**	**Hydrogen**	**Biofuels**

IF-2	REGULATORY FRAMEWORK AREA	TAX INCENTIVES	
VRT Bonus (IESDMT)		Law 38/1992, of 28 December, Excise. Law 34/2007 of 15 November on air quality and atmospheric protection	MINHAP Autonomous communities

OBJECTIVE: To promote the acquisition and use of alternative energy vehicles

DESCRIPTION: In the special tax on certain means of transport, the registration of motor vehicles whose official CO_2 emissions do not exceed 120 g/km, with the exception of 'quad' type vehicles, is taxed at a tax rate of zero Euros.
The registration of other motor vehicles, without prejudice to the tax rates that the autonomous regions can establish as provided for in Article 51 of Law 22/2009 of 18 December, regulated by the funding system of the common regime of the Autonomous Communities and cities with a Statute of Autonomy and certain tax rules are changed, will be taxed by the result of applying to taxable income a tax rate that varies depending on CO_2 emissions. In general:

- 4 75 % for CO_2 emissions above 120 g/km and below 160 g/km.
- 9.75 % for CO_2 emissions equal to or greater than 160 g/km and less than 200g/km.
- 14.75 % for CO_2 emissions at or above 200 g/km.

IMPACT: This measure will reduce the cost of acquiring an AEV and thus boost demand

Natural gas	Electricity	LPG	Hydrogen	Biofuels

IF-3	REGULATORY FRAMEWORK AREA	TAX INCENTIVES	
Income tax reduction applicable to employment income in kind		Law 35/2006 of 28 November on Income Tax of Individuals and partial modification of the laws of the Corporation Tax on Non-Resident Income and Wealth Tax	MINHAP

OBJECTIVE: Promoting alternative energy vehicles as company and/or commercial vehicles

DESCRIPTION: For company vehicles available to employees for private purposes there has existed since 1 January, 2015 a reduction in the valuation of employment income in kind in Income Tax for Physical Persons (IRPF), as at No.1 of paragraph 1 of Article 43 of Law 35/2006 of 28 November on the Income Tax of Individuals, the revised text of the Law on Non-resident Income Tax approved by Royal Legislative Decree 5/2004 of 5 March, and other tax rules (BOE of 28 November) and Article 48a of the Tax Regulations approved by Royal Decree 439/2007, of 30 March (BOE of March 31st).

The reduction is 15 percent in the case of vehicles that meet the Euro VI emission limits set out in Appendix I to Regulation (EC) No. 715/2007, its official CO_2 emissions must not exceed 120g/km and the market value of the vehicle if it were new, before taxes, may not exceed 25 000 Euros.

This reduction will be 20 percent when additionally applied to hybrid vehicles powered by internal combustion engines that can use alternative fossil fuels (LPG and Natural Gas) provided that, in this case, the market value if it were new, before taxes, should not exceed 35 000 Euros.

The reduction is 30 percent in the case of any of the following categories of vehicles:

- battery electric vehicle (BEV).
- extended-range electric vehicle (EREV).
- Plug-in hybrid electric vehicle (PHEV) with a minimum range of 15 kilometres provided that in this case, the market value of the vehicle if it were new, before taxes, may not exceed 40 000 Euros.

IMPACT: This measure encourages the use of alternative energy company cars by reducing personal income tax.

Natural gas	Electricity	LPG	Hydrogen	Biofuels

III.7. MEASURES AT LOCAL AND REGIONAL LEVEL

ANDALUSIA

No.	MEASURE	COMPETENCE	NORMATIVE	ENERGY
	SPECIFIC REGIONAL STRATEGIES			
1	**2020 ANDALUSIA ENERGY STRATEGY** Among the five programmes into which this strategy is divided, we may note the following lines of action for their connection with alternative energy in transport: Intelligent Energy Programme ▪ EI_9 Energy efficiency in vehicles ▪ EI_10 Infrastructure development to improve mobility in urban environments Competitiveness Improvement Programme ▪ MC_5 Improving the industrial competitiveness of the alternative energy sector ▪ MC_12 Roadmap for the development of biorefineries in Andalusia ▪ MC_14 Innovation in energy technologies and increasing the potential and use of indigenous energy resources ▪ MC_15 development of the hydrogen economy in Andalusia Energy Management Programme of the Andalusian Administration ▪ GA_6 Promotion of mobility and sustainable transport in the Administration of the Andalusian Administration	Department of Employment, Enterprise and Trade DG of Industry, Energy and Mines Andalusian Energy Agency	Agreement of 27 October 2015 of the Governing Council	Natural gas Electricity LPG Hydrogen Biofuels
2	**DRAFT ANDALUSIAN LAW OF SUSTAINABLE MOBILITY**	Ministry of Public Works and Housing	Pending approval. In September 2016 submitted for public information.	Natural gas Electricity LPG Hydrogen Biofuels
	MARKET: VEHICLE ACQUISITION AND DISSEMINATION			
3	**ACQUISITION PROGRAMME FOR EFFICIENT VEHICLES** The grants cover up to 15 % of the market price of the vehicle according to the energy efficiency of the model and type of vehicle. Since 2012 (as no previous requests were made) to date 2 830 Andalusians have applied for grants to purchase more efficient vehicles and have been awarded €368 598. Within this programme, note the following actions related to transport and public services: ▪ Bus acquisition by municipal transport companies of Seville (natural gas buses), Malaga (electric and natural gas buses) and Cordoba (electric buses). ▪ Since 2009, 1 262 grants have been made for the purchase of alternative fuel taxis amounting to 2 795 612 Euros. It is expected to continue this aid. ▪ The Andalusian Regional Government is incorporating electric vehicles in its fleet of parcel and courier service for the various ministries. These vehicles cover urban and suburban routes and provide service to all the ministries belonging to the REDEJA (Energy Network of the Regional Government of Andalusia), coordinated by the Andalusian Energy Agency.	Andalusian Energy Agency	Order of 4 February 2009 establishing the regulatory bases of an Incentive Programme for Sustainable Energy Development of Andalusia are established, and its call for 2009-2014 has been made. (BOJA no. 30) Order of December 7, 2010 (BOJA no. 244) partially amending the Order of 4 February 2009. The continuity of such aid is expected until 2020 by the publication of a new call in the second half of 2016.	Natural gas Electricity LPG Hydrogen Biofuels

4	**VICTORIA PROJECT: ELECTRIC BUSES** Currently tests are being developed on city bus line 16 of the capital city of Malaga to demonstrate that dual induction recharging is both technically and economically feasible. This measure is particularly relevant for its application to other Spanish cities since the public surface transportation is responsible for 30 % of emissions caused by traffic in cities. Electrifying these service networks, and especially buses, for their ability to transport hundreds of people every day, is essential for reduction of local pollution.	Private initiative[129]	Collaboration agreement	Electricity
5	**OUTREACH PROGRAMME TO PROMOTE ELECTRIC VEHICLES** Aimed at promoting electric mobility at the local level because municipalities have a key role in its development. Within it the following working groups were created: Group 0- 'Local Action'; Group 1: 'Roadmap to install a recharging point for public use'; Group 2: 'Roadmap to replace part of the municipal fleet by electric vehicles'; Group 3: 'Guidelines for preparation of technical specifications'; Group 4: 'Models of ordinances' and Group 5: 'Tool for Analysis of the Feasibility of Performances'	Andalusian Energy Agency Private initiative[130]	Collaboration agreement	Electricity
6	**TECHNICAL MANUAL FOR BIOFUELS IN AUTOMOTIVE ENGINES** Since ignorance of biofuels is one of the main barriers to use this manual has been published in both print and digital editions. Presentation days have been held in different municipalities (Malaga, Seville, etc.).	Andalusian Energy Agency		Biofuels
	INFRASTRUCTURE			
7	**ANDALUSIA A+ PROGRAMME (INCENTIVE PROGRAMME FOR ENERGY DEVELOPMENT IN ANDALUSIA)** ▪ Aid to municipal transport companies of Seville and Malaga for the installation of refuelling points for natural gas buses. ▪ Aid for the installation of recharging points: o Single-family and/or community housing o parking of private companies o locations managed by public entities	Andalusian Energy Agency	Resolution of 15 April 2015 (BOJA no. 74 of 20 April)	Natural gas Electricity
8	**ANDALUSIAN MAP FOR SUPPLY OF CLEAN FUELS** The Andalusian Energy Agency publishes on its website the application 'supply Andalusian Map biofuels and other clean fuels' with the aim of promoting regional market development of alternative energy in the transport sector. The map is addressed both to citizens who demand any of the products and to supply companies that can consider this map as a way to publicise their product and company.	Andalusian Energy Agency		Natural gas Electricity LPG Hydrogen Biofuels

[129] The company Endesa leads the consortium, also made up of other companies (EMT, Conacon, Isotrol, Mansel, Innterconecta, MC2 and Omeca) and several research organisations (CIRCE, University of Malaga and AICIA).

[130] ENDESA ENERGY, IBERDROLA, IBIL, N2S, ABB, ASSOCIATION AEDIVE, AYESA, INABENSA, TELVENT (SCHNEIDER), ATOS WORLD GRID, BLUEMOBILITY, ISOIN, GAMESA ELECTRIC, ELECTRIC VEHICLES RENEWABLE SL, SIMON, INDRA, ACTISA, E- MOBILITY CONSULTING EUROPE, GH ELECTROTERMIA, ACONFORT, BECHARGED, AUTOMOCIONA, ROBERT BOSCH SPAIN, SLU, FENIE ENERGY, ACE ENERGY SERVICES SL, INNOVA, INARTEC, ALFASEL SL, RENAULT SYRSA, RENAULT SPAIN, TOYOTA, PEUGEOT, CITROËN, ECOBIKE ZERO ANDALUCIA SL , NISSAN, MITSUBISHI, MOVECO, COMARTH, BMW, VELMUS IDI, TECHNICAL SOLAR GRANADINA, EVSHOP ELECTRIC VEHCLES SHOP, RONDAMÓVIL, COCHELE, ANIACAM, ALPHABET CAR LEASE SPAIN, MCE BANK, APREAN (ASSOCIATION OF DEVELOPERS AND PRODUCERS OF ANDALUSIA) TEXLA RENOVABLES, SA ANDEL, SOLAR DEL VALLE and ALAMEDA CIS.

ARAGON

No.	MEASURE	COMPETENCE	NORMS	ENERGY
	SPECIFIC REGIONAL STRATEGIES			
1	**III MASTER PLAN FOR HYDROGEN IN ARAGON 2016-2020** This is the continuation of two previous Master Plans for Hydrogen in Aragon 2007-2011 and 2011-2015.	Department of Economy, Industry and Employment - Government of Aragón Foundation for the Development of New Hydrogen Technologies in Aragon		Hydrogen
2	**ARAGON ENERGY PLAN 2013-2020** Among the various measures envisaged, the greater connection with the promotion of alternative energies in transport are as follows[131]: ▪ modal shift towards more efficient transport ▪ drive towards sustainable mobility ▪ integration of renewable energy in transport	Department of Economy, Industry and Employment - Government of Aragón		Electricity Hydrogen (Master Plan)
	MARKET: ACQUISITION OF VEHICLES			
3	**COMPETITION FOR RENTED ELECTRIC VEHICLES FOR PUBLIC SERVICES** In the first phase electric vehicles will be rented until April 2017, bound for the Brigade of the municipal cemetery of Torrero whose budget amounts to 132 400 €.	City of Zaragoza	Award by public tender	Electricity
	INFRASTRUCTURE			
4	**H2P i R-2020: CROSS−BORDER CORRIDOR ARAGON-CATALONIA-ANDORRA- FRANCE** Installation of 3 new hydrogen plants in Aragon (Zaragoza, Huesca, the capital and Fraga-Huesca) that generate hydrogen from renewable energy sources (a 4th hydrogen plant is to be installed in Tarragona).	Government of Aragon Generalitat de Catalunya Andorra France	European Territorial Cooperation Programme INTERREG V Spain-France Andorra (POCTEFA 2014-2020)	Hydrogen

[131] Since 2011 no aid has been given for the purchase of vehicles or to boost supply infrastructure of the following alternative energies: electricity, natural gas, LPG and biofuels.

BALEARIC ISLANDS

No.	MEASURE	COMPETENCE	NORMS	ENERGY
	SPECIFIC REGIONAL STRATEGY			
1	**RENEWABLE ENERGY AND ENERGY EFFICIENCY IN THE BALEARIC ISLANDS: STRATEGIES AND LINES OF ACTION 2020**	Ministry of Land, Energy and Climate Change	Adopted by the Advisory Board of Energy on September 18, 2014[132]	Natural gas Electricity LPG
	MARKET: ACQUISITION OF VEHICLES			
2	**AID TO PROMOTE SUSTAINABILITY IN ROAD TRANSPORT** ▪ The acquisition and/or processing of **passenger cars and/or vans.** ▪ The acquisition and/or processing of **taxis.** ▪ The acquisition and/or processing **of industrial vehicles** for public use.	Ministry of Economy and Competitiveness	Resolution of the Minister of Economy and Competitiveness of April 9, 2015, published in BOIB No. 56 of 18 April, 2015. It is expected to continue in coming years.	Natural gas Electricity LPG
	INFRASTRUCTURE			
3	**AID FOR SETTING UP OF POINTS OF COMPRESSED NATURAL GAS REFUELLING**	Ministry of Economy and Competitiveness	Resolution of the Minister of Economy and Competitiveness of April 9, 2015. It is expected to continue in coming years.	Compressed natural gas
4	**AID FOR SETTING UP RECHARGING POINTS** Incentives for all types of recharge (slow, semi-fast and fast) and for different types of beneficiaries (business and government).	Ministry of Land, Energy and Mobility	BOIB # 135, 09. 12. 2015 - Budget €85 000 for slow and semi-fast points for commercial recharge. BOIB No. 116, 01/08/2015- Budget €589 000 for slow and semi-fast points for the Public Administration to recharge. BOIB No. 56, 18/04/2015-budget of €30 000 for recharging points for motorbikes of the Public Administration. BOIB No. 104, 02/08/2014- Budget €200 000 for fast recharging points for businesses. BOIB No. 96, 07/17/2014 - Budget €150 000 for slow and semi-fast points for commercial recharge. It is expected to continue in coming years.	Electricity
5	**FAST RECHARGE AUTO CLUB (ECAR)** Commercial development of a **network of 6 rapid recharging points** (80 % of the battery in less than 30 minutes) in the form of a mesh, which allows any electric vehicle to travel around the island of Mallorca.	Private Initiative (Endesa)	Programme funded by the ERDF	Electricity
6	**AIDS FOR INSTALLATION OF CNG REFUELLING POINTS** It has supported the installation of a CNG refuelling point in Palma de Mallorca.	Ministry of Land, Energy and Mobility	BOIB No. 56, 04/18/2015 - Budget €120 000 It is expected to continue in coming years.	Compressed natural gas

CANARY ISLANDS

No.	MEASURE	COMPETENCE	NORMS	ENERGY

[132] http://www.caib.es/sacmicrofront/archivopub. do?ctrl=MCRST5325ZI190898&id=190898

SPECIFIC REGIONAL STRATEGY				
1	**SPECIFIC STRATEGY TO ENCOURAGE ENERGY ALTERNATIVES IN THE CANARY ISLANDS** The Canary Islands are shaping their strategy which will focus on electric propulsion and hydrogen in the medium term.	Directorate General of Industry and Energy	Adoption foreseen for the first half of 2017.	Electricity Hydrogen
MARKET: DISSEMINATION				
2	**PLATFORM FOR ELECTRIC VEHICLE DEVELOPMENT IN THE CANARY ISLANDS** It aims to be a meeting point for all entities related to electric vehicles, with the aim of: (1) minimising most existing barriers and enhancing the benefits of electric vehicles, (2) generating demand in society by promoting and explaining electric mobility, (3) adapt the energy, automotive, information and communications technology sectors, and new emerging sectors around electric vehicles, (4) establish the necessary synergies between efficient modes of transport and EVs and (5) ensure sustainable development of electric vehicles in the Canaries.	Department of Employment, Industry and Commerce	Collaboration agreement	Electricity

CASTILE AND LEON

No.	MEASURE	COMPETENCE	NORMATIVE	ENERGY
SPECIFIC REGIONAL STRATEGY				
1	**REGIONAL STRATEGY TO ENCOURAGE ALTERNATIVE ENERGY IN CASTILE AND LEON 2016-2020** This new strategy is being developed in order to extend the main lines of action contemplated by the Regional Electric Vehicle Strategy in Castile and Leon 2011-2015 to all alternative energy sources.	Castile and Leon meeting	Adoption foreseen for the second half of 2016.	Natural gas Electricity LPG Biofuels Hydrogen
MARKET: ACQUISITION OF VEHICLES AND DISTRIBUTION				
2	**PROMOTION AND SUPPORT OF THE USE OF LPG** The public-private partnership agreement involved the transformation of four official vehicles of the Government of Castile and Leon (located in Avila, Burgos, Soria and León) in order to track and analyse this technology to check the advantages and disadvantages of this technology in the fleet of the regional administration. Also, the Ministry of Economy and Employment is committed to: ▪ Include LPG in the development of measures to promote the use of alternative fuels and vehicles based on their environmental qualities in terms of reducing urban pollution (nitrogen oxides, particulates and noise). ▪ Promote the use of LPG powered vehicles with other alternative vehicles and fuels in the fleets of vehicles of Castile and Leon, whether publicly owned properties or concessionaires of the administration. ▪ Include LPG within dissemination and training actions carried out by the Ministry of Economy and Employment on alternative fuels and vehicles. ▪ Study the development of a line of public grants for conversion of private and/or fleet vehicles powered by LPG.	Ministry of Economy and Employment Private Initiative (Repsol Butano SA)	Collaboration agreement signed in 2014.	LPG

3	**DIPLOMA FOR VEHICLE TECHNICIAN IN ELECTROMECHANICS**	Ministry of Education	Decree 27/2011 of 9 June, the curriculum corresponding to the Diploma of Motor Vehicle Technician in Electromechanics established in the Community of Castile and Leon	Electricity
4	**WEB PORTAL ELECTRIC MOBILITY, GUIDE AND DISSEMINATION WORKSHOPS** • Creating portal for electric vehicles in Castile and Leon: http://www. vehiculoelectrico.jcyl.es/ • It has published a Guide to Electric Vehicles and organised 10 seminars for dissemination. • Since 2014, we have implemented a specific section in http://www.vehiculoelectrico.jcyl.es/ for members of the Network of Municipalities, where information is exchanged, are made known best practices, and contact is maintained live with other representatives of the municipalities of the Network of Municipalities.	Ministry of Economy and Employment Directorate General of Industry and Technological Innovation. Municipalities of the Network of Municipalities of Castille and Leon Regional Energy Agency		Electricity
5	**PLAN OF CLEAN MUNICIPAL VEHICLES**[133] Incorporation of electric buses for AUVASA (Valladolid City Bus), electric taxis, commercial vehicles and passenger cars for the municipal fleet.	City of Valladolid	Approved in December 2014 with a budget for 2015 of 2 million Euros for fleet renewal and 100 000 Euros for innovative public procurement. It is expected to continue.	Electricity
	INFRASTRUCTURE			
6	**AID FOR DEVELOPMENT OF RECHARGING INFRASTRUCTURE** Addressed to individuals, local authorities and private companies (large companies, SMEs and freelancers). Funds both private points (€200 per point installed in homes and €1 200 per point installed in companies and local authorities) and points accessible by the public (€1 600 per point installed)	Ministry of Economy and Finance	ORDER EYH/1143/2015 of 23 December, that there shall be public subsidies for the development of recharging infrastructure for electric vehicles in Castile and Leon for the year 2016. It is expected to continue.	Electricity
7	**PLAN FOR CLEAN MUNICIPAL VEHICLES** [134] Expansion of the recharging infrastructure to reach 63 stations, which involves the construction of 29 new points. Specifically: ▪ 1 quick recharging station in the facilities of AUVASA (City Bus Valladolid) with 4 points/sockets. ▪ 1 quick recharge station for last mile commercial vehicles and electric taxis. ▪ 4 semi-rapid recharge points for taxis. ▪ 20 new semi-rapid recharging points in public car parks of hotels, shopping centres and hypermarkets.	City of Valladolid	Approved in December 2014 It is expected to continue.	Electricity

CASTILE LA MANCHA

No.	MEASURE	COMPETENCE	NORMS	ENERGY
	MARKET: ACQUISITION OF VEHICLES			
1	**GRANTS FOR THE ACQUISITION AND PROCESSING OF ALTERNATIVE ENERGY VEHICLES.**	Ministry of Public Works (Grants up to 2015) Ministry of Economy, Enterprise and	Order of November 30, 2011 (DOCM No. 236 of 2011). Order of April 16, 2014 (DOCM No. 84 of 2014).	Natural gas Electricity LPG Biofuels Hydrogen

[133] the prioritisation of alternative energy vehicles is expected when it is time to renew the municipal fleet of the City of Valladolid, made up of 460 passenger cars and commercial vehicles and 150 buses.

[134] the prioritisation of alternative energy vehicles is expected when it is time to renew the municipal fleet of the City of Valladolid, made up of 460 passenger cars and commercial vehicles and 150 buses.

		Employment-DG Industry, Energy and Mining (Grants from 2015)	Order of December 29, 2015 (currently in force)	
	INFRASTRUCTURE			
2	**GRANTS FOR THE INSTALLATION OF RECHARGING POINTS FOR ELECTRIC VEHICLES**	Ministry of Economy, Business and Employment	Order of December 29, 2015 (currently in force)	Electricity

CATALONIA

No.	MEASURE	COMPETENCE	NORMS	ENERGY
	MARKET: ACQUISITION OF VEHICLES AND DISTRIBUTION			
1	**AID FOR THE ACQUISITION OF LOW-EMISSION VEHICLES FOR TAXI SERVICE** Target taxis operating in the special protection areas of the atmospheric environment of Catalonia.	Department of Planning and Sustainability	Resolution TES/110/2015 of 21 January calls for subsidies to promote the purchase of low-emission vehicles for taxi service operating in areas of special protection of the atmospheric environment. It is expected to continue.	Natural gas Electricity LPG
2	**AID FOR THE PURCHASE OF MOTORCYCLES AND ELECTRIC SCOOTERS** The beneficiaries may be private companies, families, foundations, local corporations, consortia of municipalities and public entities of the Generalitat.	Catalan Institute of Energy	Resolution EMO/1986/2015, of 2 September, establishing the regulatory basis for awarding grants for improving energy saving and efficiency under the Plan of Energy and Climate Change in Catalonia 2012-2020 approved (PECAC 2020), and call 2015 (DOGC of 9 September, 2015) is opened.	Electricity
3	**LIVE PLATFORM** Created in 2011 to promote electric mobility in Barcelona. In 2015 extended its scope of action to incorporate natural gas vehicles and its radius of action to all of Catalonia. Its directing members are: (1) the City of Barcelona, (2) the Generalitat de Catalunya, through the Catalan Energy Institute, the Directorate General of Industry and the Directorate General of Environmental Quality, (3) the Metropolitan Area of Barcelona and (4) the companies B:SM, TMB, SEAT, Gas Natural Fenosa, ACS, Nissan, Renault and Volkswagen-Audi Spain. Its aim is to coordinate and support its members in project development, promotion of strategic policies and new business models, and create a network of local and international knowledge.	Generalitat de Catalunya Municipalities of the Metropolitan Area of Barcelona Private initiative		Natural gas Electricity
	SUPPLY INFRASTRUCTURE			
4	**PLAN OF ACTION FOR THE DEPLOYMENT OF INFRASTRUCTURE FOR RECHARGING ELECTRIC VEHICLES (PIRVE).** **CATALAN INFRASTRUCTURE TABLE FOR ELECTRIC RECHARGE TO ENCOURAGE ITS DEVELOPMENT (TIRVEC).** This seeks to be a forum for dialogue to strengthen cooperation of both public and private Catalan agents linked to electric mobility. It was established in June 2016.	Catalan Institute of Energy	TIRVEC: Partnership.	Electricity
5	**GRANTS FOR SETTING PUBLIC FAST RECHARGING STATIONS FOR ELECTRIC VEHICLES**	Catalan Institute of Energy	Resolution EMO/1986/2015, of 2 September, establishing the regulatory basis for awarding grants for improving energy saving and efficiency under the Plan of Energy and Climate Change in Catalonia 2012-2020 approved (PECAC 2020), and call 2015 (DOGC of 9 September, 2015) is opened.	Electricity

6	**CATALAN MAP OF DELIVERY POINTS** Electricity: https://www.google.com/maps/d/edit?mid=z4xnIt9uT66s.kxkW7LH1hZ_w Natural Gas: https://www.google.com/maps/d/edit?hl=ca&authuser=0&mid=z4xnIt9uT66s.kuGVFWgWagXU	Catalan Institute of Energy		Natural gas Electricity
7	**INSTALLATION OF RAPID RECHARGE POINTS IN BARCELONA METROPOLITAN AREA** Installation in the city of Barcelona of 15 50kW DC-AC-43kW, TRIO points (CHAdeMO, CCSCombo2 and Mennekes). Currently 13 have already been installed. Installation in other municipalities in the metropolitan area of Barcelona of 10 TRIO points (CHAdeMO, CCSCombo2 and Mennekes). Currently one is already installed.	Municipalities of the Metropolitan Area of Barcelona		Electricity
8	**INSTALLATION OF RECHARGING POINTS AT RAILWAY STATIONS** Installation of 5 recharging stations in car parks at transport hubs at the stations of Volpelleres, Martorell, Igualada, Sant Quirze del Valles and Sant Cugat del Valles.	Catalan Institute of Energy Ferrocarrils de la Generalitat (FGC) Private initiative[135]	Collaboration agreement signed in 2015.	Electricity
	NORMS			
9	**ECOVIAT: DISCOUNTS ON TOLL ROADS**	Generalitat de Catalunya		Electricity Hydrogen

VALENCIAN COMMUNITY

No.	MEASURE	COMPETENCE	NORMS	ENERGY
	SPECIFIC REGIONAL STRATEGY			
1	**VALENCIAN ENERGY PLAN 2020 ACTION PLAN FOR SAVINGS AND ENERGY EFFICIENCY IN TRANSPORT**	Ministry of Sustainable Economy Ministry of Housing, Building and Planning Structuring Institute for Small and Medium Industry of the Generalitat Valenciana (IVACE) Deputations Councils	Not yet published	Electricity Natural gas Biofuels
	MARKET: ACQUISITION OF VEHICLES AND DIFFUSION			
2	**GRANTS FOR THE PURCHASE OF VEHICLES POWERED BY ALTERNATIVE ENERGY** Incentives for different types of vehicles (private cars, commercial, bus, Lorry, etc.) and beneficiaries (companies, individuals, independents, foundations, local corporations, public entities, etc.) The use of electric vehicles for public transport or public service is	Institute for Small and Medium Industry of the Generalitat Valenciana (IVACE)	Resolution of 23 December 2015 determining aid on sustainable mobility and energy efficiency in transport for the year 2016 (12/30/2016 DOCV No. 7 688). Action T27A. They have been promoting such aid	Electricity Natural gas

[135] SIMON, DTES, RAILGRUP, Voltour, Imesapi and EMPARK.

	specifically supported.		since 2011 and this is expected to continue in coming years. Line co-financed with the ERDF programme.	
	INFRASTRUCTURE			
3	**SUPPORT FOR SUPPLY POINTS FOR ELECTRICITY, NATURAL GAS AND HYDROGEN** Promotes the implementation of points both accessible to the public and for private fleets.	Institute for Small and Medium Industry of the Generalitat Valenciana (IVACE)	Resolution of 23 December 2015 determining aid on sustainable mobility and energy efficiency in transport for the year 2016 (12/30/2016 DOCV No. 7 688). ActuacionesT29A and T29B. Since 2011 they have been promoting such aid and this is expected to continue in the coming years. Line co-financed with the ERDF programme.	Electricity Natural Gas Hydrogen
4	**INCENTIVES FOR REFUELLING INFRASTRUCTURE FOR BIOFUELS** ▪ Installing pumps to supply pure biofuels or with specific labelling obligation at service stations. While both biodiesel and bioethanol blends are supported, projects related to bioethanol are valued with a higher score. ▪ Adaptation of existing suppliers to supply biodiesel or bioethanol blends with specific labelling requirement. ▪ Storage yards for distribution of biofuels	Institute for Small and Medium Industry of the Generalitat Valenciana (IVACE)	Resolution of May 28, 2015, the president of the Institute for Small and Medium Industry of the Generalitat Valenciana (IVACE) establishing incentives are called on renewable energies and biofuels for the year 2015. Since 2013 they have been promoting such aid and this is expected to continue in the coming years.	Biofuels

EXTREMADURA

No.	MEASURE	COMPETENCE	NORMS	ENERGY
	MARKET: DISTRIBUTION			
1	**PROMOTION OF ELECTRIC MOBILITY** Creation of web portal http://www.conectateameridaybadajoz.es . Identification of recharging points established with public initiatives in Extremadura.	Ministry of Industry, Energy and Environment	Cooperation agreements between Ministry of Industry, Energy and Environment of the Government of Extremadura and the companies Endesa and Ibredrola signed in 2011.	Electricity
	INDUSTRIAL PRODUCTION			
2	**EXTREMADURA BIOENERGY PLAN 2015-2020 (PBEX)** It includes actions related to counselling biofuels production plants, to promote R & D and public private partnership for the development of biofuels.	Governing Council of the Government of Extremadura	Not yet published PBEX aids linked to the use of biofuels in transport.	Biofuels

COMMUNITY OF MADRID

No.	MEASURE	COMPETENCE	NORMS	ENERGY
	SPECIFIC REGIONAL STRATEGY			
1	**BLUE PLAN + :** STRATEGY FOR AIR QUALITY AND CLIMATE CHANGE OF THE COMMUNITY OF MADRID (2013-2020). It includes specific measures for the promotion of alternative energies in the transport sector	Ministry of Environment, Local Government and Planning-DG Environment	Agreement approved by the Governing Council of the Community of Madrid	Natural gas Electricity LPG

MARKET: ACQUISITION OF VEHICLES AND DISTRIBUTION				
2	**INCENTIVE PLAN FOR LIGHT EFFICIENT COMMERCIAL VEHICLE, AUXILIARY SERVICES AND THE COMMUNITY OF MADRID (PIVCEM-MADRID))** Aid to autonomous professionals and SMEs for the purchase of light commercial vehicles (N1).	Ministry of Environment, Local Government and Planning - DG Environment	ORDER 3222/2014 of 22 December, the Minister of Environment and Spatial Planning, establishing the regulatory bases for the granting of aid for the purchase of efficient, commercial, auxiliary and service light vehicles are established. Order 1384/2016, of July 18, the Ministry of Environment, Local Government and Planning, for which the corresponding call for the year 2016 for grants for the purchase of efficient light vehicles and auxiliary services is approved . Measure included in the Blue Plan +.	Natural gas Electricity LPG
3	**AID FOR MODERNISATION OF THE FLEET OF TAXIS** Its budget in 2016 is one million Euros.	Ministry of Environment, Local Government and Planning	Since 2013 they have been promoting this aid and **its continuation is expected until 2020.** Measure included in the Blue Plan +.	Natural gas Electricity LPG
4	**2016 SCRAPPING SCHEME TO ADAPT VEHICLES TO LPG AND CNG** Grant of €400 per petrol vehicle transformed to LPG or CNG of which €200 transferred directly to the owner of the vehicle by the Community of Madrid and the rest by discount on the invoice issued by the workshops attached, on account of them. €250 000 budget item for conversion of vehicles from petrol to LPG and €170 000 for the conversion of petrol vehicles to CNG. Conversion of 1000 of each type of vehicle is expected.	Ministry of Economy, Employment and Finance	Collaboration agreement between the Ministry of Economy, Finance and Employment and the Energy Foundation of the Community of Madrid (FENERCOM).	Compressed Natural Gas (CNG) LPG
5	**PUBLIC TRANSPORT NATURAL GAS BUS FLEET** The acquisition has been approved of 200 new buses in 2016 of which 85 % (170) will run on natural gas. So the bus fleet of the municipality of Madrid with natural gas goes from 43 % to 50 % of the total. In addition, it is planned to invest €225 000 in preparing the 'multifuel' system (dual fuel) for simultaneous gas supply of 15 buses	City of Madrid	2016 municipal budget. Measure included in the Blue Plan +.	Natural gas
INFRASTRUCTURE				
6	**SECTOR MAP FOR LOCATION OF FAST RECHARGING POINTS IN THE COMMUNITY OF MADRID** The Community of Madrid and the Madrid City Council are jointly studying the map of the areas where they should stand fast recharging points to meet the target that are never more than 10 minutes from circulation.	Madrid's community City of Madrid	In preparation.	Electricity
7	**MADRID-CASTILE-LA MANCHA - VALENCIA GASIFIED CORRIDOR** Deployment of a strategic network of gas supply points for promoting the circulation of vehicles, especially heavy goods vehicles, powered by natural gas or LPG on the A3 (Madrid-Valencia) motorway. In urban areas with a distribution network for piped natural gas, supply points for natural gas will preferably use compressed natural gas (CNG), while in the interurban area supply stations of liquefied natural gas (LNG) will be built.	General State Administration, Community of Madrid Castile La Mancha Valencian generalitat Private initiative	Measure included in the Blue Plan +. in preparation	Natural gas LPG

BASQUE COUNTRY

No.	MEASURE	COMPETENCE	NORMS	ENERGY
SPECIFIC REGIONAL STRATEGIES				

1	**PROGRAMME OF GRANTS TO INVESTMENTS IN EFFICIENT TRANSPORT AND MOBILITY**[136]	Basque Energy	Resolution of the General Director of the Basque Energy Board. Its continuation is foreseen in the coming years.	Natural gas Electricity LPG Biofuels Hydrogen
MARKET: ACQUISITION OF VEHICLES AND DISTRIBUTION				
2	**MEASURE 1 PROGRAMME HELPS TO INVESTMENTS IN TRANSPORT AND EFFICIENT MOBILITY: Purchase of electric, mobile or alternative energy vehicles and material.** - LINE 1.1: Pure, plug-in hybrids or extended range electric vehicles - LINE 1.2: Mopeds and electric motorcycles - LINE 1.3: Flexible bioethanol E-85 vehicles - LINE 1.4: Natural gas vehicles - LINE 1.5: Transformation of NGVs - LINE 1.6: Hydrogen vehicles -LINE 1.7: Pure and hybrid plug-in electric lorries - LINE 1.8: Non-plug-in hybrid electric lorries - LINE 1.9: Heavy hydrogen fuel cell vehicles - LINE 1.10: Natural gas lorries (CNG or LNG) - LINE 1.11: Transformation of heavy natural gas vehicles - LINE 1.12: Electric and natural gas rolling stock	Basque Energy Board	Resolution of the General Director of the Basque Energy Board. Its continuation is foreseen in the coming years.	Natural gas Electricity LPG Biofuels Hydrogen
INFRASTRUCTURE				
3	**MEASURE 2 OF THE PROGRAMME OF GRANTS TO INVESTMENTS IN TRANSPORT AND EFFICIENT MOBILITY: electric vehicle recharging infrastructure and supply of alternative energy.** - LINE 2.1: Recharging points related to vehicle fleets -LINE 2.2: Recharging points related to parking spaces in homes -LINE 2.3: Recharging points for public use -LINE 2.4: Supply installations for biofuels, natural gas or hydrogen.	Basque Energy	Resolution of the General Director of the Basque Energy Board. Its continuation is foreseen in the coming years.	Natural gas Electricity LPG Biofuels Hydrogen
PROMOTING INDUSTRIAL PRODUCTION AND R+ D + I				
4	**AZKARGA PROJECT:** FAST, SMART, FLEXIBLE AND MANAGEABLE ELECTRIC VEHICLE RECHARGING	Department of Economic Development and Competitiveness Private initiative		Electricity

LA RIOJA

No.	MEASURE	COMPETENCE	NORMS	ENERGY
SPECIFIC REGIONAL STRATEGY				
1	**REGIONAL STRATEGY TO ENCOURAGE ENERGY ALTERNATIVES IN LA RIOJA** The Government of La Rioja plans to develop various actions to encourage alternative energy in transport within the Energy Plan of La Rioja 2015-2020.	DG Innovation, Labour, Industry and Commerce.	In development.	Not yet materialised

CEUTA

No.	MEASURE	COMPETENCE	NORMATIVE	ENERGY
MARKET: ACQUISITION OF VEHICLES				

[136] http://www.eve.eus/CMSPages/GetFile.aspx?guid=8beaf9c7-fb78-4921-80d6-4a7919c04b03

1	**ACQUISITION OF TWO ELECTRIC VEHICLES IN GOVERNMENT SERVICE AT CEUTA**	Ministry of Environment and Sustainability of the Government of Ceuta		Electricity
	SUPPLY INFRASTRUCTURE			
2	**INSTALLING RECHARGING POINTS FOR THE TWO ELECTRIC VEHICLES IN GOVERNMENT SERVICE AT CEUTA**	Ministry of Environment and Sustainability of the Government of Ceuta		Electricity

IV. MARINE TRANSPORT

IV.1. NATURAL GAS

IV.1.1. GENERAL DESCRIPTION

Spain is in a unique position to develop the new shipping-oriented LNG market. This is due firstly to its geostrategic location at the crossroads of the most important transoceanic routes, and meeting point between the Mediterranean, North Africa and the Atlantic, which positions it as a logistics platform in Southern Europe. Secondly, Spain has the existing infrastructure and experience gained over the last 45 years in storage and transfer of LNG, both nationally and internationally.

It is also important to note that Spain has the longest coastline (8 000 km) of the countries of the European Union. This has allowed the country to develop an integrated system of state-owned ports, with forty-three ports of general interest in operation in June 2016, managed by 28 Port Authorities. Thirteen of these are part of the core network of the TEN-T.

Figure IV-1. Map of ports of general interest also belonging to the Trans-European Network (TEN-T)

Source: *Puertos del Estado* (State Ports) (from EU Regulation No 1315/2013 on TEN-T).

KEY TO FIGURE:
Legend at left
Basic Network Port
General Network Port
Other ports
Mediterranean Corridor

Atlantic Corridor
Geographic names in capitals, clockwise from bottom left
ATLANTIC OCEAN, PORTUGAL, CANTABRIAN SEA, FRANCE, MEDITERRANEAN SEA

Table IV-1. State-owned port system and membership of the Trans-European Network (TEN-T)

PORT AUTHORITY	PORT	BASIC NETWORK TEN-T		GENERAL NETWORK TEN-T (PORTS)	PORTS OUTSIDE THE TEN-T
		SEAPORTS	INLAND PORTS		
A Coruna	A Coruna	A Coruna			
Alicante	Alicante			Alicante	
Almería	Almería Carboneras			Almería Carboneras	
Aviles	Aviles			Aviles	
Algeciras Bay	Algeciras Bay Tarifa	Algeciras Bay			Tarifa[137]
Bay of Cadiz	Bay of Cadiz			Bay of Cadiz	
Balearics	Palma de Mallorca Alcudia Mahon Ibiza La Savina	Palma de Mallorca		Mahon Ibiza La Savina	Alcudia
Barcelona	Barcelona	Barcelona			
Bilbao	Bilbao	Bilbao			
Cartagena	Cartagena	Cartagena			
Castellón	Castellón			Castellón	
Ceuta	Ceuta			Ceuta	
Ferrol-San Cibrao	Ferrol San Cibrao			Ferrol San Cibrao	
Gijon	Gijon	Gijon			
Huelva	Huelva	Huelva			
Las Palmas	Las Palmas Arrecife Puerto Rosario	Las Palmas		Arrecife Puerto Rosario	
Malaga	Malaga			Malaga	
Marin and Ria de Pontevedra	Marin-Pontevedra				Marin-Pontevedra
Melilla	Melilla			Melilla	
Motril	Motril			Motril	
Pasajes	Pasajes			Pasajes	
Santa Cruz de Tenerife	Santa Cruz de Tenerife Los Cristianos Santa Cruz de La Palma San Sebastián de La Gomera La Estaca	Santa Cruz de Tenerife		Santa Cruz de La Palma San Sebastián de La Gomera La Estaca	Los Cristianos [138]
Santander	Santander			Santander	
Seville	Seville		Seville		
Tarragona	Tarragona	Tarragona			
Valencia	Sagunto Valencia Gandia	Valencia		Sagunto	Gandia
Vigo	Vigo			Vigo	

[137] Inclusion in the RET-T General Network is expected soon.
[138] Inclusion in the RET-T General Network is expected soon.

Arousa	Arousa				Arousa
TOTAL	**43**	**12**	**1**	**24**	**6**

Source: *Puertos del Estado* (State Ports) (from EU Regulation No 1315/2013 on TEN-T). Information available in September 2016.

In considering LNG as fuel for shipping, the starting point was to consider all general interest ports as possible refuelling points, taking into account the need to promote smart, sustainable and inclusive development of the internal market, and safeguard the efficiency of the system.

LNG AS AN ALTERNATIVE MARITIME FUEL

One of the main factors encouraging the use of LNG as maritime fuel is environmental law. Therefore, we have compared the different solutions and technologies available today to reduce emissions of sulphur oxides (SO_X), nitrogen oxides (NO_X) and particulate matter (PM) in order to comply with two sets of rules: firstly the limits set by the International Maritime Organisation (IMO) in emission control areas of (ECA); and secondly, with Directive 2016/802/EU of the European Parliament and of the Council of 11 May 2016 on reducing the sulphur content of certain liquid fuels.

Annex IV of the International Convention for the Prevention of Pollution from Ships (MARPOL) establishes limits to emissions of SO_X and NO_X from leaks from ships and prohibits deliberate emissions of ozone depleting substances. In addition zones with emission control (commonly called ECAs, for Emission Control Area) are established, where the restriction is even stricter in relation to the emission of SO_X, NO_X and PM as well as Sulphur Emission Control Areas (SECA) in which only restrictions on emission of SO_X are established.

The emission control areas for Sulphur Oxides (SO_x), nitrogen oxides (NO_X) and particulate matter (PM) (ECA) established by the IMO through May 2016 are as follows:

- The east and west coasts of Canada and the United States defined under Appendix VII of Appendix VI of MARPOL (SO_X, NO_X and PM).
- Hawaii area (US Caribbean Sea) defined in Appendix VII of Appendix VI of MARPOL.

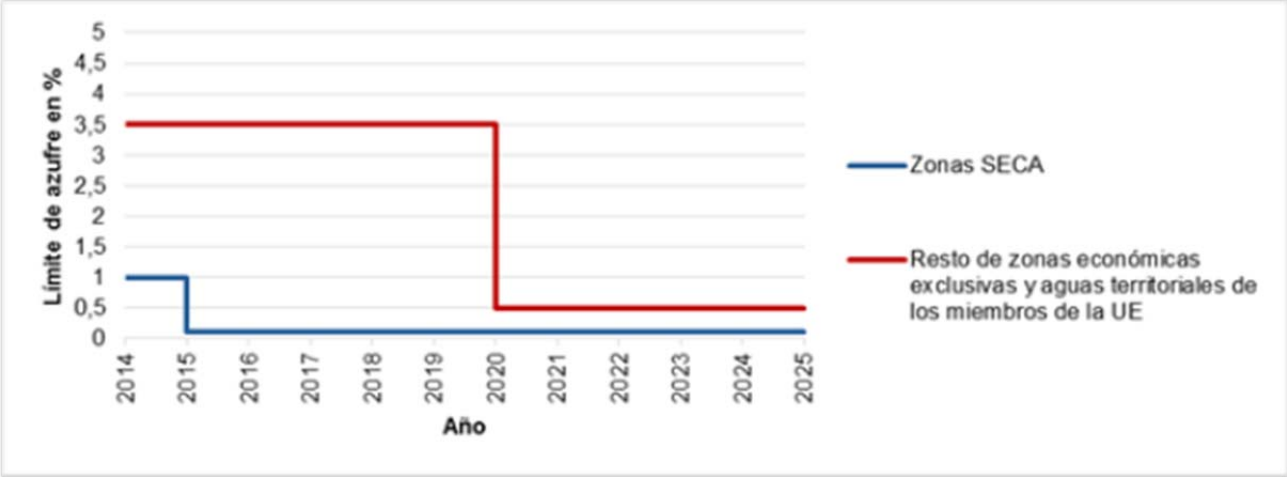
Meanwhile, the emission control areas established for sulphur oxides (SO_X) (SECA) are:

- Baltic Sea area as defined in Appendix I of MARPOL.
- North Sea and English Channel Area as defined in Appendix V of MARPOL.

In future revisions of MARPOL the possible inclusion of the Mediterranean Sea as a SECA is considered.

Directive 2016/802/EU transposes MARPOL limit values for sulphur content of marine fuel to its area of influence, reducing the limits in the European Union from 1.0 % to 0.1 % from the year 2015 in SECA areas, and from 3.5 % to 0.5 % from 2020 in the other exclusive economic zones and territorial waters of the members of the European Union (EU).

Figure IV-2. Established sulphur limits for marine fuels in the waters of the European Union [139]



Source: Directive 2016/802/EU.

KEY TO FIGURE
Vertically at left: Limit of Sulphur in %
Legend at right:
SECA Areas
Other exclusive economic areas and territorial waters of EU member states
At bottom:
Year

The directive also sets a limit of 1.5 % sulphur content for marine fuels used by passenger vessels on regular services to or from any EU port, and a limit of 0.1 % in the case of ships at berth in EU ports (except those vessels which will remain berthed less than 2 hours and turn off all engines and connect to shore-side electricity while at berth). Both limits are currently in force.

Therefore shipowners are facing a number of important investment decisions in terms of affecting the viability of their activity in SECAs and areas affected by Directive 2016/802/EU.

Conventional fuels exist in various markets for maritime use, but not all meet these environmental constraints, which are required to navigate in certain waters. Generally these fuels differ from each other by the quality of crude oil and the refining process, detailed technical specifications being in ISO 8217: 2010. They can be grouped into the following types:

- Residual fuel oil (HFO-Heavy Fuel Oil): Commonly referred to as fuel oil or heavy fuel oil, it is of higher viscosity and lower cost.

- Intermediate Fuel (IFO-Intermediate Fuel Oil): HFO is often mixed with marine gasoil (MGO), resulting in this intermediate fuel.

- Marine diesel (MDO): Distillate fuel mixed with heavier contains residual components and is therefore cheaper

- Marine gasoil (MGO): Distilled light, clean waste, and higher price.

To use HFO (heavy fuel oil) and comply with the emission limitations established in SECAs it is necessary to use an additional exhaust purification system, commonly called a *scrubber.* This system uses water to remove SO_x from the exhaust from ship engines, as well as some particulate matter (PM) and other gases. There are three main types of technological solutions:

[139] Does not apply to the waters of the ultra-peripheral regions of the European Union.

- Open-loop systems. These systems use seawater for washing the exhaust gases. Seawater, once its function is completed, it is filtered of heavy metals and particulate matter and discharged directly to the sea, containing all the SO_X from the washing. These are the simplest systems, but sometimes the ports do not allow discharge into waters, if it is found that quality levels established under Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 are not met, these directives establishing a framework for Community action in the field of water policy, called the Water Framework.

- Closed-loop systems. This technology uses seawater that is cooled and chemically treated, usually by injection of caustic soda. Most of the treated water is recycled and only a fraction is discharged into the sea. These systems avoid the problems of wastewater discharges but are more complex, more expensive and need space on board for storage and subsequent treatment of the resulting waste. They are indicated in Directive 2016/802/EU for use with fuels containing more than 3.5 % sulphur.

- Hybrid systems. This is a combination of open loop and closed loop systems, so it can offer the advantages of both solutions with greater flexibility. So, in this way they can operate in closed loop mode when necessary due to restrictions on discharges of wastewater, and in open cycle mode when such restrictions do not apply.

In addition to conventional marine fuels there is liquefied natural gas (LNG). To analyse the feasibility of using each of the alternatives that arise as a possible solution to the limitations on sulphur emissions (SECAs), the use of HFO (heavy fuel oil) is taken as a reference. Different possibilities are listed below.

Table IV-2. Comparison of available technologies for compliance with the SO_X emission limit

	STRENGTHS INHERENT TO THE FUEL ITSELF	WEAKNESSES INHERENT TO THE FUEL ITSELF	OPPORTUNITIES FOR USE OF THE FUEL IN SHIPPING	THREATS FOR USE OF THE FUEL IN SHIPPING
MGO (MARINE DIESEL OIL)	■ Reduces emissions of SO_X ■ Technically feasible with today 's engines.	■ Does not eliminate NO_X. ■ Does not eliminate greenhouse gases (GHGs). ■ Higher price than HFO.	■ Negligible costs for the shipping sector investment. ■ Logistics chain developed in many ports. ■ There are no legal or regulatory barriers. ■ It is more cost effective than treatment systems for exhaust gases (scrubbers) as navigation in SECAs decreases, and increases engine efficiency.	■ It maintains dependence on oil prices. ■ Higher fuel prices to navigate in SECAs, resulting in loss of competitiveness over other modes of transport such as road transport. ■ Insufficient fuel supply if the demand at the port increases significantly.
MGO USE (MARINE DIESEL) TO NAVIGATE IN SECA AREAS AND HFO (HEAVY FUEL) IN THE REST[140]	■ Reduces emissions of SO_X ■ Technically feasible with today 's engines. ■ Costs less than MGO.	■ Does not eliminate NO_X. ■ Does not eliminate greenhouse gases. ■ Need to adapt the vessel to dual-fuel use. ■ Need for training in use of dual fuel.	■ It is more profitable to sail only with MGO. ■ Logistics chain developed in many ports. ■ There are no legal or regulatory barriers. ■ It is more cost effective than treatment systems for exhaust gases (scrubbers) as navigation in SECAs decreases, and increases engine efficiency	■ An average investment in the shipping sector is necessary. ■ The need for two separate deposits (MGO and HFO) reduces the load capacity. ■ Increased maintenance expenses by having two fuel tanks, as well as the system for switching between fuels. ■ Maintains dependence on oil prices. ■ Fuel price increases but less than when using only MGO. ■ Higher fuel prices to navigate in SECAs, resulting in loss of competitiveness over other modes of transport such as road transport. ■ Insufficient fuel supply if demand increases significantly in port. ■ Risk of no payback if there is no navigation in SECAs (unnecessary

[140] This alternative gives value to the possibility of using MGO when the ship navigates SECAs, and HFO in other routes. At no time are the two fuels mixed. Vessels have double fuel tanks installed, and both fuels are kept on board (HFO and MGO), and either can be used in navigation in each zone depending on the limitations of emissions in force.

				investment and loss of load capacity).
HFO (HEAVY FUEL OIL) COMBINED WITH EXHAUST GAS PURIFICATION SYSTEMS	■ SO_X emissions reduced virtually to zero. ■ It reduces particulate emission.	■ Does not eliminate GHG ■ It produces sludge pollutants whose treatment involves a high cost of maintenance, and risk to workers because of its high sulphur content. ■ It causes erosion and corrosion in the engine due to its high sulphur content. ■ Does not eliminate NO_X, another specific aftertreatment system for NO_X gases is also needed. ■ Space is lost on the ship.	■ It provides high collection efficiency for very large particle ranges. ■ It can be installed in new or existing vessels. ■ Allows continued use of HFO. ■ Logistics chain developed in many ports, nationally and internationally. ■ There are no legal or regulatory barriers.	■ A high investment in the shipping sector is necessary. ■ Increased maintenance expenses related to the management of sludge contaminants. ■ The installation produces loss of capacity. ■ Risk of no payback if navigation is reduced in SECAs (unnecessary investment as MGO would have been enough).
LNG	■ Eliminates NO_X, SO_X, PM, and GHG significantly. ■ More viable to meet requirements if, in the future, it is decided that the Mediterranean Sea is a SECA area.	■ Greater technical complexity being a cryogenic supply, although Spain has experience in that . ■ You need adjustment or replacement of the engine to operate with LNG.	■ New adaptations to meet the limitation of 0.1 % sulphur in the fuel would not be necessary. ■ Reduces engine maintenance costs.	■ A high investment in the shipping sector is necessary. ■ Possible risk of no investment recovery depending on the ratio between the price of LNG and HFO/MGO. ■ The installation of new tanks may not be viable in existing ships since, depending on their location, they could compromise the stability of the ship. ■ Installing tanks can cause loss of capacity because it is necessary to have at least twice the volume of LNG to generate the same power as with HFO. ■ The use of LNG as marine fuel and its supply at port can cause reluctance due to the subjective perception of security risk, although in Spain there is experience and training. ■ The regulation of the gas sector in Spain is aimed at final use as fuel and not as a maritime fuel. ■ There may be restrictions on routes due to nonexistence of supply points.

Source: *Puertos del Estado* (State Ports).

The result of this analysis, the attractiveness of LNG, compared with the technology of purification systems exhaust/MGO, can reasonably rely on the following key aspects:

- The time spent in SECA area until 2020, as well as new limits on the sulphur content in marine fuels in other territorial and international waters from 2020.
- The price of LNG compared to traditional fuels and its evolution, highly correlated with changes in the price of oil in the case of the latter
- The cost of investments in LNG systems on the ship, compared with other alternative technologies.
- The life of the ship.
- The availability of adequate supply points in ports.

Given these factors, outlined below different viable options for meeting the requirements of navigation in the short and medium term depending on the age of the vessel and its navigation routes:

- For vessels nearing the end of their useful life and/or with limited periods of stay in SECA operation, MGO may be an appropriate solution.
- For vessels with an average lifespan and high residence times in SECAs, the use of HFO combined with a system of gas purification provides an adequate solution.
- For new ships or a high remaining life the most reasonable option seems the transition to the use of LNG.

Accordingly, LNG is presented as a realistic and viable long-term option to meet environmental restrictions.

EMISSIONS OF LNG IN SHIPPING[141]

LNG emits no sulphur or particulate matter. It also reduces NOx by 85 % and mitigates emissions of greenhouse gases by 30 % compared to traditional fuels (HFO). Its use enables compliance with environmental regulations in both ECAs and SECAs.

TAXATION OF LNG AS A MARITIME FUEL

The Law 38/1992 of 28 December, on Special Excise Duties, determines that the use of natural gas as fuel for navigation, including fishing, other than private pleasure boating is exempt from taxation.[142]

AVERAGE CONSUMPTION OF A SHIP POWERED BY LNG

The average consumption of a vessel propelled by LNG depends on multiple factors such as engine power, its age, operating system, etc. The generally accepted conversion factor between these fuels is of 0.8 tonnes of LNG for 1 ton of HFO daily consumption per vessel in terms of mass[143].

IV.1.2. CURRENT SITUATION

FLEET OF SHIPS USING LNG AS FUEL

The total number of ships powered by LNG in the world fleet is still very limited. As at March 21, 2016 77 vessels were operating, most of which are manufactured in European shipyards (65-70 %). The following figure shows the evolution of the world fleet in the period 2000-16 as well as ships in the portfolio confirmed until 2022 (excluding here the LNG transport ships and inland waterway vessels powered by LNG). By type, ferries and container ships have a higher propensity to operate with LNG.

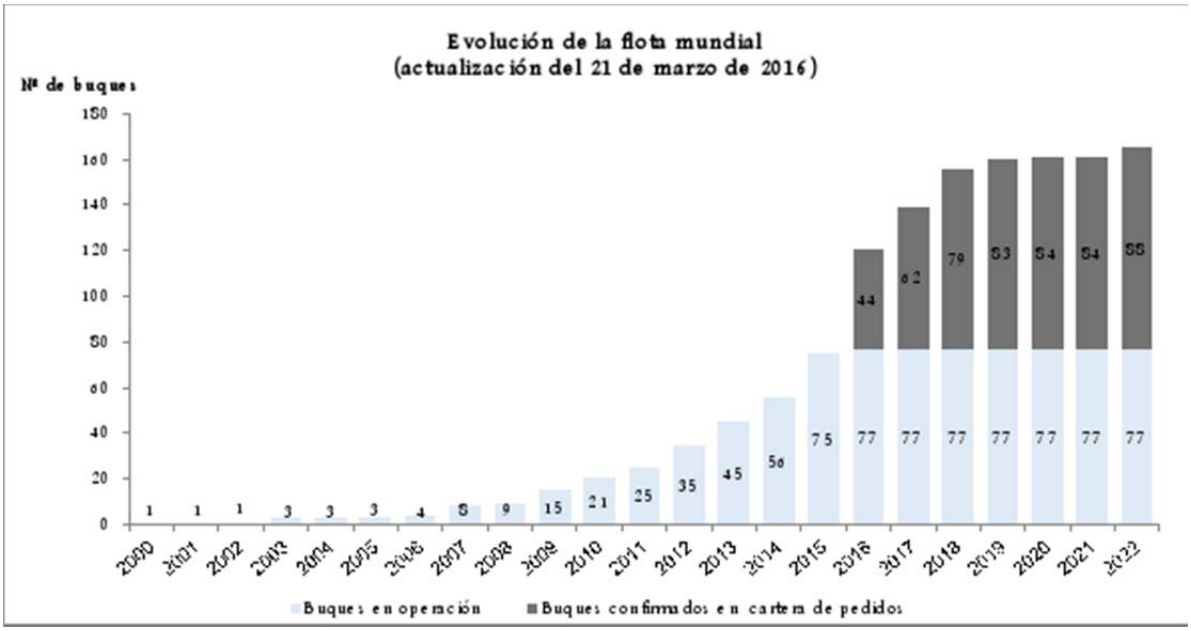
The existing fleet is mainly concentrated in the Baltic Sea, the North Sea and the English Channel, as they are currently the only EU SECAs. However, in the portfolio of orders confirmed by 2022, vessels operating in the rest of Europe predominate.

[141] Source of all data included in this section: Presentation of study of the technical and economic aspects of the use of liquefied natural gas (LNG) as a marine fuel, constituted within the Committee on the Environment and Climate Change. Senate (2014).

[142] Exemption established by Article 51 (paragraph 2. b) of Law 38/1992, of 28 December, Excise.

[143] LNG is less dense than HFO. So, in terms of volume, LNG requires a larger tank in the vessel to have the same stored energy.

Figure IV-3. Development of global fleet of ships (operating and confirmed in portfolio of orders) powered by LNG from existing information in March 2016.



Source: DNV GL [144]**.**

KEY TO FIGURE:
Title: Development of world fleet (update at 21 March 2016)
At top left: No. of vessels
At bottom: Vessels in operation Vessels confirmed in order books

While it is true that given the international dimension of maritime transport, the analysis must be focused on the fleet as a whole, at the national level the current fleet using LNG as fuel to have been transformed, but this transformation includes only one auxiliary gas engine (not the main engines). It will go to sea trials in the third quarter of 2016 and is expected to be in service in 2017. is limited to the Ro-Pax Abel Matutes type of ship from the Balearia shipping company that covers the line Barcelona - Palma de Mallorca. This vessel is the first of the national fleet

In addition, the shipping company Balearia expects that a new ferry with LNG-powered main engines will start operating in the Baleares lines during 2019. Also the Fred Olsen ferry 'Bencomo Express,' which covers the line Tenerife-Las Palmas de Gran Canaria, will start sailing with an engine powered by LNG in 2018. The latter project is co-funded by the European Commission under the Connecting Europe Facility (Project 2014-ES-TM-0593-S: GAINN 4 Ship Innovation).

CONSTRUCTION OF SHIPS POWERED BY LNG IN SPAIN

Spanish shipyards have a good position in the construction of ships powered by LNG and in July 2015 were working on building:

- CNN La Naval de Sestao:

[144] The addition to the fleet of ships confirmed in the order book is accumulated and is calculated on the date of entry into service reflected in the forecast made on March 21, 2016.

- Balearia ferry type vessel, and the option to build a second sister ship is under consideration. In this case four dual propulsion engines will be used and four dual auxiliary generators, using natural gas or traditional liquid fuel.

- A cable-layer for the DEME Tideway group.

- An agreement has been signed with Balearia to build two new LNG powered ferries with a length of 225 m and 30.4 m beam, involving an investment of around €350 M.

- Gondán Shipyards: three tugs for the shipping company Østensjø Rederi.

The award of these contracts is the result of intense efforts in R & D & i by the Spanish shipyards to achieve technological differentiation through the introduction of natural gas solutions. Some of the projects have been given public financing by the Directorate General of Industry and SMEs under the horizontal aid scheme for shipbuilding approved by the European Commission, as detailed in the following table.

Table IV-3. Aid for R & D & i related to LNG granted to shipyards

NO.	SHIPYARD	YEAR OF COMPLETION	PROJECT	DESCRIPTION
1	CNN	2014	New developments in engine rooms powered by natural gas, for vessels other than gas tankers.	Development of a new concept of engine room for vessels other than gas tankers specific for generation and propulsion using natural gas as fuel.
2	CNN	2014	Pioneering system for terminal for receiving and storage of LNG	Design of a new type of terminal for receiving and storage of LNG
3	CNN	2015	Design of propulsion for gas tankers.	
4	MURUETA	2015	Development of a prototype tug with dual hybrid drive with natural gas as fuel.	
5	MURUETA	2015	New prototype ship with dual propulsion for 'Ship to Ship' supply of LNG.	Design of vessel for gas bunkering operations of the latest generation
6	GONDÁN	2011	Feasibility study on gas dual-fuel propulsion for PSV (Platform Supply Vessel)	Analysis of the criteria for the provision and installation of main and auxiliary engines that use natural gas as fuel, aiming to provide an equivalent level of integrity.

Source: DG Industry and SMEs (Ministry of Industry, Energy and Tourism).

LNG SUPPLY OPERATIONS TO SHIPS CARRIED OUT BY SPANISH COMPANIES

LNG demand in Spanish ports by vessels, either for propulsion or auxiliary engines, is limited to specific supplies that have been ongoing since July 2012. All these supplies have been made using tankers (called TTS supply: Truck To Ship).

Of the 77 vessels that make up the international fleet powered by LNG, 5 have berthed in Spanish ports. And of the 13 visits that have occurred LNG supply services have been requested, only on 7 occasions, and have been successfully implemented. In turn, the Spanish company HAM has

participated in an operation to supply LNG to the ship FA Gauthier in the port of Naples by tankers loaded at Spanish regasification plants.

Then the main features of refuelling operations carried out at the premises of the Port Authority of Algeciras Bay, Cartagena and Vigo as well as in the port of Naples to date will be shown.

Table IV-4. LNG supply operations to ships by Spanish traders performed until October 2015

DATE	PORT	VESSEL	TYPE	SIZE (LENGTH X BEAM M)	GROSS TONNAGE (GT)	LOADING CAPACITY LNG (M^3)	MARKETER	AUTHORISED CARRIER	REFUELLING (M^3)	NUMBER OF TANKS	RECHARGING TIME (H)	ORIGIN REGASIFICATION PLANT SUPPLY
Aug-15	Cartagena	Kvitnos	Ro-Ro[145]	120 x 22	9 132	400	Repsol	ESK	308	7	17	Cartagena
Mar 15	Cartagena	Kvitbjørn	Ro-Ro	120 x 21	9 132	400	Repsol	molgas	313	7	14	Cartagena
Mar 15	Naples	FA Gauthier	Ro-Pax	133 x 22	15 901	500	HAM	HAM	450	10	15	Barcelona
May-14	Vigo	Bokn	Tug	35 x 15	764	80	Repsol	molgas	45	2	4	Ferrol
May-14	Cartagena	Bokn	Tug	35 x 15	764	80	Repsol	molgas	45	2	4	Cartagena
Feb 14	Vigo	Borgøy	Tug	35 x 15	764	80	Repsol	molgas	45	2	4	Ferrol
Feb 14	Cartagena	Borgøy	Tug	35 x 15	764	80	Repsol	molgas	66	2	4	Cartagena
Jul-12	Algeciras	Høydal	General cargo	70 x 16	2 616	90	Cepsa	Naftran	85	2	4	Cartagena

Source: *Puertos del Estado* (State Ports) from the information provided by Cepsa, HAM, Molgas, Repsol referring to October 2015

Spanish ports were positioned as a supplier of LNG to these vessels due to both the location of Spain with respect to the course from the shipyards to their operating zones, and the leading position of our country in the field of LNG technology. However, in view of the areas of operation of these vessels, it is not expected that they will return to seek an LNG refuelling service in Spanish ports.

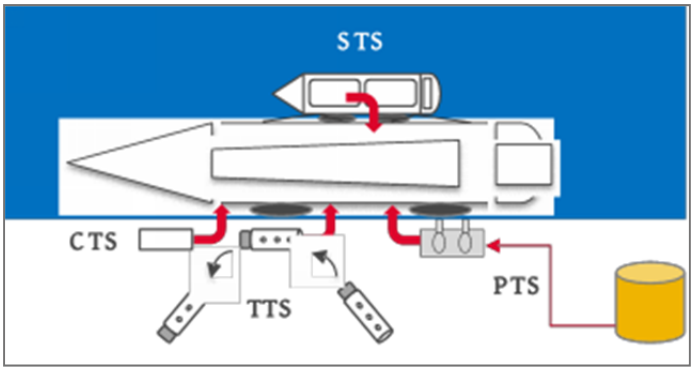
LNG SUPPLY POINTS EXISTING IN PORT

It is important to note that the Directive explicitly included as possible sources of LNG supply to ships not only those ports that have accessible storage terminals, but those where the supply can be carried out by tankers, mobile containers and/or tanker ships or barges that transport LNG from gas tankers or from storage terminals.

Thus, today there are four possible systems to supply LNG to ships in port, as reflected in the following figure. They are listed below ordered from the highest to lowest delivery rate. The mode of supply will determine the facilities to run on the port, the procedures and security measures.

[145] Ro-Ro: Roll On-Roll Off. Ro-Ro is a term used for all sorts of cargo ship carrying road vehicles, both cars and lorries.

Figure IV-4. LNG supply systems for ships



Source: *Puertos del Estado* (State Ports).

- Supply ship (also called Ship To Ship, STS)

The supply is made through LNG supply vessels lying alongside the ship to be supplied. They can be moored in port or at anchor, which enables the supply of LNG in other locations within the port or its water sheet.

It is not necessary for there to be storage facilities for LNG in the port itself, when the supply vessel is designed to sail in the open sea and has a relatively nearby storage point, although this type of supply is often closely linked to large terminals for import/export and storage of LNG.

- Supply Terminal (Pipeline To Ship, PTS)

This involves the supply of LNG to the ship from a fixed installation composed of an LNG storage facility, a jetty dedicated to loading LNG and piping from the tanks to the dock.

This delivery system is determined by the distance between the storage tanks and the ship, which must not be excessive to maintain the low temperature of the LNG (maximum length ranges, so far, between 150 and 250 metres, depending on the insulation) .

- Tanker Truck (Truck To Ship, TTS)

In this type of supply, a tanker supplies the LNG to the vessel.

This is the most versatile type of supply, as it requires no specific facilities at the port, it being possible to perform the supply of LNG on any dock provided certain conditions are met safety. The supply is through flexible hoses connecting the tank with the tanker vessel (which may incorporate all the pumping system, or be external to it).

Transport distances for tankers can easily reach 250-300 km in Spain (equivalent to 3-6 hours of travel), establishing the distances/maximum times depending on the remoteness of the tanker's deposit, making TTS almost independent of the of the need for a storage facility at the port where it is proposed to effect the fuel supply.

- Mobile Containers (Container To Ship, CTS)

In this case the ship is provided with mobile cryogenic LNG ISO standard containers, with a capacity between 20 and 45 m^3 per container.

Equipment and facilities to perform these supplies are very similar to those for loading/unloading/handling standard transport of general cargo containers. In fact most of the patents of this type of container have standardised sizes to the same dimensions as general cargo containers of 20 and 40 feet, i.e., 1 or 2 TEUs.

Containers are loaded in a specific installation for LNG supply or directly at a regasification plant. With the ship in port, the empty tank is unloaded and replaced by a full one. This operation can even be performed with the vessel's own crane, if available.

As a guideline, the following table lists the most appropriate LNG supply systems for each type of traffic according to Danish Maritime Authority[146], ordered from highest to lowest delivery rate:

Table IV-5. Features of four possible systems for LNG supply to vessels

SUPPLY TYPES	MAXIMUM FLOW	VOLUMES	AVERAGE TIME FOR OPERATIONS.[147]	ADVANTAGES	DISADVANTAGES
STS Ship Supply (Ship to Ship)	2 000 m^3/h	> 100-1000 m^3	2.5h	■ High load capacity (up to 2 000 m^3/h). ■ No storage facilities or LNG supply required. ■ Flexibility of supply to any part of the port (or outside).	■ High investment and operating cost: need for offshore barges to transport LNG. ■ Terminals linked to import (regasification plants)
PTS Terminal Supply	400 m^3/h (200 m^3/h for type 'C' tanks)	> 100-1000 m^3	1 hour	■ Speed of delivery method. ■ Application to all kinds of volumes and ships.	■ High investment: it requires storage facilities and LNG supply. ■ Occupation of space in the port terminal. ■ Not very flexible: limited number of berths.
TTS Tanker Lorry	60 m^3/h	<100 m^3	1.5-2 h	■ Low cost of investment and operation. ■ No storage facilities or LNG supply required. ■ Flexibility of supply to any part of the port.	■ Limited capacity (30-60 m^3/h). ■ Limited application: small volumes of supply between 100 and 200 m^3. ■ Limited distance between the LNG tank and the supply point.
CTS Mobile containers	-	20-45 m^3 per container	0.5h	■ Minimum investment: only a means of container handling at the port is necessary. ■ The delivery time is the fastest of all. ■ No storage facilities or LNG supply required. ■ Flexibility: Supply to any part of the port.	■ Limited application: only vessels using this type of container as fuel storage tank. ■ Limited distance between the tank deposit (LNG tank and filling system) and supply point.

Source: Danish Maritime Authority.

As mentioned in section II, Spain holds a unique position in development of the LNG market for shipping thanks to its existing infrastructure and the experience gained over the last 45 years in storage and transfer of LNG, both nationally and internationally.

LNG satellite plants provide sufficient capacity to the system to meet potential increases in demand for natural gas derived from its implementation in shipping without additional investment in basic gas infrastructure.

This storage capacity and distribution is complemented by the flexibility provided by the supply road tankers, which allows LNG to reach any geographical point in Spain and even across the borders.

Therefore we can say that it is currently possible to supply LNG to ships in all ports that form the state owned port system by road tanker, which is already in compliance with parts 1 (supply of LNG to maritime ports of the basic TEN-T network) and 2 (LNG supply in inland ports of the basic TEN-T network) of Article 6 of Directive 2014/94/EU. Also, Spain can provide the supply of LNG to other European countries due to the small scale of its national network and its experience.

However, the limitations in supplying LNG by tankers, particularly in relation to operating times, may discourage their use in certain types of vessels providing a regular service with reduced time scale, as with ferries. The use of this type of ship lines that provide short shipping distance and the progressive

[146] Source: North European LNG Infrastructure Project. A feasibility study for an LNG filling station infrastructure and test of Recommendations. Danish Maritime Authority (2012).
[147] The times include transfer auxiliary operations (pre- and post-operations required for coupling, compliance with safety protocols, etc.)

introduction of emissions control areas, will predictably make supply by road tankers insufficient to meet the expected evolution of demand for LNG .

In future revisions of the National Action Framework it will be necessary to evaluate the current scenario of supply and the logistics supply chain in relation to the expected upward trend in demand, in order to know whether the current supply solutions should be guaranteed as effective, or otherwise it they need to be adapted to ensure the efficiency of supply operations taking into account the requirements of demand.

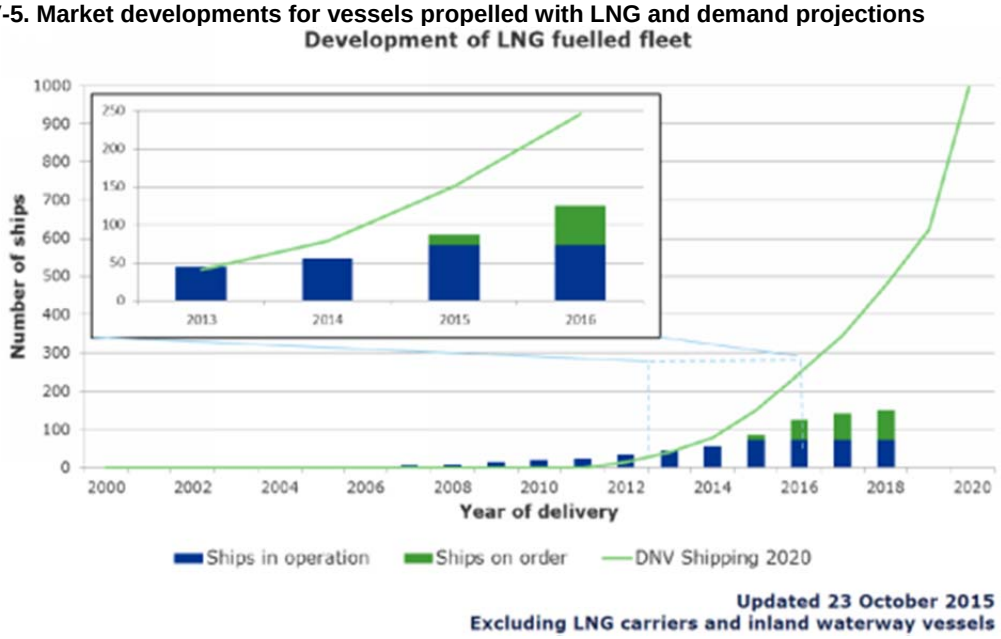
IV.1.3. EXPECTED MARKET TRENDS AND OBJECTIVES

ESTIMATED EVOLUTION OF THE FLEET OF SHIPS POWERED BY LNG

The decision to use a ship powered by LNG, whether through its transformation or by building a new one, is in the hands of shipping operators. Depending on various factors such as fuel prices, restrictions regarding emissions, different technological alternatives, regulatory frameworks in the areas of navigation, the deployment of supply infrastructures, etc., they will take the right decision for their fleet. Therefore, the reality is that today the evolution of demand is uncertain.

In fact, the number of LNG powered ships that make up the global fleet is below the demand projections made in 2012 and updated in 2015, as shown in the figure below.

Figure IV-5. Market developments for vessels propelled with LNG and demand projections



Source: Consultant DNV GL.

In 2012 the consultancy DNV GL conducted a study on the development of the world's LNG-powered fleet for which it considered several scenarios based on parameters such as economic growth (high-low), fuel prices (high-low), environmental regulations (demanding - less demanding), LNG prices decoupled from fuel prices, or low HFO prices but high MGO prices. The latest update released in October 2015 shows that the initial estimates, in 2012, were very optimistic and the number of ships powered by LNG is about half of the initial forecasts.

In 2016 global economic growth is still fragile. This, added to the uncertainty of the rules at international level, the lack of measures to encourage its use in ships, the absence of a developed market for supply of supply ports and the cyclical decline in oil prices, must without a doubt be slowing shipping operators down in making decisions on large investments in their fleets, both in new construction and adaptations of vessels already in operation.

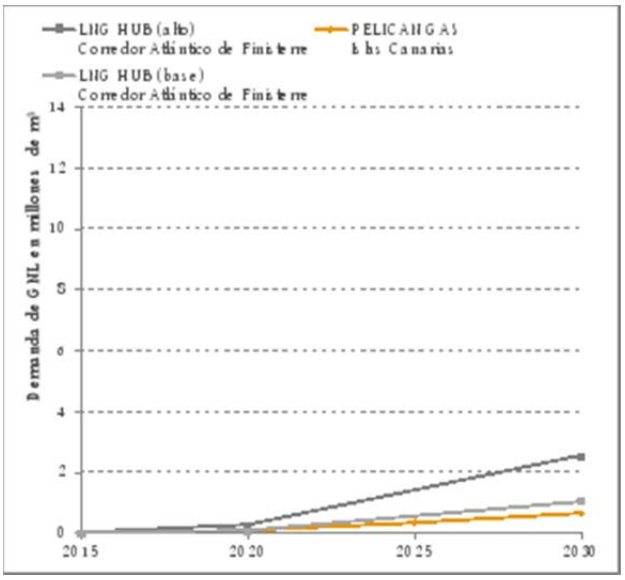
The reality today is that the world fleet powered by LNG is increasing at a rate of between 15 and 25 % annually according to the chart above. If the trend continues on the same line, in 2025 we can expect a global fleet of between 300-700 ships and in 2035 they could have reached 615-2150 units.

However, the Classification Companies have begun to distinguish, with additional notation, those newly built ships which, though initially powered by traditional fuels, are prepared for future transformation to LNG quickly and economically to meet environmental regulations. These vessels, not covered in the development of the world fleet powered by LNG, can rapidly increase the fleet in the event that such processing takes place.

It is therefore necessary to further develop market analysis appropriately for the National Action Framework, which make it possible to reduce the uncertainty regarding the development of the demand for LNG in Spanish ports, taking into account the various factors that may be critical for development of this demand (the evolution of prices of the various fuels, the cost of investment in each technological alternative, the life of the ship, the regulatory framework itself, etc.).

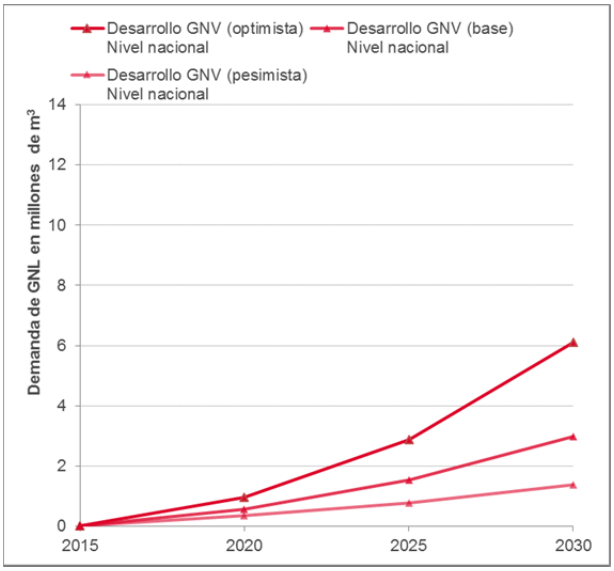
Different demand studies conducted in Spain between 2014 and 2016, with different geographical areas and methodologies, show considerably mixed results as to the forecast use of LNG as fuel for shipping. This fact further highlights the uncertainty today.

Figure IV-6. Summary of the main results of the studies conducted to determine the potential of domestic demand for LNG in shipping

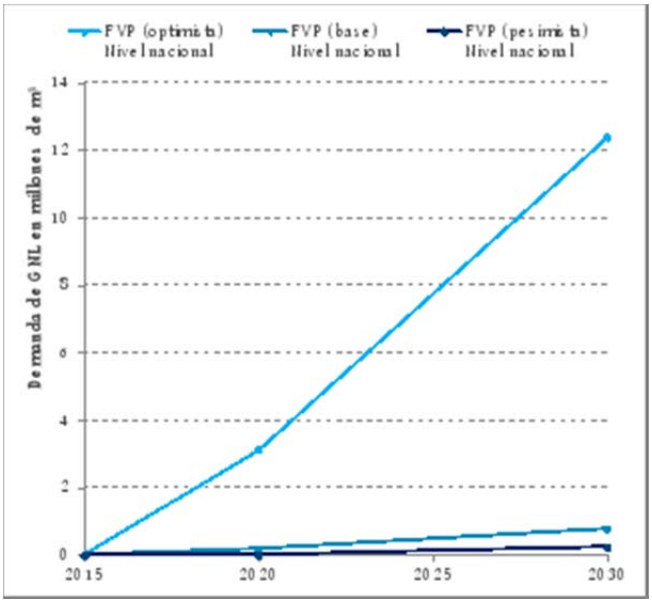


KEY TO FIGURE:

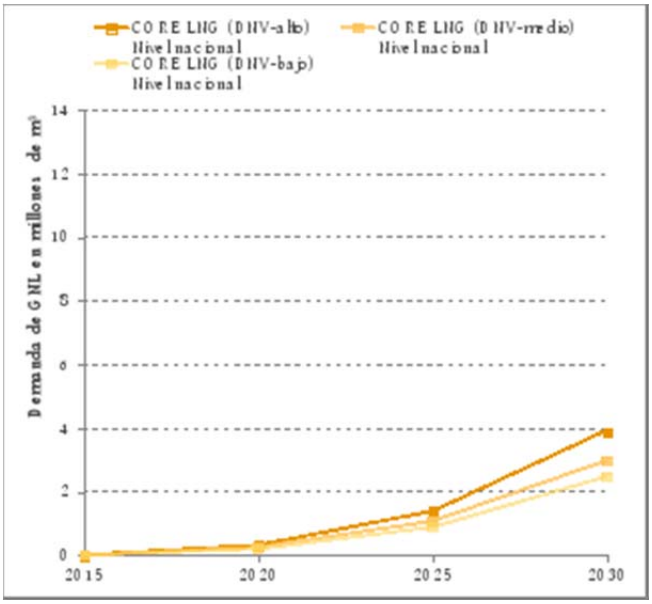
LNG HUB (high)	PELICANGAS
Atlantic Corridor Finisterre	Canary Islands
LNG HUB (base)	
Atlantic Corridor Finisterre	
Demand for LNG in millions of m^3	



KEY TO FIGURE:
Development of GNV (optimist) Development of GNV (base)
National level National level
Development of GNV (pessimist)
National level
Demand for LNG in millions of m^3



KEY TO FIGURE:
Development of FVP (optimist) Development of FVP (base)
National level National level
Development of FVP (pessimist)
National level
Demand for LNG in millions of m^3



KEY TO FIGURE:
Core LNG (DNV - high) Core LNG (DNV - medium)
National level National level
Core LNG (DNV - low)
National level
Demand for LNG in millions of m^3

Source: Projects PELICAN GAS[148], LNG HUB[149], CNG Development in Spain[150], FVP [151], CORE LNGas Hive[152] .

Based on these results, in Spain it would be possible to replace between 0-22 % of maritime bunkering of conventional fuels that took place in 2015 with the supply of LNG by 2020, and to 2-87 % in 2030 according to the proposed scenarios. These figures have a direct impact on domestic demand for natural gas, which could increase to 0-7 % for 2020 and 0.5-27.0 % by 2030, compared with domestic demand in 2015 (315 TWh).

As is evident, these estimates vary significantly depending on the underlying assumptions and calculation methodologies. Consequently, although the potential is significant, it is necessary to deepen the methodological aspects and support the assumptions with field work in order to determine more accurate results on the horizon established by Directive 2014/94/EU, taking into account the level of uncertainty associated with this type of market research.

CORE LNGAS HIVE PROJECT

In order to ensure a coherent development of supply and demand, the Ministry of Public Works (through *Puertos del Estado* (State Ports) and the Directorate General of Merchant Marine) has driven the CORE LNGas Hive Project closely with public and private entities representing the sector. It is

[148] PELICAN GAS: The excellence of a project called PelicanGas. Jose Rafael Diaz Hernandez (May 2016).
[149] LNG HUB: Definition an analysis of the different scenarios of LNG demand. DNV GL (July 2014).
[150] Development of CNG in Spain: Development of natural gas vehicles in Spain: analysis of benefits and potential contribution to the national economy. Deloitte, for GASNAM (October 2014).
[151] FVP: Update and adaptation to the scope of CORE LNGas Hive project results published in the 'Feasibility of LNG as fuel for the SSS Mediterranean fleet: profitability, facts and figures' study prepared in the framework of the European project COAST. Valenciaport Foundation (July 2016).
[152] CORE LNGas DNV Hive: Preliminary Forecasts. DNV-GL (July 2016).

funded by the 'Connecting Europe Facility ' (CEF) mechanism and a detailed description of this is included in section IV.1.4.

The project includes the development of a market study with a demand analysis, the preliminary results of which are described in the previous section, and the development of LNG supply at ports and of the logistics supply chain so that can meet projected demand.

Once completed, there will be a new tool that will facilitate monitoring and review of the National Action Framework. The project will also make it possible to launch an Observatory, a tool whose purpose is to establish the basis for future evaluation of the LNG market in shipping, establishing the structure, methodology, and other tools needed to, inter alia, update changing demand systematically ahead of future revisions in the National Action Framework.

In any case, it seems unlikely before 2019, when the first revision of the National Action Framework is planned, and a year before the entry into force of the limit to 0.5 % sulphur content in marine fuel of the European Union (which will help reduce the current market uncertainty), that the development of demand for LNG supply in Spanish ports will be significant.

By then it is expected that market uncertainty will be less than it is at present and that there will be a tool for analysis agreed at the methodological level and contrasted with field work that will validate the hypothesis of development with the highest incidence in the evolution of demand available. Thus, it will be easier to assess to what extent the current supply capacity and initiatives being implemented or studied (many of them within the Project itself as pilot actions) will be sufficient to meet future demand. And it will be possible to promote a coherent planning between the development of the supply of supply and demand forecast, facing the horizons 2025 and 2030 set out in the directive.

EVOLUTION OF LNG SUPPLY POINTS IN PORTS AND OBJECTIVES

Within the CORE LNGas Hive Project the execution is foreseen of 11 pilot actions between 2015 and 2020 at a cost of 24.4 million Euros that will be used to study the efficiency and the economic, technical and commercial viability of the different solutions and technologies to supply ships in various ports. This will, predictably, suppose the incorporation of new specific supply infrastructure to operational ships before 2020 in the ports of Ferrol (supply terminal), Bilbao (supply terminal and supply vessel), Barcelona (supply terminal and vessel supply) and Cartagena (supply terminal), complementing the current offer supply through the existing 250 road tankers with infrastructure and supply equipment specific to the port allowing higher transfer flows (and therefore fewer operational constraints) and more suitable to meet more favourable scenarios to meet changing demand. There are also other feasibility studies to explore the possibility of expanding the supply from the regasification plants of Sagunto and Huelva (supply terminal).

Additionally, outside the scope of the CORE LNGas Hive Project, initiatives have also been raised such as the development of supply from the terminal in the port of Algeciras, a supply ship in the port of Valencia and a supply vessel in Ferrol.

Below is a table with the LNG refuelling points existing today in the ports of general interest in the port system, as well as pilot actions that will predictably expand the offer to 2020. Current projections indicate that the development of infrastructure solutions tend to supplies from terminals (PTS) and/or supply vessels (STS).

Table IV-6. LNG refuelling infrastructure in existing and pilot implementation phase in Spanish ports[153]

SUPPLY TYPES	EXISTING	PLANNED
TTS Tanker Lorry <100 m^3	Possibility of supply, demand, depending on the volume, discharge rate and geographic availability by the current fleet, consisting of 250 tankers	▪ **Port of Barcelona:** Building a Skid[154] for supply vessel from several LNG tanks simultaneously.

[153] No initiatives are included in the design phase and/or study without commitment to commissioning.

[154] Collector system mounted on a skate that allows flexibility in handling.

STS Supply Ship (Barge) > 100-1000 m^3	Any	▪ **Port of Barcelona:** Adaptation of existing vessel for LNG supply services to larger vessels (Capacity: 4 tanks with a total capacity of 1 300 m^3 of LNG)[155]. ▪ **Port of Bilbao:** Adaptation of vessel to LNG supply on the Cantabrian coast (capacity: in a first phase 600 m^3 of LNG, expandable to 1 000 m^3 LNG)[156]. ▪ **Port of Valencia**[157]: Adaptation of existing vessel for LNG supply services to ships (capacity: between 800-1 000 cubic metres of LNG). ▪ **Port of Ferrol**[158]: Design of an LNG supply ship for supply on the Iberian Atlantic coast, both intermediate storage terminals located in other ports as ships using it as fuel, allowing supplies in operation.
PTS Terminal Supply > 100-1000 m^3	Any	▪ **Port of Barcelona:** Installation of dedicated hoses for LNG supply in existing dock. ▪ **Port of Cartagena:** Adaptation of Dock of Enagas regasification plant in Escombreras for ship refuelling service. ▪ **Port of Bilbao:** Adaptation of large dock regasification plant for refuelling ships or barges. ▪ **Puerto de Ferrol:** Adaptation of large dock regasification plant for refuelling ships.
CTS Mobile Containers 20-45 m^3 per container	Possibility of supply, demand, depending on the volume and geographic availability of the 27[159] existing containers.	not provided

Source: *Puertos del Estado* (State Ports).

To ensure proper market developments, it will not be enough to have the infrastructure or adequate equipment supply. In fact, potential barriers have been identified that may affect the future development of LNG supply activities regarding:

- The use of regulated infrastructure, to the extent that consumption of gas in its liquid form for supply vessels represents a new activity for the Spanish gas system. It is therefore necessary to define this activity and a treatment to ensure a coherent and balanced development on the market compatible with the basic principles of regulation of the gas system and the port system. In any case, it is understood that the marketing activities of LNG ships bound for final customer must be developed under a free market.

- The definition and standardisation of technical specifications for the design and operation of infrastructure and equipment for LNG supply, including risk assessment, aiming at the safety and efficiency of supply activities and the definition of requirements for the granting of authorisations and licenses if any provision of supplies under the service regime provided for in the existing port legislation.

- The definition, standardisation and assurance of quality levels due to LNG.

- The development of training, identification of competencies and definition of authorisation processes for the agents that provide the activity of LNG supply in the port area, ensuring the safety and efficiency of operations and ensuring consistency with the existing training requirements along the supply chain, thereby facilitating validation in the training processes.

- The resistance to the change involved in the development of LNG supply infrastructure in port and transit of ships and boats propelled by that fuel, caused by a subjective perception of safety risks.

[155] Entry into service: before the end of 2020.
[156] Entry into service: before the end of 2020.
[157] According to information provided by the project coordinator GAINN4MOS.
[158] Source: Reganosa. Project Reganosa Xunta de Galicia and framed in the work and studies are being developed to create the LNG Hub Northwest Iberian. In September 2016 the design has been finalised. Entry into scheduled service: 2020.
[159] Information compiled from data provided by various economic operators.

- The uncertainty of the final consumer regarding the market price of LNG can be an obstacle to undertake the investment required to use it as a maritime fuel. Therefore, a mechanism that encourages price transparency should be considered.

Considering the current capacity to supply LNG at any point of the national territory by the 250 existing tankers, we can say that all ports of general interest in the port system should be able to offer a point of supply of LNG to ships and, consequently, they would all be able to do so in the coming years without prejudice to the need to adapt the type of supply to future demand requirements (evolving towards PTS or STT types).

In any case, the Directive poses as a quantitative target the identification of supply points in ports, and not necessarily the type of supply, which on the other hand requires a market analysis in more depth, and agreed with the sector, to the extent that such developments will fall mainly on private initiative. For that reason, and although to date it is possible to realise certain ports where other types of different supply tanker are expected to be available, it was considered prudent not to set goals regarding types of supply until we have a better understanding of market developments.

Looking ahead to the next revision of the NAF, scheduled in 2019, and based on market analyses that are being developed in the field of CORE LNGas Hive Project, it is possible to deepen the process by identifying supply points by type for the horizon years 2025 (seaports) and 2030 (inland ports) established by the Directive.

The following tables list the quantitative targets set for ports of general interest and which relate to the identification of ports where it will be possible to establish LNG supply points in the time horizon established by the Directive, at least by road tankers.

Table IV-7. Target LNG refuelling points at ports of the basic network of the TEN-T. 2025 and 2030

YEAR	AMBIT	PORTS
2025	Seaports of the Basic Network TEN-T	A Coruna Algeciras Bay Barcelona Bilbao Cartagena Gijon Huelva Las Palmas Palma de Mallorca Tarragona Santa Cruz de Tenerife Valencia
2030	Inland ports Basic Network TEN-T	Seville

Source: *Puertos del Estado* (State Ports).

Table IV-8. Target LNG refuelling points at ports of the general network of the TEN-T, 2025 and 2030

YEAR	AMBIT	PORTS
2025	Seaports General Network TEN-T	Alicante Almería Arrecife Aviles Bay of Cadiz La Savina (Formentera) Carboneras Castellón Ceuta El Hierro (La Estaca) Ferrol Fuerteventura (Pto. Del Rosario) Ibiza Santa Cruz de La Palma Mahon (Menorca) Malaga Melilla Motril Pasajes Sagunto San Cibrao San Sebastian de la Gomera Santander Vigo Los Cristianos[160] Tarifa[161]

Source: *Puertos del Estado* (State Ports).

Table IV-9. Objective of other LNG refuelling points in ports of general interest of the port system

YEAR	AMBIT	PORTS
2025	Seaports	Alcudia Gandia Marin-Pontevedra Arousa

Source: *Puertos del Estado* (State Ports).

IV.1.4. MEASURES

According to Article 3 of the Directive, the NAF considers it necessary to ensure that the objectives and targets are achieved. Whereas here the development of supply is closely linked to the existence of sufficient demand, a wide range of services has been considered that can boost the LNG market in

[160] It is expected that the ports of Tarifa and Los Cristianos will soon be included in the General Network RTE-T after the review being undertaken in the Appendix to Regulation (EU) No 1315/2013 of the European Parliament and of the Council of December 11, 2013, on Union guidelines for the development of the Trans-European Transport Network, and amending Decision No 661/2010/EU is repealed. This review is expected to be approved in 2016 and taking effect in January 2017.
[161] See previous footnote.

Spain from direct investment aid, tax incentives, financial support, policy and strategic measures to each of the (naval, port and gas) sectors, etc.

Table IV-10. Measures to support the use of LNG as fuel for shipping

CATEGORY	NO.	MEASURE	COMPETENCE	NORMS
strategic actions	1	**CORE LNGas Hive Project:** Core Network Corridors and Liquefied Natural Gas 2014-2020 Budget: 33M €*financed 50 %*	DG Ports and Merchant Marine (MFOM) Private initiative	CEF mechanism (Adopted in 2014)
tax incentives	2	**Bonus in the port charges** applicable to vessels powered by LNG or LNG consuming auxiliary engines (LNG tankers are excluded)	MFOM	the seventeenth final provision of Law 36/2014 of 26 December on the General State Budget for 2015 by the revised text of the Law on *Puertos del Estado* (State Ports) and the Merchant Marine, approved by Royal Decree amending legislative 2/2011 of 5 September.
Promotion of infrastructure and equipment supply and consumption of LNG ports	3	**Adaptation and development of infrastructure and equipment supply and consumption of LNG** ports through the actions of the CORE LNGas Hive Project and other projects currently in development.	DG Ports and Merchant Marine (MFOM) Private initiative	CEF mechanism
	4	**Boosting the participation of Spanish entities in development projects for supply and demand for LNG consumption** in ports programmes co-financed by the European Union.	MFOM MINECO DGFONDOS	CEF mechanism Horizon 2020 programme ERDF programme
regulatory developments	5	**Programmes of training for crews of vessels using LNG**	MFOM	IMO in its resolutions MSC. 396 (95) and MSC. 397 (95)
	6	**Analysis of consumer activity LNG:** LNG supply to ships in the current regulation in the gas sector	MINETUR *Puertos del Estado* (State Ports) (MFOM)	Law 34/1998 of 7 October, on the Hydrocarbons Sector Royal Decree 1434/2002, of 27 December, the activities of transport, distribution, marketing, supply and authorisation procedures for natural gas facilities are regulated
	7	**Standardisation of various procedures for the supply of LNG** ships	AENOR	
	8	Definition of procedures for the provision of LNG supply in ports and establishing the minimum qualification requirements	*Puertos del Estado* (State Ports) (MFOM) DG Merchant Marine (MFOM)	
Promoting industrial production and RDI	9	**State guarantees** for construction and transformation of low-emission ships annual budget €40M	MFOM	General Law on State Budget of each annuity
	10	**Aid for R & D & shipyards** to build ships and innovative new manufacturing processes.	MINETUR	Royal Decree 442/1994, of 11 March, on premiums and financing to shipbuilding
	11	Grant interest rate loans granted by banks to shipowners for shipbuilding in **Spain: credit facilities to shipowners.**	MINETUR	Royal Decree 442/1994, of 11 March, on premiums and financing to shipbuilding

Source: Developed in-house.

STRATEGIC ACTIONS

1. Core LNGas Hive - Core Network Corridors and Liquefied Natural Gas Project.

The CORE LNGas Hive - Core Network Corridors and Liquefied Natural Gas Project, funded by the European Commission under the Connecting Europe Facility (2014-EU-TM-0732-S), represents the most important strategic move from an institutional point of view to promote the development of LNG supply infrastructure in ports and facilitate market development.

This project is designed and structured to meet the requirements of the Directive, particularly in the face of the development of National Action Framework, monitoring their implementation and future revisions in accordance with the provisions of the Directive and the recommendations Presentation of the Senate in his study of the technical and economic aspects of the use of LNG as marine fuel, constituted within the Committee on the Environment and Climate Change (2014).

The project is led by the Ministry of Development, through *Puertos del Estado* (State Ports) and the Directorate General of Merchant Marine, in close collaboration with public and private entities representing the sectors affected and coordinated by Enagas. Specifically, the Project involves 42 entities of international, national and regional levels of the gas, port and shipping industry. The project has an implementation period that goes from 2014 to 2020, has a budget of €33 M, mainly private investment, and is co-funded at 50 % by the CEF mechanism for aid to TEN-T projects.

The objective of this project is to develop a logistics chain that makes it possible to boost the deployment of LNG as fuel for shipping. The activities that make up the project include various studies and pilot projects for the adaptation of existing infrastructure so as to allow the service of supply to ships. Also the developments that are taking place within the framework of this project will support the development and subsequent revisions of the NAF.

One of the main objectives to be achieved by the project is the identification of the barriers that must be overcome to promote the use of LNG as a maritime fuel. To this end, in addition to direct contact with affected agents and interaction between industrial and institutional project partners, a working group has been created with industry associations and representatives of administrations whose foundation is not only identifying barriers but the discussion on possible alternatives that could respond to the difficulties encountered in the development of the market.

Thus it is important to ensure, as provided for in Directive, and which affects LNG as marine fuel, that the NAF, including its national goals and targets and measures to promote market development, including implementation of the necessary infrastructure, is developed in close cooperation with the relevant industrial sector. Likewise, participation in the Project of REN (the technical manager of the gas system in Portugal) responds to the recommendations for cooperation between countries which the Directive also establishes.

The project also includes the development of a Plan for deployment of innovative technologies used in the pilot projects area of the entire port system of general interest. This plan will serve as a basis for identifying the funding needs of new infrastructure to be developed.

Issues are also developed that go beyond infrastructure development but which are crucial to promote market development, such as the development of technical specifications that as far as possible allow standardisation both of operations and design of infrastructure and equipment, training and qualification of personnel who provide supply services or regulatory aspects in order to promote the development of this new activity consistent with the regulations of the gas and maritime and port sectors.

In addition, other issues that are directly or indirectly related to the achievement of the objectives and targets set and with the requirements of the Directive will be addressed. Among other things, this includes the creation of an observatory that will facilitate the monitoring and review of the national action framework with regard to LNG as fuel in shipping.

In the CORE LNGas Hive project itself work has been developing to identify barriers to penetration of LNG as marine fuel that may affect the achievement of objectives and goals, consistently and by consensus evaluating the need to propose and develop specific measures to overcome these barriers, for example through incentives (direct, fiscal or financial) improvement or development of technical and administrative procedures, adapting legislation, etc.

Aspects that affect, for example, training or development of technical specifications, due to their impact on both the security and efficiency of supply activities and administrative procedures for approval have been identified as potential barriers to market development. As study of these issues progresses under the CORE LNGas Hive Project they may propose concrete measures.

Similarly, reluctance to use LNG as fuel in the port area has been identified as a possible barrier, motivated by a subjective perception of risk associated with the unique characteristics of this fuel. In this sense, in terms of awareness, the authorities, port authorities and operators involved must make a major effort. In this connection, training aspects are again essential, so as to ensure that all personnel involved in logistics and the supply chain operating in the maritime-port area are appropriately qualified according to their normal work and able to respond not only to the usual operations but also to the resolution of possible emergencies.

In this regard, the Project includes specific activities, both to identify training needs, and to develop a communication strategy in order to identify those sectors likely to need more information about the use of LNG as a maritime fuel. After identifying the target audience, a specific information campaign will be established and launched for each representative group, aimed at disseminating and sharing the benefits of using LNG as fuel for society. Throughout the course of the CORE LNGas Hive Project will deepen these issues to develop more concrete measures.

TAX INCENTIVES

2. Bonus in the port charges applicable to vessels consuming LNG.

The seventeenth final disposal of Law 36/2014 of 26 December on the General State Budget for 2015 by which the revised text of the Law on *Puertos del Estado* (State Ports) and Merchant Marine is modified, approved by Royal Legislative Decree 2/2011 of 5 September, establishes a 50 % discount on the full fee for entry and stay in Zone I (within port waters) and/or Zone II (outside port waters), for ships using natural gas as fuel for propulsion offshore and for vessels during their stay in port using natural gas to power their auxiliary engines whenever they are not gas tankers.

PROMOTION OF INFRASTRUCTURE AND EQUIPMENT FOR SUPPLY AND CONSUMPTION OF LNG IN PORTS

3 Adaptation and development of infrastructure and equipment for the supply and consumption of LNG in ports through the actions of the CORE LNGas Hive Project and other projects currently in development.

The ongoing CORE LNGas Hive project contains specific provisions for the development of the pilot LNG refuelling infrastructure in Spanish ports. These are investment projects, mainly private, for development of infrastructure and supply equipments and adaptation of machinery and port service vessels so as to permit the consumption of LNG. Additionally, the project includes the establishment of a plan for deployment of such infrastructure.

In addition, there are other projects and complementary initiatives[162] of the CORE LNGas Hive that will on the one hand increase the fleet of LNG vessels, helping to generate greater demand, and on the other hand supply equipment, extending the refuelling points.

[162] Project GAINN4SHIP INNOVATION (2014-ES-TM-0593-S): Transformation of the ship 'Bencomo Express' Fred Olsen for LNG consumption.
CLEANPORT Project (2014-ES-TM-0711-S): Transformation of the ship 'Abel Matutes' Balearia for LNG consumption.

4 Boosting the participation of Spanish entities in projects to develop the offer to supply and demand for LNG consumption in ports programmes co-financed by the European Union.

Puertos del Estado (State Ports), the Secretary of State for R & D & i and the Directorate General of Community Funds will jointly encourage the participation of the Spanish private sector in various European programmes such as the CEF Mechanism, the Horizon 2020 programme and the various operational ERDF programmes that allow co-financing for the deployment of infrastructure and equipment for the supply of LNG in the port area and the adaptation of equipment and vessels for LNG consumption.

REGULATORY DEVELOPMENTS

5 Training programmes for crews of vessels using LNG as fuel.

The Directorate General of the Merchant Marine will handle the transposition into national law of the training programmes for crews of vessels using LNG as fuel, established by IMO in its resolutions MSC. 396 (95) and MSC. 397 (95), as it applies to operators of LNG terminals.

6 Analysis of consumer activity to supply LNG ships in current regulation in the gas sector.

Since LNG consumption for supply ships represents a relatively new activity, it is necessary to analyse in depth the implications of such a development for the current regulation in the gas sector, based on costs. As a result of which, the feasibility of the deployment of this activity, which may or may not rely on shared use of existing storage infrastructures belonging to the Spanish gas transport system (subject to third party access to the network) will be assessed.

From this point of view, it is necessary to analyse the economic regime governing the use of storage infrastructure belonging to the system, particularly as regards the level of toll cargo ships from such infrastructure when it comes to small vessels (less than 9 000 m^3)' either supply or consumers. In this regard, it is to study the appropriateness toll to supply small volumes required for LNG consumption.

7 Standardisation of various procedures for the supply of LNG ships.

AENOR[163] has created a working group for the standardisation of various procedures for the supply of LNG vessels called AEN/CTN 27/GT2, 'Natural gas as a marine fuel', whose role is the analysis, study and standardisation proposal for the different procedures for the supply of LNG to ships.

During 2014-2015 this Working Group developed a draft standard for the supply of LNG as fuel for ships (PNE 27005) for the standardisation of the (human and material) means and procedures (protocols) required so that LNG supply to ships[164] for use as a marine fuel is carried out under appropriate conditions of quality and safety. This draft standard is being processed internally in AENOR, although currently the process of this standard becoming a Spanish official standard is awaiting the publication of ISO DIS 20519 'Ships and marine technology-Specification for bunkering of gas fuelled ships'.

The next activity of this Working Group will develop three possible types of supply (tanker, supply ship and supply terminal), to be added as annexes to the standard.

8. Definition of procedures for the provision of an LNG supply service in ports and establishing the minimum qualification requirements

This measure arises in the context of the proposed regulation of the European Parliament and of the Council establishing a framework on market access to port services and financial transparency of

GAINN4MOS Project (2014-EU-TM-0698-M): Adaptation of a supply vessel for LNG supply to consumers ships.

[163] AENOR is legally responsible for the development and dissemination of technical standards in Spain (UNE), and also for developing its own standards at the national level, and is responsible for adapting and implementing the ISO and EN standards that are mandatory in the Spanish territory.

[164] does not apply to the procedures for loading LNG carriers.

ports. According to the proposal for a regulation, bunkering (including LNG) will be considered a port service so that the port authorities are obliged to regulate the provision of said service through the corresponding product specifications of special requirements that must be informed by the Public Agency *Puertos del Estado* (State Ports) binding. In October 2016 that regulation is in the phase of the trialogue between the Commission, Parliament and the Council and its approval is expected this year.

As for the definition of procedures and as part of the experience of the port system of state ownership during operations to supply LNG to ships that have been carried out since 2012, some Port Authorities (Cartagena, Valencia, Vigo and Huelva) have developed their own procedures for providing this service in port public domain. These procedures, together with analyses being carried out in the CORE LNGas Hive Project on technical requirements for operations of LNG supply, may be used as a baseline for the development of recommendations or guidelines to be covered by the specifications of services, to ensure use of LNG compatible with the necessary levels of security, including simultaneous loading/unloading of goods and/or passengers.

On the other hand, it is necessary for security to establish minimum qualification requirements for personnel involved in supply operations in port, according to the analysis being carried out in the ambit of the CORE LNGas Hive Project.

PROMOTING INDUSTRIAL PRODUCTION AND RDI

9 State guarantees for construction and conversion of ships with low emissions.

Since 1999, there exists in the State Budget a sum of 40 million Euros to grant State Guarantees for investment in ships for Spanish shipping companies. Its application was limited to underwriting acquisitions of merchant ships through 'purchase, lease to own or financial lease to own'.

In the State Budget 2016 it has been recognised that these State Guarantees can guarantee the investments necessary to meet the new emissions requirements, including the conversion of vessels to use LNG as fuel or the installation of systems purifying exhaust gases (scrubbers), with the same amount (40 million) as in previous years.

The guarantees may be used to finance both used and newly built vessels and in the latter case, both those built in Spain and abroad. Vessels may be up to 15 years of age and up to 70 % of the investment can be guaranteed. In these cases of acquisition of ships, the guarantee may cover at most 35 % of the value of the vessel.

10. Aid for R & D & i for shipyards to build ships and innovative new manufacturing processes.

There is an aid scheme, authorised by the European Commission for the realisation of RDI by Spanish shipyards, regulated by Royal Decree 442/1994, of 11 March, on premiums and financing for shipbuilding. Support is contemplated for construction projects for innovative ships propelled by LNG and the introduction of new manufacturing processes in these yards.

11. Credit facilities to shipowners.

The Ministry of Industry, Energy and Tourism has a grant that subsidises the interest on loans granted under OECD conditions by banks to shipowners for shipbuilding, including vessels powered by LNG, in Spanish shipyards. It is regulated by Royal Decree 442/1994, of 11 March, on premiums and financing to shipbuilding.

IV.2. ELECTRICITY

IV.2.1. CURRENT SITUATION

Connection to the electrical mains network by berthing ships allows them to turn off their auxiliary engines that generate energy for different needs on board (e.g. heating and air conditioning for the passengers). This possibility represents an alternative to burning fuel and locally eliminates both emissions and noise.

In addition to eliminating the impact on the atmosphere where the ship is docked with the engines running, this alternative has two other important advantages for the shipping company: the elimination of vibration on board, and less wear on the said auxiliary engines.

In Spain there is a power point currently undergoing testing for vessels docked in the Maritime Station of the Port of Melilla. In addition, feasibility studies are being conducted in the ports of Barcelona, Valencia, Palma de Mallorca, Ibiza, Santa Cruz de Tenerife, La Gomera and La Palma.

Puertos del Estado (State Ports) has estimated that more than 100 000 tonnes of conventional fuel – fuel oils, marine gas oils, etc. – could theoretically be replaced by about 600 GWh of electricity consumption during the stay of ships in port in Spain.

The possibility of such replacement must be taken into account when drawing up action plans at the local level in those port cities or areas where there is a risk that the level of pollutants exceed one or more of the alert thresholds, according to Article 24 of Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. By way of illustration, the following table shows the estimated emissions at the Port of La Luz-Las Palmas.

Table IV-11. Estimation of emissions at the Port of Las Palmas from real data from stays and others

PORT OF LAS PALMAS 2011		EXHAUST EMISSIONS					OPERATING TIME			
		NO_X (Tonnes)	SO_X (Tonnes)	PM2.5 (Tonnes)	CO (Tonnes)	CO_2 (Tonnes)	H (H)	M (H)	C (H)	T (H)
Traffic Type	Passenger	1 063	536	113	99	50 426	22 109	597	4254	26 960
	Service	283	72	19	37	14 500	26 583	338	316	27 237
	General cargo	373	112	27	47	17 700	59 444	2 121	3 861	65 426
	Container	1 019	288	73	119	48 000	63 889	1 648	2 712	68 249
	Tanker	667	186	47	91	33 300	65 833	2 889	3 028	71 750
	Other	241	52	15	37	13 300	78 889	4 500	2 361	85 750
	Fishing	296	59	17	33	15 100	43 611	229	349	44 188
	Car carrier	153	56	13	17	7 479	8 583	245	699	9 528
	Unknown	143	58	13	18	8 892	90 833	3 667	5 972	100 472
TOTAL		**4 237**	**1 420**	**338**	**497**	**208 697**	**459 776**	**16 233**	**23 551**	**499 560**

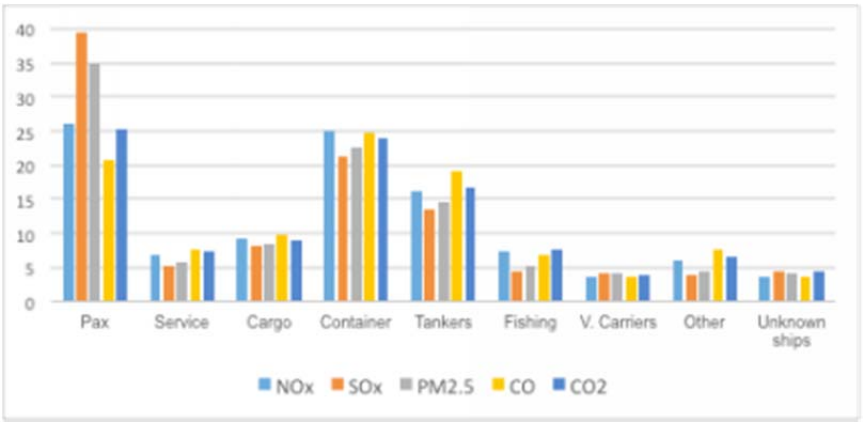
PORT OF LAS PALMAS 2011		EXHAUST EMISSIONS					OPERATING TIME			
		NO_X (Tonnes)	SO_X (Tonnes)	PM2.5 (Tonnes)	CO (Tonnes)	CO_2 (Tonnes)	H (H)	M (H)	C (H)	T (H)
Cruise ships	GT < 4 kt	2	1	0	0	96	10	1	3	14
	GT 4-10 kt	9	2	0	1	96	1 575	4	17	1 596

	GT 10-20 kt	3	1	0	0	133	55	2	10	67
	GT 20-30 kt	7	2	0	1	355	148	6	29	183
	GT 30-45 kt	26	10	2	2	1 261	371	13	50	433
	GT 45-60 kt	22	9	2	2	1 003	195	9	32	236
	GT 60-80 kt	74	39	8	9	3 529	1 002	31	179	1 212
	GT> 80 kt	16	13	3	3	831	301	15	63	379
TOTAL CRUISE		**158**	**75**	**16**	**18**	**7 683**	**3 657**	**79**	**384**	**4 120**
Ferries	GT <4KT	0	0	0	0	21	199	1	1	202
	GT 4-10 kt	57	13	3	6	2 590	3 046	45	593	3 685
	GT 10-20 kt	588	316	65	47	27 446	10 854	329	2 433	13 616
	GT 20-30 kt	259	132	28	29	12 686	4 352	143	843	5 338
	Total ferries	905	461	97	81	42 744	18 452	517	3871	22 840
TOTAL PAX		**1 063**	**536**	**113**	**99**	**50 426**	**22 109**	**597**	**4254**	**26 960**

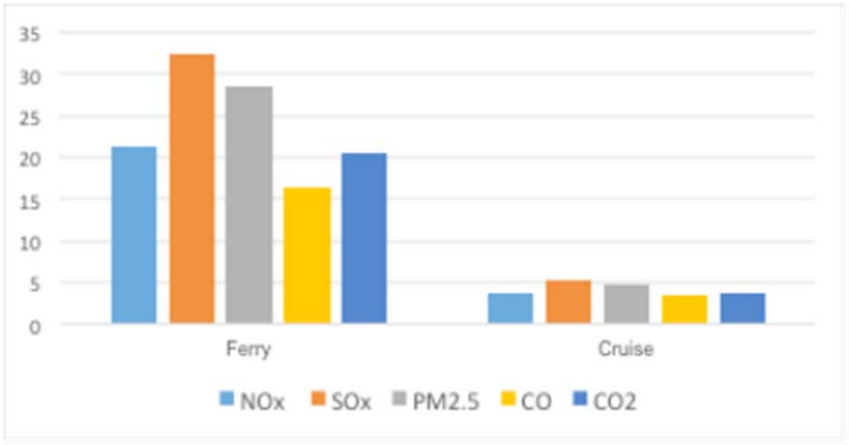
Source: Study 'Essays on vessel emissions and externality cost in Las Palmas Port'

Figure IV-7. Estimation of emissions at the Port of Las Palmas from data from stays

Percentage (%) of emissions per type of vessel



Percentage (%) of emissions from cruisers and ferries over total emissions



Source: Study 'Essays on vessel emissions and externality cost in Las Palmas Port'

In addition, the supply of electricity to ships at berth represents the contribution of shipping to meet the target that 10 % of the energy consumed in transport should be from renewable sources, set by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources. In fact, the maximum potential removal of greenhouse gases in Spain has been estimated by the public body *Puertos del Estado* at about 200 000 tonnes of CO_2.

However, to connect a docking ship you not only need the corresponding equipment at the dock, but the ship itself must be suitably adapted. To date most of them only have one emergency electrical connector, necessary for maintenance and repair operations in the shipyard. However, the provision of high voltage connectors is increasingly common in modern ships, especially on cruise ships,[165] whose owners have recognised in this alternative a distinctive image advantage, suggesting comfort on board and care for the environment.

In any case, the decision to seek electrical power while berthed is affected first of all by the price differential between the two sources of energy and by the investment costs required both on board and on the quay. On the other hand, the supply of electricity to ships at berth is a technologically mature alternative in the market.

Supply to merchant ships is done both at 400 V voltage and at 6.6 and 11 kV, the latter two voltages international standard also reflected in the level of the European Union. Thus, under Article 4.6 of Directive 2014/94/EU, these shore-side electricity supply installations, from November 18, 2017, must comply with the IEC/ISO/IEEE 80005-1 standard.

From a technological point of view, the high voltage supply is recommended from medium power levels above 1 MW demanded by ships, which can consume several MWh per year while in port. The supply should be - for much of the fleet - at 60 Hz, requiring frequency conversion from the 50 Hz of the general network. Moreover, the electrical connection can be made either by sending a cable from the dock to the ship or by manoeuvring the vessel itself so the cable descends on board. In any case, once the physical connection is carried out, power is gradually transferred from the auxiliary engines of the ship to the general electricity network. This transfer is carried out in just a few minutes, but when the vessel is connected for the first time in a berth, it is necessary to carry out a series of checks that can last up to an hour. Those tests follow an established procedure and have been previously agreed, after notification by the consignee of the ship of the intention of its Captain to request the supply of electric power.

The ships most suitable for connecting to the grid are those making frequent journeys and that dock near the most populated areas of the port: that is, ferries with total stays per year above 1 500 hours and cruise ships[166].

Table IV-12. Ship traffic in 2013 in the general interest ports managed by the Port Authorities

PORT AUTHORITY	TANKERS		BULK CARRIERS		FREIGHTERS		CONTAINER SHIPS	
	No.	GT	No.	GT	No.	GT	No.	GT
A Coruña	283	6 204 927	108	2 234 361	520	2 364 918	61	453 283
Alicante	19	73 046	71	791 423	94	517 845	438	4 122 686
Almería	8	26 137	131	3 116 347	142	649 765	102	861 141
Aviles	92	649 756	152	1 688 626	565	3 042 270	3	13 065
Algeciras Bay	2 230	44 410 378	606	21 476 263	389	3 262 561	3 342	125 199 428
Bay of Cadiz	32	501 253	93	1 822 945	145	944 350	210	3 239 283
Balearics	167	1 732 198	212	862 403	187	684 382	1	3 338

[165] At present, power supply to large cruise ships in Spanish ports is technically not a viable option given the high demand for electrical energy required.
[166] See footnote 154.

Barcelona	836	12 042 126	123	2 825 984	661	3 012 733	1 979	71 142 850
Bilbao	529	14 094 742	542	4 174 476	674	5 347 407	708	6 197 190
Cartagena	750	22 739 670	398	4 233 863	151	614 166	280	2 215 715
Castellón	296	6 391 122	344	2 401 266	178	710 966	444	6 279 168
Ceuta	871	5 389 031	264	3 940 204	2 960	13 256 641	120	643 605
Ferrol-San Cibrao	181	7 964 843	273	5 348 258	584	2 451 096	4	35 392
Gijon	74	894 028	273	10 031 473	412	1 990 228	290	2 222 965
Huelva	1 265	22 003 163	2.3.4	3 447 993	353	1841045	-	-
Las Palmas	731	22 174 432	1 067	35 827 103	1 526	11041841	1 418	33 472 371
Malaga	33	200 275	49	469 015	130	401 763	238	7 618 598
Marin and Ria de Pontevedra	-	-	26	540 293	333	2195413	79	1 044 508
Melilla	36	166 903	5	13 125	-	-	112	796 991
Motril	96	1064013	26	355 409	134	609 966	56	406 067
Pasajes	-	-	157	426 190	515	1 714 280	-	-
Sta. Cruz de Tenerife	1 013	25 778 076	366	17 426 584	223	2 053 289	584	5 683 785
Santander	70	357 239	64	1 327 063	602	2 617 007	12	159 701
Seville	91	380 195	16	160 229	634	2 082 844	121	814 450
Tarragona	1 091	17 816 739	200	4 583 992	782	4 882 804	270	5 692 208
Valencia	224	6 792 130	161	1 286 952	1 510	12 475 568	3 014	120 844 652
Vigo	26	174 034	47	205 092	208	2 149 621	478	5 597 528
Vilagarcía	41	544 316	19	157 439	123	325 648	52	514 176
Total	**11 085**	**220 564 772**	**6 027**	**131 174 371**	**14 735**	**83 240 417**	**14 416**	**405 274 144**

PORT AUTHORITY	RO-RO FERRIES		CRUISE SHIPS						REST OF PASSAGE
	No.	GT	No.	Embarking	Landed	Transit	Total	Average passengers	No.
A Coruña	1	14 162	108	423	155 701	156 890	156 890	1 453	-
Alicante	230	3 817 171	32	40	119	41 701	41 860	1 308	-
Almería	906	14 397 603	28	-	-	16 971	16 971	606	-
Aviles	4	38 112	4	-	-	655	655	164	-
Algeciras Bay	296	2 372 276	2	-	-	85	85	43	17 900
Bay of Cadiz	184	3 994 745	311	784	1 236	373 114	375 134	1 206	-
Balearics	701	12 411 098	699	245 440	246 994	1 042 240	1 534 674	2 196	25 300
Barcelona	3 284	100 613 745	837	754 038	752 248	1 092 946	2 599 232	3 105	-
Bilbao	152	3 562 085	44	6 725	6 303	44 324	57 352	1 303	114
Cartagena	9	83 218	115	71	79	134 075	134 225	1 167	-
Castellón	111	2 189 378	3	-	-	1 514	1 514	505	-
Ceuta	629	3 985 333	3	-	-	2 527	2 527	842	6 368
Ferrol-San Cibrao	2.3	386 184	9	46	6	10 801	10 853	1 206	-
Gijon	11	486 373	11	5	5	14 281	14 291	1 299	167
Huelva	-	-	2	-	-	294	294	147	55

Las Palmas	3 828	64 381 720	445	120 906	121 052	588 266	830 224	1 866	-
Malaga	781	12 270 963	249	34 224	36 707	326 167	397 098	1 595	-
Marin and Ria de Pontevedra	-	-	-	-	-	-	-	-	-
Melilla	1 199	24 902 062	7	-	-	3 248	3 248	464	147
Motril	585	13 509 424	27	-	-	15 231	15 231	564	-
Pasajes	202	3 876 175	-	-	-	-	-	-	-
Sta. Cruz de Tenerife	4 365	68 643 933	525	83 346	84 028	626 969	794 343	1 513	4 985
Santander	563	16 417 103	12	-	172	16 575	16 747	1 396	-
Seville	135	1 525 500	58	8 274	8 521	2 708	19 503	336	-
Tarragona	100	3 505 297	3	-	-	1 394	1 394	465	-
Valencia	1 955	54 420 785	223	35 782	38 566	398 766	473 114	2 122	-
Vigo	426	13 632 421	83	1 337	1 655	168 808	171 800	2 070	-
Vilagarcía	-	-	6	-	-	2 199	2 199	367	-
Total	**20 680**	**425 436 866**	**3 846**	**1291441**	**1 453 392**	**5 082 749**	**7 671 458**	**1 995**	**55 036**

Source: Public Agency *Puertos del Estado* (State Ports).

While in certain ports of the United States and Asia a significant number of vessels already adapted for electrical connection make calls, in Europe the situation is different and this alternative is not yet widespread. The Port of Gothenburg (Sweden) is a pioneer in supplying power to ships in dock because the Baltic Sea has been declared a SECA area (area with sulphur emission control, as declared in the IMO Marpol Convention). Regarding the ports known as the 'Le Havre-Bremen range' in the North Sea, only specific actions in separate terminals for cruisers in Hamburg, road traffic in Zeebrugge, containers in Antwerp and passengers in Rotterdam, have made use of this alternative.

Table IV-13. Ports in the world with facilities for electricity supply to berthed ships

YEAR OF IMPLEMENTATION	PORT	COUNTRY	POWER (MW)	FREQUENCY (HZ)	TENSION (KV)	TYPE OF VESSEL
2000-2010	Gothenburg	Sweden	1.25-2.5	50- 60	6.6 and 11	Ro-Ro, Ro-Pax
2000	Zeebrugge	Belgium	1.25	50	6.6	Ro-Ro
2001	Juneau	USES	7-9	60	6.6 and 11	cruise
2004	Los Angeles	USES	7.5 to 60	60	6.6	Container, cruise
2004	Pitea	Sweden	1.0	50	6	Ro-Ro
2005-2006	Seattle	USES	12.8	60	6.6 and 11	cruise
2006	Kemi	Finland		50	6.6	Ro-Pax
2006	Kotka	Finland		50	6.6	Ro-Pax
2006	Oulu	Finland		50	6.6	Ro-Pax
2008	Antwerp	Belgium	0.8	50 - 60	6.6	Container
2008	Lubeck	Germany	2.2	50	6	Ro-Pax
2009	Vancouver	Canada	16	60	6.6 and 11	cruise
2010	San Diego	USA	16	60	6.6 and 11	cruise
2010	San Francisco	USA	16	60	6.6 and 11	cruise

2010	Karlskrona	Sweden	2.5	50	11	Ro-Pax
2011	Long Beach	USES	16	60	6.6 and 11	Container
2011	Oslo	Norway	4.5	50	11	cruise
2011	Prince Rupert	Canada	7.5	60	6.6	
2012	Rotterdam	Netherlands	2.8	60	11	Ro-Pax
2012	Ystad	Sweden	6.25	50 & 60	11	Ro-Pax
2013	Trelleborg	Sweden	3.5-4.6	50	11	Ro-Pax
2015	Hamburg	Germany	12	50 & 60	6.6 and 11	cruise

Source: International Association of Ports and Harbours (IAPH) - World Ports Climate Initiative.

From the point of view of Community policies, the supply of electricity to ships at berth is considered as a solution to meet the requirement imposed by Directive 2012/33/EC, amending in turn Directive 1999/32/EC and also in turn Appendix VI of the MARPOL Convention approved by the IMO. This requirement concerns the limitation to 0.1 % by mass of sulphur content of fuels used by ships while they are berthed in port.

IV.2.2. EXPECTED MARKET TRENDS AND OBJECTIVES

The Spanish Port Authorities are willing to facilitate the provision of electrical connection points on the docks of the ports of general interest. The initiative for this service can be taken either by the shipping company itself when it has own terminal or marine station concession or by companies in the electricity sector.

It would be necessary for the private initiative to request a concession for occupation of port land under public ownership to host the connecting cables from the pier to the transformer centre – whether in trenches or in galleries - from the corresponding Port Authority, which will be granted under the conditions and the obligation to pay the rate for occupation and activity set out in the Ports Act in force (Royal Legislative Decree 2/2011 of 5 September, approving the revised text of the Law on *Puertos del Estado* (State Ports) and the Merchant Marine).

There is no obligation for port authorities to provide a commercial service in the absence of private enterprise, since this obligation will be imposed only for services such as the port services defined in the said Ports Act. However, according to the proposal for a regulation of the European Parliament and of the Council establishing a framework on market access to port services and financial transparency of ports in an advanced state of processing in the EU, it should be noted that the supply of power, like bunkering, will be considered a port service, in which case the port Authority will be obliged to provide it if requested in the absence of private initiative.

The goal for 2020 that the National Framework states, according to the best estimate of the demand made to date of manufacture (October 2016) is reflected in the following table.

Table IV-14. Forecast for Spanish ports with power supply for ships at berth in 2020

PORT	TERMINAL	NO. OF CONNECTIONS	VOLTAGE (V)	FLEET SERVED	OBSERVATIONS
Melilla *General network TEN-T*	Maritime station	1	400	Ferries	In testing phase
Light - Las Palmas *Basic network TEN-T*	Large dock	2	400	Ferries	2015-EU-TM-0417-S project selected in the 2015 call for CEF Mechanism. Conditional on final financing.
Santa Cruz de Tenerife *Basic network TEN-T*	Maritime station	2	400	Ferries	2015-EU-TM-0417-S project selected in the 2015 call for CEF Mechanism. Conditional on final financing.

Palma de Mallorca *Basic network TEN-T*	Dock of Paraires, extension to dock of Poniente and Dock of Poniente Sur	3	400 and 6 600	Ferries	2015-EU-TM-0417-S project selected in the 2015 call for CEF Mechanism. Conditional on final financing.
Pasajes *General TEN-T*	Dock of Lezo	1	11 000[167]	Car-Carriers	2015-EU-TM-0417-S project selected in the 2015 call for CEF Mechanism. Conditioned on final financing.

Source: *Puertos del Estado* (State Ports).

IV.2.3. MEASURES

Table IV-15. Measures to support the electricity supply to ships docked in port

CATEGORY	No.	MEASURE	COMPETENCE	NORMS
tax incentives	1	**50 % reduction** in the tax levied for stays by ships docked in port when mains electricity is connected	*Puertos del Estado* (State Ports) (MFOM)	The seventeenth final provision of Law 36/2014 of 26 December on the General State Budget for 2015 by the revised text of the Law on *Puertos del Estado* (State Ports) and Merchant Marine, approved by Legislative Royal Decree 2/2011 of 5 September.
	2	**Creating a working group** to analyse the possible future demand for electricity supplied to ships docked at our ports and the viability of the possible relevance of taxes on market conditions.	*Puertos del Estado* (State Ports) (MFOM) MINHAP	
Promoting supply infrastructure	3	**Promoting the participation of Spanish entities** in development projects for electricity supply infrastructure in ports	*Puertos del Estado* (State Ports) (MFOM)	CEF mechanism Horizon 2020 programme ERDF programme
	4	**Tracking shipping company plans** to meet the foreseeable needs of electricity supply in port	*Puertos del Estado* (State Ports) (MFOM)	
Regulatory developments	5	Analysis of the possible up-dating of the rules applicable to the supply of electricity to ships at berth	*Puertos del Estado* (State Ports) SE Energy (MINETUR)	.
Promoting industrial production and RDI	6	Studies on the applicability of smart grids in the electrical connection port	*Puertos del Estado* (State Ports) (MFOM)	
	7	Participation in innovative projects to ensure on-site power generation from renewable energy sources	*Puertos del Estado* (State Ports) (MFOM)	
Dissemination and awareness	8	Creation of a web page with information about the ports that provide electricity to berthed ships	*Puertos del Estado* (State Ports) (MFOM) REE	

Source: Developed in-house.

[167] In this case the delivery is expected in medium voltage (11kV as established by the IS0 80005) for this type of ship. In Pasajes there is a ro-ro terminal with frequent stops and that is why this type of supply is suitable.

TAX INCENTIVES

1. 50 % reduction in the tax levied for stays by ships docked in port when mains electricity is connected.

The seventeenth final disposal of Law 36/2014 of 26 December on the General State Budget for 2015 amending the recast text of the Law on *Puertos del Estado* (State Ports) and Merchant Marine is modified, approved by Royal Legislative Decree 2/2011 of 5 September, establishes a 50 % discount on the full amount of the tax on the vessel for access and stay in Zone I or interior port waters for vessels which during their stay in port use electricity supplied from the dock to feed their auxiliary engines.

This measure is designed, in accordance with the recommendation of the European Commission COM 2006/339/EC, to encourage the supply of electricity to ships at berth and is in line with Action 8 of the European Commission which envisages encouraging more coherent application of port infrastructure charges, differentiated according to environmental parameters.

This measure helps to lessen the high annual costs presently involved in connecting a ship to the electricity mains instead of burning fuels to keep the auxiliary engines running; the measure also helps defray the initial investment required for such connection.

2. Creating a working group to analyse the possible future demand for electricity supplied to ships docked at our ports and the viability of the possible relevance of taxes on market conditions.

Since the supply of electricity to berthed vessels represents a new activity and involves reducing levels of air pollution in ports, it is necessary to make an analysis in depth, based on costs, on the implications of its development is the current tax regime. It is therefore necessary to go more deeply in the advance study into future demand that could use the service and its impact.

This measure could find its legal protection through Article 19 of Directive 2003/96/EC of 27 October 2003 establishing the Community framework for the taxation of energy products and electricity restructuring. It is also in line with the intention expressed by the European Commission in its Communication COM (2007) 575 on an integrated European Union maritime policy to adapt the tax on electricity supplied to docked ships to market conditions. To this end, a working group will be created, formed by the General Directorate of Taxes and *Puertos del Estado* (State Ports).

PROMOTING SUPPLY INFRASTRUCTURE

3. Promoting the participation of Spanish entities in development projects for electricity supply infrastructure in ports.

Through the CEF Mechanism, the H2020 Programme (Mobility for Growth and Blue Growth initiatives) and the ERDF Programme (multiregional Operative Programmes for sustainable growth, for the development of the Atlantic area and for the development of the Mediterranean area), Ports State encourages the investment plans necessary for the development of electricity supply to ships.

4. Tracking shipping company plans to meet the foreseeable needs of electricity supply in port.

Puertos del Estado (State Ports) promotes cooperation with foreign ports, through the European Ports Association (ESPO) and the ESSF (European Sustainable Shipping Forum) forum of the European Union, to carry out shared monitoring of fleets whose plans include adaptation of their ships to be supplied with electricity at berth; this is necessary to know in advance the needs for electrical connection for vessels calling at Spanish ports.

REGULATORY DEVELOPMENTS

5. Analysis of the possible up-dating of the rules applicable to the supply of electricity to ships at berth.

The Ministry of Energy and *Puertos del Estado* (State Ports) are analysing the arrangements for the supply of electricity to ships at berth to see if regulatory changes are required for the development of this activity

PROMOTING INDUSTRIAL PRODUCTION AND RDI

6. Studies on the applicability of smart grids in the electrical connection port.

The public body *Puertos del Estado* (State Ports) and Spanish port authorities, through the R & D sections of their respective investment plans, boost research on the possibility of incorporating berthed ships connected to the electrical system to the so-called 'smart grids'.

7. Participation in innovative projects to ensure on-site power generation from renewable energy sources.

It is anticipated that the Spanish Port Authorities and the public agency *Puertos del Estado* (State Ports) participate in innovative projects promoting the application of hydrogen technology as an energy source.

DISSEMINATION AND AWARENESS

8. Creation of a web page with information about the ports that provide electricity to berthed ships.

Red Eléctrica Española (Spanish Electricity Network) and *Puertos del Estado* (State Ports) will incorporate into their respective websites information about the supply of electricity to berthed ships, including identification of the connection points and their characteristics as well as other relevant information.

In the same vein, *Puertos del Estado* (State Ports), through the Port Authorities, will promote advertising for such connection points through the WORLD PORTS CLIMATE INITIATIVE led by the International Association of Ports.

V. AIR TRANSPORT

V.1. ELECTRICITY

V.1.1. GENERAL DESCRIPTION

THE AUXILIARY POWER UNIT (APU) OF AIRCRAFT

In addition to the main engines, aircraft usually have an auxiliary power unit (APU) usually located in the tail of the plane. This turbine has two basic functions: one is responsible for supplying electric power to all aircraft systems for ground operation and, on the other hand, the bleed air extracted from the compressor of the APU is used for the aircraft's air conditioning and for starting the main engines. If the APU is not used for starting the main engines, the compressed air needed for this operation should be provided by a pneumatic group or ASU ('Air Starter Unit').

In flight, the APU is usually switched off and only switched on in special cases such as landing, in which the aircraft engines are at low engine speeds and extra power is needed, or in case of need for increased power during the flight for cabin air conditioning or for the de-icing system. In general, the main engines are responsible for supplying the energy needed for all systems during flight.

Therefore, the operation of the APU is usually limited to times when the aircraft is rolling to and from the parking position, or is stationary next to the terminal building. The APU is often disconnected immediately after ignition of the main engines and is usually connected after landing when the aircraft is approaching the parking stall in the terminal area.

If one or more of the main engines are switched off during taxiing, it may also be necessary to connect the APU. Several airports have established maximum times of use of the APU in order to minimise noise and emissions in the terminal area.

Also, it should be noted that, where the local climate forces the aircraft to use air conditioning for a significant part of the year, there may be little or no economic justification for a fixed installation only supplying 400 Hz, since during that period it would also be necessary APU that the slashed for conditioning of the aircraft. In these cases, the installation of a fixed system of 400 Hz must be considered along with another system for air conditioning, which increases costs, and economic justification must be based on both systems simultaneously. These fixed air conditioning systems (PCA, 'Pre-Conditioned Air') can replace the power supply on the ground provided by the APU of the aircraft or by mobile air conditioning units (ACU, 'Air Climate Unit').

V.1.2. CURRENT SITUATION

EXISTING SUPPLY INFRASTRUCTURE

TYPES OF INSTALLATION

Depending on the location of the converter equipment and the supply system to the aircraft we find three types of solutions:

- Converter on separate island and cable drum attached to the walkway.

This is the most common type of installation in Aena airports since historically precedence was given to not compromising the operation of the runway by any maintenance of auxiliary equipment. The island of equipment is located around the walkway's turntable and apart from the 400 Hz converter, usually also includes the CBTH and the PCA machine.

- Converter and cable drum attached to the boarding.

With increasing MTBF (mean time between failures) of equipment it is not so critical to install it on the walkway itself; most of these installations have been performed with an integrated converter/cable drum set.

- Converter installed on a separate island and supply through 'pits' integrated in the platform.

This system introduces more flexibility due to the independent use of the walkway and 400 Hz services.

As for the power requirements of the installation, depending on the fleet of aircraft stationary at each station, one or more standard equipments of 90 KVa will be installed:

Table V-1. Power requirements depending on the aircraft (fleet)

AIRCRAFT TYPE	NUMBER OF 90 KVA CONVERTERS
C and D	1
AND	2
F (A380)	4

Source: AENA.

With some peculiarities: the B767-400, B747-800 and MD-11 need 2 units, the B787 requires 3 units.

GROUND POWER SUPPLY FACILITIES FOR AIRCRAFT

Modern aircraft, when stationary at the gates of the terminals or at a remote location, require three-phase power at 200/115 V - 400 Hz.

Since the 1990s installations of systems to supply electricity at 400 Hz have been performed in most positions of contact with the Terminal, either to complete the provision of these positions or during delivery with installation of passenger boarding bridges and equipment for assistance to aircraft.

These systems are tasked to supply electric power to stationary aircraft, allowing disconnection of any other system of the aircraft, exterior or interior, for this purpose. Furthermore, in combination with the air conditioning system, it is possible to avoid using the APU, except for the supply of compressed air required when starting the engines.

The availability of the system allows significant cost savings to airlines, operational benefits in ground support tasks for aircraft and environmental benefits (drastic reductions in emissions and noise levels at the airport).

AIRPORTS OF THE TEN-T (SPAIN) BASIC NETWORK WITH POWER TO STATIONARY AIRCRAFT

In Spain, Aena, following its plan for quality of service to users and in line with its environmental and energy policy, installs walkways that allow easy access for operations of embarking and disembarking passengers on and off the aircraft, in safety and comfort for users, and equipment for assistance to aircraft allowing greater speed in operations around the aircraft, which results in better performance of airport infrastructure and greater safety in the work on the platform to eliminate or reduce vehicle traffic and passengers in it. These gateways can be equipped with outlets for the supply of electricity and air conditioning to aircraft on the ground.

Based on these policies, Aena has made a major effort to equip its airports with infrastructure giving fixed 400 Hz ground power supply for aircraft. This provision has been made based on the needs of airports, sometimes coinciding with the expansion of terminal buildings and, increasingly frequently,

replacement of equipment (gangways) that has reached the end of its operational life. Another major reason to install 400 Hz is the provision of services to airlines to enable Aena to implement operating procedures that restrict the use of the APU, it being necessary to provide adequate infrastructure for that purpose. The infrastructure may include providing air conditioning to the aircraft by installing PCA machines (pre-conditioned air), with high costs for investment and operation.

Then the installed units are in various airports, differentiating between airports belonging to the basic network of the Trans-European Transport Network (TEN-T)[168] and airports belonging to the global network of TEN-T.

Table V-2. Airports of the TEN-T (Spain) Basic Network with power to aircraft

AIRPORT (CODE ICAO)	No. STATIONARY UNITS	No. INTEGRATED UNITS
Adolfo Suarez Madrid-Barajas (LEMD)	139	9
Alicante-Elche (LEAL)	16	-
Barcelona-El Prat (LEBL)	77	-
Bilbao (LEBB)	6	-
Gran Canaria (GCLP)	15	-
Malaga-Costa del Sol (LEMG)	29	1
Palma de Mallorca (LEPA)	37	-
Seville (LEZL)	-	-
Tenerife Sur (GCTS)	8	-
Valencia (LEVC)	6	-
totals	**333**	**10**

Source: AENA.

AIRPORTS IN THE TEN-T GLOBAL NETWORK (SPAIN) WITH POWER TO STATIONARY AIRCRAFT

Table V-3. Airports in the TEN-T Global Network (Spain) with power to aircraft

AIRPORT (CODE ICAO)	No. STATIONARY UNITS	No. INTEGRATED UNITS
A Coruña (LECO)	2	-
Almería (LEAM)	-	-
Asturias (LEAS)	3	-
Badajoz (LEBZ)	-	-
Burgos (LEBG)	-	-
Fuerteventura (GCFV)	13	-
Girona-Costa Brava (LEGE)	-	-
FGL Granada-Jaen (LEGR)	-	-
Hierro (GCHI)	-	-
Ibiza (LEIB)	-	4
Jerez (LEJR)	-	-
La Gomera (GCGM)	-	-

[168] http://ec.europa.eu/transport/themes/infrastructure/index_en.htm

La Palma (GCLA)	7	-
Lanzarote (GCRR)	6	-
Leon (LELN)	-	-
Melilla (GEML)	-	-
Menorca (LEMH)	5	-
Murcia-San Javier (LELC)	-	-
Pamplona (LEPP)	-	-
Reus (LERS)	-	-
Salamanca (LESA)	-	-
San Sebastián (LESO)	-	-
Santiago (LEST)	12	-
Seve Ballesteros-Santander (LEXJ)	2	-
North Tenerife (GCXO)	10	-
Valladolid (LEVD)	-	-
Vigo (LEVX)	-	3
Vitoria (LEVT)	-	-
Zaragoza (LEZG)	-	-
totals	**60**	**7**

Source: AENA.

The Airports of the TEN-T network in Spain have 410 fixed and integrated electric power supply units for aircraft. Except for Seville, practically all Spanish airports that make up the core network of TEN-T have fixed 400 Hz power supply infrastructure in aircraft parking positions. Regarding the airports that make up the overall TEN-T network, the following have power supply units for aircraft: A Coruña, Asturias, Fuerteventura, Ibiza, La Palma, Lanzarote, Menorca, Santiago, Seve Ballesteros Santander, Tenerife North and Vigo.tc

Therefore, the degree provision of units to supply electricity to aircraft at Spanish airports of the basic network of TEN-T is 90 %, and 38 % in the airports of the overall TEN-T network.

V.1.3. EXPECTED MARKET TRENDS AND OBJECTIVES

ESTIMATED ECONOMIC DATA

Although there is great dispersion of costs depending on the volume of units to be acquired, the insularity of locations and clustering with other facilities, we can estimate an order of magnitude for the three types of facilities:

Table V-4. Estimated economic data for units supplying electricity to aircraft

INSTALLATION	INSTALLATION COST	ANNUAL MAINTENANCE COST[169]
Converter on island and cable drum under walkway	€68 000.00	€2 500.00
Converter and cable drum integrated under walkway	€58 000.00	€2 000.00

[169] Estimated cost per equipment, very variable also in terms of costs, due to the use of connectors and cables by 'Handling' agents responsible for the connection.

Converter on island + Pit	€71 000.00	€1 500.00

Source: AENA.

With an estimated energy cost of €0.13/kWh (variable in each case for each airport) and Aena's fee for the 400Hz service of €11.135092 per quarter hour or fraction thereof, the typical amortisation periods obtained are very low: two to four years depending on the percentage of daily use of the stand.

While the installation of 400 Hz equipment coincides with that of other aircraft assistance systems, we must consider the part of the installation corresponding to electrical power, with the current from the closest Transformer Centres and the related equipment in the CBTH; communications and integration in the SCADA SIGMA, responsible for the management and especially automatic billing of services; and the need to install PCA equipment and supply systems to force the shutdown of the APU.
Investments in PCA facilities are considerable; an estimation of orders of magnitude is given below:

Table V-5. Estimated economic data for supply of air conditioning units to aircraft

PCA	NB	WB	JUMBO
Cost of installation (estimated)	€175 000.00	€186 000.00	€219 000 00
Cost of maintenance (estimated annual)	€1 800.00	€2 100.00	€2 600 00
Energy consumption (operating) KVA	85	109	190

Source: AENA.

EXPECTED EVOLUTION OF THE PROVISION OF POWER TO STATIONARY AIRCRAFT AT AIRPORTS

Recital No 20 of Directive 2014/94/EU states that the guidelines of the Trans-European Transport Network (TEN-T) requires the airports in the basic network established by Regulation (EU) No. 1315/2013, the TEN-T Core Network, provide for the availability of clean alternative fuels. According to Article 2, electricity is included among these alternative fuels, and according to Article 3, the national action framework should include an examination of the need to install an electricity supply at airports to stationary aircraft.

Investments in facilities of 400 Hz correspond to three main reasons:

- Remodelling/reorganisation of the parking platform, in cases where the parking spaces are redesigned and new needs appear for 400 Hz equipment (e.g. remodelling for HUB at T123 Barajas).

- Expansion/remodelling of terminals. Cases where new positions of contact are generated with walkway services and other assistance systems (remodelling Terminal and ramp 15 in Barcelona, future expansion in Palma de Mallorca).

- Replacement for obsolescence. In those locations where equipment has reached the end of its useful life of, estimated at fifteen years.

Below is a forecast of facilities and investment by airports, based on the three reasons presented above.

Table V-6. 2016-2030 forecast investment in 400 Hz supply facilities (thousands of Euros)

AIRPORT	Barcelona	Gran Canaria	Vigo	Madrid/Barajas	Palma de Mallorca	South Tenerife	Bilbao
UNITS	20 00	4.00	1.00	110 00	36 00	6.00	6.00
2016	1 016.00			190 50	762 00		
2017					1524.00		
2018							
2019							
2020	444 50	190 50					
2021	444 50						
2022						381.00	
2023			63 50	254.00			
2024				381.00			
2025					571 50		381.00
2026				889.00			
2027							
2028				317 50			
2029	381.00	63 50		2540.00			
2030				2603.50			
Total investment	2 286	254	63.5	7175.5	2857.5	381	381

AIRPORT	Lanzarote	A Coruna	North Tenerife	Fuerteventura	Asturias	Santander	totals
UNITS	7.00	2.00	7.00	2.00	3.00	1.00	**205.00**
2016			444 50				**2413.00**
2017	444 50						**1968.50**
2018							**0.00**
2019							**0.00**
2020							**635.00**
2021							**444 50**
2022				127.00			**508 00**
2023		127.00	381.00				**825.50**
2024						63 50	**444 50**
2025					190 50		**1143.00**
2026							**889.00**
2027							**0.00**
2028							**317 50**
2029							**2984.50**
2030							**2603.50**
Total investment	444 50	127.00	825.50	127.00	190 50	63 50	**15176.50**

Source: Aena. Estimate made in October 2015.

The previous forecasts were estimated with the available information about new investments under way, although for the bulk of long-term facilities, due mainly to replacement of units through obsolescence, it has been assumed that investments will coincide with the renewal of the walkways the same reason.

This forecast is subject to revision since the working life of walkways currently being used is 22 years.

APPENDIX A. BUSINESS ASSOCIATIONS AND OTHER ENTITIES THAT HAVE PARTICIPATED IN THE PREPARATION OF THE NATIONAL ACTION FRAMEWORK

Appendix Table A-1. Business associations and other entities that have participated in the preparation of the National Action Framework.

BUSINESS ASSOCIATIONS AND OTHER ENTITIES THAT HAVE PARTICIPATED IN THE PREPARATION OF THE NATIONAL ACTION FRAMEWORK
ACETA - Asociación de Compañías Españolas de Transporte Aéreo (Spanish Association of Air Transport Companies)
AEBIG - Asociación Española de Biogás (Spanish Biogas Association)
AECA - Asociación Española de Compañías Aéreas (Spanish Association of Airline Companies)
AECOC – Asociación Española de Codificación Comercial (Spanish Association of Commercial Codification)
AEDIVE - Asociación Empresarial para el Desarrollo e Impulso del Vehículo Eléctrico (Business Association for Development and Promotion of Electric Vehicle)
AeH2 - Asociación Española del Hidrógeno (Spanish Hydrogen Association)
AEUTRANSMER - Asociación Española de Usuarios de Transportes de Mercancías y Asimilados (Spanish Association of Goods Transport Users and Assimilated)
AENOR - Asociación Española de Normalización y Certificación (Spanish Association for Standardisation and Certification)
AFBEL - Asociación de Fabricantes de Bienes de Equipos Eléctricos (Goods Manufacturers Association Electrical Equipment)
AFME - Asociación de Fabricantes de Material Eléctrico (Association of Electrical Manufacturers)
ALA - Asociación de Líneas Aéreas (Airline Association)
AMETIC - Asociación de Empresas de Electrónica, Tecnologías de la Información, Telecomunicaciones y Contenidos Digitales (Association of Electronics, Information Technology, Telecommunications and Digital Content)
ANAVE - Asociación de Navieros Españoles (Spanish Shipowners Association)
ANESCO - Asociación Nacional de Empresas Estibadoras y Consignatarias de Buques (National Association of Stevedoring Companies and Ship Consignees)
ANFAC - Asociación Española de Fabricantes de Automóviles y Camiones (Spanish Association of Automobile and Truck Manufacturers)
AOC - Comité de Aerolíneas Operadoras (Airline Operators Committee)
AOLPG - Asociación de Operadores de GLP (LPG Operators Association)
AOP - Asociación Española de Operadores de Productos Petrolíferos (Spanish Association of Operators of Petroleum Products)
APPA - Asociación de Empresas de Energías Renovables (Biocarburantes) (Association of Renewable Energy (Biofuel))
APPICE - Asociación Española de Pilas de Combustible (Spanish Association of Fuel Cells)
ASEATA - Asociación de Empresas de Servicios de Asistencia en Tierra en Aeropuertos (Association of Ground Assistance Service Companies in Airports)
CDTI - Centro para el Desarrollo Tecnológico Industrial (Centre for the Development of Industrial Technology)

CEOE - Confederación Española de Organizaciones Empresariales (Spanish Confederation of Business Organisations)
CITET - Centro de Innovación para la Logística y Transporte de Mercancías (Innovation Centre for Logistics and Transport of Goods)
Maritime cluster
Goods Department of the National Road Transport Committee
Travellers Department of the National Road Transport Committee
Foundation for the development of new hydrogen technologies in Aragon
GASINDUSTRIAL- Association of industrial gas companies
GASNAM - Iberian Association of Natural Gas for Mobility
MIBGAS - Iberian Gas Market
PTE-HPC platform - Spanish Technology Platform for Hydrogen and Fuel Cells
SEDIGAS - Spanish Gas Association
SERCOBE- National Association of Manufacturers of Capital Goods
SERNAUTO- Spanish Manufacturers Association of Automotive Equipment and Components
Transprime - Spanish Association of Enterprises with Private Carriage of Goods Large public sector users.
TRANSVEGAS - Association of transformers of vehicles to gas
UNESA - Spanish Electricity Industry Association
UNO - Business Organisation of Logistics and Transport

APPENDIX B. EXISTING SUPPLY INFRASTRUCTURE FOR ALTERNATIVE ENERGIES FOR ROAD TRANSPORT IN SPAIN

Appendix table B-1. Refuelling points for LNG, CNG and blends (CNG/LNG) accessible to the public and existing in Spain in June 2016.

AUTONOMOUS COMMUNITY	PROVINCE	LOCATION	LABEL	KIND
Andalusia	Seville	Alcala de Guadaira	HAM SEVILLA	LNG
		Seville	GAS NATURAL FENOSA	CNG
Aragon	Zaragoza	Zaragoza	VIA GAS	MIXED
Castile la Mancha	Cuenca	Motilla del Palancar	GAS NATURAL FENOSA	MIXED
	Guadalajara	Alovera	GAS NATURAL FENOSA	MIXED
		Guadalajara	GAS NATURAL FENOSA	CNG
		Torremocha del Campo	HAM TORREMOCHA	MIXED
	Toledo	Toledo	CEPSA	CNG
Castile and Leon	Burgos	Rubena	BEROIL, SL	LNG
Catalonia	Barcelona	Abrera	HAM	LNG
		Abrera	GALP	CNG
		Barcelona	GAS NATURAL FENOSA	CNG
		Barcelona	GAS NATURAL FENOSA	CNG
		Hospitalet de Llobregat (L ‘)	GALP	CNG
		Hospitalet de Llobregat (L ‘)	GAS NATURAL FENOSA	CNG
		Igualada	HAM IGUALADA	CNG
		S. Sadurni d’Anoia	GALP	MIXED
		Mogoda	MARINÉ	MIXED
		Viladecans	GAS NATURAL FENOSA	CNG
	Tarragona	Tarragona	HAM BIONET	MIXED
Valencian Community	Alicante	San Isidro	GAS NATURAL FENOSA	MIXED
	Valencia	Riba-Roja de Turia	GAS NATURAL FENOSA	MIXED
		Valencia	TAXCO	CNG
Galicia	Coruña (A)	Fene	HAM VILAR DO COLO	LNG

	Ourense	San Cibrao Das Viñas	GAS NATURAL FENOSA	CNG
Madrid	Madrid	Alcorcón	GAS NATURAL FENOSA	CNG
		Madrid	GAS NATURAL FENOSA	CNG
			GAS NATURAL FENOSA	CNG
			GAS NATURAL FENOSA	CNG
			GAS NATURAL FENOSA	CNG
			GAS NATURAL FENOSA	CNG
			GAS NATURAL FENOSA	CNG
			HAM Tres Cantos	LNG
		Parla	GAS NATURAL FENOSA	CNG
Murcia	Murcia	It was High	GAS NATURAL FENOSA	CNG
Navarre	Navarre	Villava Atarrabia O	GAS NATURAL FENOSA	CNG
Basque Country	Álava	Nanclares de la Oca	GAS NATURAL FENOSA	MIXED
	Guipúzcoa	olaberria	AVIA	MIXED
	Viscaya	Bilbao	HAM BILBAO	MIXED

Source: Geoportal of the Ministry of Industry, Energy and Tourism.

Appendix Table B-2. Refuelling points for CNG, LNG and blends in varying degrees of accessibility to the public in June 2016

	AUTONOMOUS COMMUNITY	LOCATION	START	DENOMINATION	PROPERTY	No. FILLING POINTS	CNG/LNG	STATE
1	ANDALUSIA	Alcalá de Guadaira (Seville)	2013	MOBILE STATION	HAM		LNG	EXISTING PUBLIC ACCESS
2		Seville	Project	ES Alcala de Guadaira	Galp		CNG-LNG	UPCOMING PUBLIC ACCESS OPENING
3		Seville	2014	TUSSAM Ext.	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS
4		Seville			TUSSAM		CNG	PRIVATE
5		Seville			PEPSI (HAM)		CNG	PRIVATE
6		Santa Fe (Granada)	2016	Granada Airport	GNF		CNG-LNG	UPCOMING PUBLIC ACCESS OPENING
7		Algeciras (Cádiz)	2016	ENDESA Algeciras	Endesa		CNG-LNG	UPCOMING PUBLIC ACCESS OPENING
8		Puerto Sta. Maria (Cadiz)			FCC		CNG	PRIVATE
9		Malaga			EMTSAM		CNG	PRIVATE
10	ARAGON	Zaragoza	2013	GAS VIA AUGUSTA	VIA AUGUSTA	1 CNG/LNG 1	CNG-LNG	EXISTING PUBLIC ACCESS
11		Alfajarín (Zaragoza)	Project	HAM Zaragoza	HAM		CNG	UPCOMING PUBLIC ACCESS OPENING
12		Zaragoza		ENDESA Zaragoza	ENDESA		CNG	UPCOMING PUBLIC ACCESS OPENING
13	P. DE ASTURIAS	Gijón (Asturias)	2016	EDP Gijon	EDP		CNG	EXISTING PUBLIC ACCESS
14		Gijón (Asturias)			EDP NATURGAS		CNG	CLOSED
15		Oviedo (Asturias)			FCC		CNG	PRIVATE
16		Llanera (Asturias)			FCC		CNG	PRIVATE

17	BALEARICS	Palma de Mallorca	2012	CA TRESOR ENDESA	ENDESA	2 CNG	CNG	LIMITATION OF EXISTING PUBLIC ACCESS POSSIBLE[170]
18		Palma de Mallorca			EMT Palma		CNG	PRIVATE
19	CASTILE LA MANCHA	Torremocha del Campo (Guadalajara)	2011	HAM TORREMOCHA	HAM		CNG-LNG	EXISTING PUBLIC ACCESS
20		Alovera (Guadalajara)	2012	J. SANTOS	GNF	2 CNG/LNG 1	CNG-LNG	EXISTING PUBLIC ACCESS
21		Guadalajara	2013	Guadalajara	GNF	6 CNG	CNG	EXISTING PUBLIC ACCESS
22		Toledo	2011	Sta. Barbara	Serpaut O ALPI		CNG	EXISTING PUBLIC ACCESS
23		Toledo			UNAUTO (Ruiz Group)		CNG	PRIVATE
24		Motilla del Palancar (Cuenca)	2013	MONEGAS	GNF	2 CNG/LNG 1	CNG-LNG	EXISTING PUBLIC ACCESS
25	Castile and Leon	Rubena (Burgos)	2015	BEROIL RUBENA	Beroil		LNG	EXISTING PUBLIC ACCESS
26		Burgos			SMAUB		CNG	PRIVATE
27		Burgos			JOHNSON CONTROLS (HAM)		CNG	PRIVATE
28		Burgos			BENTELER		CNG	PRIVATE
29		Salamanca			Salamanca Transport		CNG	PRIVATE
30		Salamanca			FCC		CNG	PRIVATE
31		Almazan (Soria)			PURINES		CNG	PRIVATE
32	CATALONIA	Barcelona	Draft	ES Cornellà	Galp		CNG-LNG	UPCOMING PUBLIC ACCESS OPENING
33		Barcelona	2009	URBASER Bon Pastor ext.	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS
3.4		Barcelona	2012	MARENOSTRUM	GNF	3 CNG	CNG	EXISTING PUBLIC ACCESS
35		Barcelona		LLULL	GNF		CNG	UPCOMING PUBLIC ACCESS OPENING

[170] According to the Geoportal of the Ministry of Industry, Energy and Tourism, this refuelling point is not listed as accessible to the public.

36		Barcelona			FCC		CNG	PRIVATE
37		Barcelona			CESPA		CNG	PRIVATE
38		Barcelona			URBASER		CNG	PRIVATE
39		Barcelona			TMB		CNG	PRIVATE
40		Barcelona			Cobega (CocaCola)		CNG	PRIVATE
41		Barcelona			DAMM		CNG	PRIVATE
42		Barcelona			CLD Corporation		CNG	PRIVATE
43		Barcelona			Industrias García		CNG	PRIVATE
44		Puerto Barcelona	Project	ES Calle Y	Galp		CNG-LNG	UPCOMING PUBLIC ACCESS OPENING
45		Abrera (Barcelona)	2008	HAM ABRERA	HAM		CNG-LNG[171]	EXISTING PUBLIC ACCESS
46		Sta. Perpetua de Mogoda (Barcelona)	2014	TRANSPORTS MARINÉ	GNF	2 CNG/LNG 1	CNG-LNG[172]	EXISTING PUBLIC ACCESS
47		Sant Sadurní d'Anoia (Barcelona)	2011	SANT HAM SADURNÍ	HAM		CNG-LNG	EXISTING PUBLIC ACCESS
48		L'Hospitalet de Llobregat (Barcelona)	2010	HAM Hospitalet	HAM		CNG	EXISTING PUBLIC ACCESS
49		L'Hospitalet de Llobregat (Barcelona)	2011	BOTANY	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS
50		L'Hospitalet de Llobregat (Barcelona)			City Hall/FCC		CNG	PRIVATE
51		Igualada (Barcelona)	2011	HAM Igualada	HAM		CNG	EXISTING PUBLIC ACCESS
52		Viladecans (Barcelona)	2015	GNF Viladecans	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS
53		Viladecans (Barcelona)			URBASER		CNG	PRIVATE
54		Vacarisses (Barcelona)			HERA AMASA		CNG	PRIVATE

[171] According to the Geoportal of the Ministry of Industry, Energy and Tourism this point is only LNG.
[172] According to the Geoportal of the Ministry of Industry, Energy and Tourism, this point is only CNG.

55		El Prat (Barcelona)			URBASER		CNG	PRIVATE
56		Girona	Draft	HAM Girona	HAM		CNG-LNG	UPCOMING PUBLIC ACCESS OPENING
57		La Junquera (Girona)	Draft	ES Junquera Tramuntana	Galp		CNG-LNG	UPCOMING PUBLIC ACCESS OPENING
58		Salt (Girona)	2011	Salt GNF TTSS	GNF	2GNC	CNG	EXISTING[173] PUBLIC ACCESS
59		Tarragona	2011	HAM BIONET	HAM		CNG-LNG	EXISTING PUBLIC ACCESS
60		Tarragona			FCC		CNG	PRIVATE
61		Reus (Tarragona)			FCC		CNG	PRIVATE
62		Lleida			KNAUF (HAM)		CNG	PRIVATE
63	GALICIA	Fene (A Coruña)	2014	EST. MÓVIL VILAR DO COLO	HAM		LNG	EXISTING PUBLIC ACCESS
64		A Coruña			CESPA		CNG	PRIVATE
65		San Cibrao das Viñas (Ourense)	2014	SAN CIBRAO	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS
66		Vigo (Pontevedra)			FCC		CNG	PRIVATE
67		Vigo (Pontevedra)			FAURECIA		CNG	PRIVATE
68		Vigo (Pontevedra)			GKN		CNG	PRIVATE
69		Vigo (Pontevedra)			Fishing Port CNG IBÉRICA		CNG	PRIVATE
70		Vigo (Pontevedra)			BENTELER		CNG	PRIVATE
71		Vigo (Pontevedra)			GESTAMP		CNG	PRIVATE
72	C. MADRID	Tres Cantos (Madrid)	2013	MOBILE STATION	HAM		LNG	EXISTING PUBLIC ACCESS

[173] According to the Geoportal of the Ministry of Industry, Energy and Tourism, this point is not listed as accessible to the public.

73		Valdemoro (Madrid)	2016	ENDESA AISA VALDEMORO	Endesa		CNG-LNG	EXISTING LIMITED PUBLIC ACCESS [174]
74		S. Sebastián de los Reyes (Madrid)	2016	ES Jarama	Galp		CNG-LNG	UPCOMING OPENING TO PUBLIC ACCESS
75		Madrid	2011	EMT SANCHINARRO ext.	GNF	5 CNG	CNG	EXISTING PUBLIC ACCESS
76		Madrid	2011	CTM	GNF	4 CNG	CNG	EXISTING PUBLIC ACCESS
77		Alcorcón (Madrid)	2014	MIGENO	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS
78		Madrid	2013	SAN BLAS	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS
79		Madrid	2015	GNF-Vicálvaro	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS
80		Parla (Madrid)	2012	SERPARLA	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS
81		Madrid		GNF-Villaverde	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS
82		Madrid		GNF-Aravaca	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS
83		Madrid	2017	calle Portomarín	Aliara ENERGIA SA		CNG	UPCOMING PUBLIC ACCESS OPENING
84		Madrid	2016	calle Fuembellida	GNF		CNG	UPCOMING PUBLIC ACCESS OPENING
85		Madrid	2016	Avda. De la Democracia	Pdt. Award		CNG	UPCOMING PUBLIC ACCESS OPENING
86		Madrid	2017	Avda. De Córdoba	Aliara ENERGIA SA		CNG	UPCOMING PUBLIC ACCESS OPENING
87		Madrid	2016	Avda. De los Poblados	Aliara ENERGIA SA		CNG	UPCOMING PUBLIC ACCESS OPENING
88		Madrid	2017	Calle Fuente de Lima	Aliara ENERGIA SA		CNG	UPCOMING PUBLIC ACCESS OPENING
89		Madrid		Madrid. entrevías	EMT		CNG	PRIVATE
90		Madrid		Madrid. Carabanchel	EMT		CNG	PRIVATE
91		Madrid		Madrid. Fuencarral	EMT		CNG	PRIVATE

[174] According to the Geoportal of the Ministry of Industry, Energy and Tourism, this point is not listed as accessible to the public.

92		Madrid		Madrid. Sanchinarro int/GNF	EMT		CNG	PRIVATE
93		Madrid			FCC		CNG	PRIVATE
94		Madrid			Linde		CNG	PRIVATE
95		Madrid			CESPA		CNG	PRIVATE
96		Madrid			AENA		CNG	PRIVATE
97		Madrid			Ground Force (Air Europa)		CNG	PRIVATE
98		Madrid			MARTIN (Ruiz Group)		CNG	PRIVATE
99		Madrid			HERRANZ		CNG	PRIVATE
100		Madrid		Madrid Manoteras	URBASER		CNG	PRIVATE
101		Madrid		Madrid. Avocado	URBASER		CNG	PRIVATE
102		Madrid		Madrid. Hormigueras	URBASER		CNG	PRIVATE
103		Madrid			URBASER/CESPA		CNG	PRIVATE
104		Madrid			IVECO PEGASO		CNG	PRIVATE
105		Alcobendas (Madrid)			CESPA		CNG	PRIVATE
106		Pozuelo (Madrid)			FCC		CNG	PRIVATE
107		Aranjuez (Madrid)			CESPA		CNG	PRIVATE
108		Colmenar (Madrid)			CESPA		CNG	PRIVATE
109		Boadilla (Madrid)			URBASER		CNG	PRIVATE
110	MURCIA R.	Murcia	2011	MURCIA DISFRIMUR	GNF	6 CNG	CNG	EXISTING PUBLIC ACCESS
111	NAVARRE CF	Villava (Atarrabia, Navarra)	2011	ANAIZ EZCABA	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS

112		Navarre			IBEREMBAL		CNG	PRIVATE
113	BASQUE COUNTRY	Zierbena (Vizcaya)	2013	ZIERBENA	HAM		CNG-LNG	EXISTING PUBLIC ACCESS
114		Bilbao (Vizcaya)			Norbega (CocaCola)		CNG	PRIVATE
115		Sondika (Vizcaya)			Instagas		CNG	PRIVATE
116		Olaberria (Guipúzcoa)	2010	GN TRUCK	VICUÑA	3 CNG/LNG 1	CNG-LNG[175]	EXISTING PUBLIC ACCESS
117		Anoeta (Guipúzcoa)			EDP NATURGAS		CNG	PRIVATE
118		S. Sebastian (Guipuzcoa)			EDP NATURGAS		CNG	PRIVATE
119		Vitoria (Alava)	2012	EUROCAM	GNF	2 CNG/LNG 1	CNG-LNG	EXISTING PUBLIC ACCESS
120		Vitoria (Alava)	2016	EDP Vitoria	EDP		CNG	EXISTING PUBLIC ACCESS
121		Vitoria (Alava)			FCC		CNG	PRIVATE
122		Vitoria (Alava)			PEPSI (HAM)		CNG	PRIVATE
123	C. VALENCIANA	Valencia	2012	VALENCIA DISFRIMUR	GNF	2 CNG/LNG 1	CNG-LNG	EXISTING PUBLIC ACCESS
124		Sagunto (Valencia)	Draft	It is Sagunto	Galp		CNG-LNG	UPCOMING PUBLIC ACCESS OPENING
125		Valencia	2008	TAXCO	GNF	2 CNG	CNG	EXISTING PUBLIC ACCESS
126		Valencia			EMT		CNG	PRIVATE
127		Valencia			FCC		CNG	PRIVATE
128		Valencia			Franz Schneider		CNG	PRIVATE
129		Castellon de la Plana (Castellón)	2007	TRANS. MONFORT	MONFORT	2 CNG/LNG 1	CNG-LNG	POSSIBLE EXISTING PUBLIC ACCESS RESTRICTION[176]

[175] According to the Geoportal of the Ministry of Industry, Energy and Tourism, this point is only CNG.

[176] According to the Geoportal of the Ministry of Industry, Energy and Tourism, this point is not listed as accessible to the public.

130		Castellon de la Plana (Castellón)			FCC		CNG	PRIVATE
131		San Isidro (Alicante)	2012	ALICANTE DISFRIMUR	GNF	1 CNG/LNG 1	CNG-LNG	EXISTING PUBLIC ACCESS

Source: GASNAM.

Appendix Table B-3. Recharging points managed by recharging managers in June 2016.

LOAD DATA MANAGER				DATA ABOUT INSTALLATION		
No.	**BUSINESS NAME**	**AMBIT PERFORMANCE**	**START DATE Cm**	**INSTALLATION ADDRESS**	**MUNICIPALITY (PROVINCE)**	**A.C.**
R4-0001	IBIL GESTOR DE CARGA DE VEHÍCULO ELÉCTRICO, S.A. TORRE BEC - RONDA AZKUE Nº1 PLTA. 14 BARAKALDO (VIZCAYA)	NACIONAL	16/06/2011	PARKING ARTIUM, PRUDENCIO Mª VERASTEGUI 1 01002	GASTEIZ (ÁLAVA)	PAIS VASCO
				ALBERT EINSTEIN, 25	MIÑANO (ÁLAVA)	
				PT ÁLAVA, ALBERT EINSTEIN 48 01510	MIÑANO (ÁLAVA)	
				BOULEVARD SALBURUA S/N	VITORIA (ÁLAVA)	
				MUSAKOLA AUZOA, S/N, 20500	ARRASATE (GUIPÚZCOA)	
				AVENIDA OTAOLA, 5, 20600	EIBAR (GUIPÚZCOA)	
				AUTONOMIA 8, 20870	ELGOIBAR (GUIPÚZCOA)	
				ALBITXURI INDUSTRIGUNEA 2, 20870 (C/ IÑIGUEZ KARKIZANO)	ELGOIBAR (GUIPÚZCOA)	
				PLAZA UBITARTE	ELGOIBAR (GUIPÚZCOA)	
				MINASOROETA KALEA	HONDARRIBIA (GUIPÚZCOA)	
				C/ MAGDALENA 1, BAJO	MUTRIKU (GUIPÚZCOA)	
				ARCCO AMARA PLAZA IRÚN S/N	SAN SEBASTIÁN (GUIPÚZCOA)	
				DOKTOR BEGIRISTAIN PASEALEKUA, 107, 20014	SAN SEBASTIÁN (GUIPÚZCOA)	
				PASEO ERROTABURU 1, 6ª PLANTA 20018	SAN SEBASTIÁN (GUIPÚZCOA)	
				PASEO MIRARNON	SAN SEBASTIÁN (GUIPÚZCOA)	
				PASEO MIKELETEGI Nº53 20009	SAN SEBASTIÁN (GUIPÚZCOA)	
				BARRIO MURUETA, S/N, 48220	ABADIÑO (VIZCAYA)	
				BEC AVENIDA DE LA RIBERA 1	BARAKALDO (VIZCAYA)	
				INMACULADA 1	BARAKALDO (VIZCAYA)	
				BEC, RONDA DE AZKUE, 1, 48902	BARAKALDO (VIZCAYA)	
				PLAZA DE INDAUTXU 2 48010	BILBAO (VIZCAYA)	
				BOLUETA CARRETERA BILBAO-GALDAKAO 20	BILBAO (VIZCAYA)	
				PARKING ZABALBURU	BILBAO (VIZCAYA)	
				PARKING ALHONDIGA	BILBAO (VIZCAYA)	
				PARQUE EMPRESARIAL IBARRABARRI EDIFICIO A-2 48940	BILBAO (VIZCAYA)	
				ELORRIETA	BILBAO (VIZCAYA)	
				PARQUE TECNOLÓGICO ZAMUDIO, EDIFICIO 210	ZAMUDIO (VIZCAYA)	
				PARQUE TECNOLÓGICO ZAMUDIO (KANALA BIDEA EDIFICIO 101)	ZAMUDIO (VIZCAYA)	
R4-0002	E.ON ENERGÍA, S.L. C/ MEDIO, 12 SANTANDER (CANTABRIA)	SANTANDER	08/08/2011	PASEO PEREDA 30	SANTANDER (CANTABRIA)	CANTABRIA
				CALLE REAL CONSULADO	SANTANDER (CANTABRIA)	
				AVDA. GARCÍA LAGO	SANTANDER (CANTABRIA)	
				CALLE LUCIANO	SANTANDER (CANTABRIA)	

				MALUMBRES		
R4-0003	GAS NATURAL SERVICIOS SDG, S.A. PLAÇA DEL GAS, 1 BARCELONA	NACIONAL	24/11/2011	CALLE DE LA PLAZA, 4	A CORUÑA	GALICIA
				CARRETERA CIRCUNVALACIÓN, 1-15	A CORUÑA	
				C/ ENRIQUE MARIÑAS ROMERO PERIODI, 9	A CORUÑA	
				RUA DE LA TORRE, 60	A CORUÑA	
				AVDA. DEL ALCALDE ALFONSO MOLINA	A CORUÑA	
				C/ GALILEO GALILEI	A CORUÑA	
				COSTA DE PALLOZA, 5	A CORUÑA	
R4-0004	IBERDROLA SERVICIOS ENERGÉTICOS, S.A.U. PLAZA EUSKADI, 5 BILBAO (VIZCAYA)	NACIONAL	15/02/2012	PSEO. JUAN DE BORBON, 12 BJ EXT	BARCELONA	CATALONIA
				C/ LLULL, 285, BAJO	BARCELONA	
				C/ PASCUAL I VILA, 15-23 BAJO	BARCELONA	
				C/ DURAN I BAS, 10-14, BAJO EXT	BARCELONA	
R4-0005	SOL ARDILA, S.L. P. I. EL NEVERO, CALLE 18-19, VIAL INT. NAVE 28 BADAJOZ	EXTREMADURA	05/07/2012	P. I. EL NEVERO. CALLE NEVERO 18-19, VIAL INT. NAVE 17	BADAJOZ	EXTREMADURA
R4-0006	ENDESA ENERGIA, S.A. (Unipersonal) C/ RIBERA DEL LOIRA, 60 MADRID	NACIONAL	12/07/2012	CAMÍ DE CAN PASTILLA S/N (frente edificio social Endesa)	ES COLL D'EN RABASSA (PALMA DE MALLORCA)	ISLAS BALEARES
				C/ LOPE DE VEGA, 125 08005 (E.S. Cepsa)	BARCELONA	CATALONIA
				CAMÍ DE CIUTAT VEL, S/N	CAMPOS (PALMA DE MALLORCA)	ISLAS BALEARES
				CARRETERA DE DESVIAMENT, 30	SOLLER (PALMA DE MALLORCA)	
				CARRETERA PALMA ALCUDIA KM 36 8	CAMPANET (PALMA DE MALLORCA)	
				CARRETERA ANDRATX KM 12-12 4	PALMANOVA (PALMA DE MALLORCA)	
				CAMÍ FONDO S/N	PALMA DE MALLORCA	
				VÍA PALMA, 87	MANACOR (PALMA DE MALLORCA)	
R4-0007	ACCIONA EFICIENCIA ENERGÉTICA, S.L. AVENIDA DE EUROPA, 6 ALCOBENDAS (MADRID)	NACIONAL	22/11/2011	CALLE BLAS DE LA SERNA 6	PAMPLONA (NAVARRA)	NAVARRA
				AVDA. SAN IGNACIO 10	PAMPLONA (NAVARRA)	
				CALLE VALPORTILLA II 8-1, BJ	ALCOBENDAS (MADRID)	MADRID
				AVDA. CIUDAD DE LA INNOVACIÓN, 5	SARRIGUREN (NAVARRA)	NAVARRA
R4-0008	REGESA APARCAMENTS I SERVEIS, S.A. C/ TA`PIES, 4 BARCELONA	CATALONIA	03/11/2011	PLAZA MARAGALL - PARKING (PLAZ - GAR APARCAMIENTO)	BARCELONA	CATALONIA
				MIQUEL FERRA - APARCAMENT - F.PUIG/J ALCOBER BARCELONA	BARCELONA	
				PLAÇA FERRAN REYES - PRK SUM. - PPAL BARCELONA	BARCELONA	
				PLAÇA WAGNER - SOS PARKING APARCAMENT BARCELONA	BARCELONA	
				FRANCESC MACIA I LLUS - PARKING - GAR GARAJE	HOSPITALET DE LLOBREGAT (BARCELONA)	
R4-0009	GESTIÓN INTELIGENTE DE CARGAS, S.L. C/ CARDENAL MARCELO SPÍNOLA, 10 MADRID	NACIONAL	18/04/2013	AVDA. MADRID, 46	VALLADOLID	CASTILLA Y LEÓN
R4-0010	NEW BROADBAND NETWORK SOLUTIONS,	NACIONAL	23/04/2013	CALLE PADRE DAMIÁN, 23, 28036	MADRID	MADRID

	S.L. (N2S) C/ CAPITÁN HAYA, 56 4ºE MADRID			CALLE DE ORENSE, 50, 28020	MADRID	
				CAMPO DE LAS NACIONES AVDA. CAPITAL DE ESPAÑA, 10, 28042	MADRID	
				PASEO DE LA CASTELLANA, 220, 28046	MADRID	
R4-0011	ESTABANELL Y PAHISA MERCATOR, S.A. C/ REC, 28 GRANOLLERS (BARCELONA)	CATALONIA	21/11/2013	CTRA. MANRESA, 2	TONA (BARCELONA)	CATALONIA
R4-0012	ELECTRIC PARKING SOLUTIONS, S.L. C/ CASTELLA Nº26 RUBÍ (BARCELONA)	NACIONAL	25/03/2014	PIZARRO, 41	RIPOLLET (BARCELONA)	CATALONIA
R4-0013	SAMPOL INGENIERIA Y OBRAS GREMIO BONETEROS Nº48 PALMA DE MALLORCA (ISLAS BALEARES)	ISLAS BALEARES	24/07/2014	CARRETERA VALLDEMOSA KM 7 4 C/MIKEL FARADAY Nº1 07121	PALMA DE MALLORCA	ISLAS BALEARES
R4-0014	DRIVETHECITY, S.L. RONDA DEL GENERAL MITRE, 15 7º 2ª BARCELONA	NACIONAL	20/05/2015	C/ CIÈNCIES, 77	HOSPITALET DE LLOBREGAT (BARCELONA)	CATALONIA
R4-0015	TESLA MOTORS NETHERLANDS BV BURGEMEESTER STRAMANWEG, 122 AMSTERDAM (NOORD-HOLLAND)	NACIONAL	29/06/2015	C/ FRANCESC FERRER 16-18	GIRONA	CATALONIA
R4-0016	PROMOCIONES BLAUMAR, S.A. C/ PAU CLARIS 165 5C BARCELONA	CATALONIA	31/07/2015	AUTOVÍA T-11, SALIDA 12	LA CANONJA (TARRAGONA)	CATALONIA
R4-0017	RIVELSA, S.L.U. PASEO DE LA INFANTA ISABEL Nº15 MADRID	PENINSULAR	31/07/2015	PASEO DE LA INFANTA ISABEL, 15	MADRID	MADRID
R4-0018	ESTACIÓN DE SERVICIOS VICÁLVARO, S.A.U. AVENIDA DE DAROCA, 332 MADRID	PENINSULAR	31/07/2015	AVENIDA DE DAROCA, 336	MADRID	MADRID
R4-0019	ESTACIÓN DE SERVICIO MAVEL, S.L. C/ ARROYO DEL SOTO Nº2, POL IND. LA LAGUNA LEGANES (MADRID)	PENINSULAR	31/07/2015	C/ ARROYO DEL SOTO 2, POL IND. LA LAGUNA	MADRID	MADRID
R4-0020	GESDEGAS, S.L. CTRA. BOADILLA-MAJADAHONDA, KM 7 3 (M516) MAJADAHONDA (MADRID)	PENINSULAR	30/09/2015	CARRETERA DE POVEDA A MEJORADA	MADRID	MADRID
R4-0021	ZOILO RIOS, S.A. AUTOVIA DE LOGROÑO KM 0 3 ZARAGOZA	PENINSULAR	31/08/2015	AUTOVIA DE LOGROÑO KM 300	ZARAGOZA	ARAGON
R4-0022	NOSTRUM OIL MANAGEMENT, S.L.U. C/ NARCISO SERRA Nº25 LOCAL DCHA. MADRID	PENINSULAR	04/11/2015	CARRETERA AGOST (PG-B) 9, BAJO	MORALET (ALICANTE)	COMMUNITY OF VALENCIA
R4-0023	COOPELEC SERVICIOS ENERGÉTICOS, S.L. C/ GRAN VIA, 88 GUADASSUAR (VALENCIA)	GUADASSUAR (VALENCIA)	01/10/2015	CTRA. TAVERNES-XIVA, 13	GUADASSUAR (VALENCIA)	COMMUNITY OF VALENCIA
R4-0024	ABRIL, S.A.U AVENIDA MIGUEL HERNANDEZ S/N SAN JUAN DE ALICANTE (ALICANTE)	ALICANTE	31/07/2015	CARRETERA DE VALENCIA, 1	SAN JUAN DE ALICANTE (ALICANTE)	COMMUNITY OF VALENCIA
R4-0025	ATRIBAL, S.L. C/ MAESTRO SERRANO Nº11 ALBORAYA	CAMUNIDAD VALENCIANA	09/11/2015	C/ REQUENA (POL. IND. LA PILA), 9-1	BENAGUASSIL (VALENCIA)	COMMUNITY OF VALENCIA

R4-0026	ESTACION DE SERVICIO DE SAN ANTONIO S.L. CARRETERA M-516, KM 0 5 POLIGONO COMERCIAL EL CARRALERO MAJADAHONDA (MADRID)	PENINSULAR	14/01/2016	CARRETERA M-516 KM 0 5 POLIGONO COMERCIAL EL CARRALERO	MAJADAHONDA (MADRID)	MADRID
R4-0027	FENIE ENERGÍA S.A. C/ JACINTO BENAVENTE 2B- BAJO - EDIFICIO TRIPARK LAS ROZAS (MADRID)	ISLAS CANARIAS	26/01/2016	C/ MAZO 5	LA LAGUNA (TENERIFE)	CANARIAS
R4-0028	FRANCISCO RIPOLL S.L. AVENIDA DE PRIMADO REIG, 76 VALENCIA	PENINSULAR	26/01/2016	AVENIDA PRIMADO REIG, 76	VALENCIA	COMMUNITY OF VALENCIA
R4-0029	ESTACION DE SERVICIO ALZ S.L. CR NIII MADRID-VALENCIA KM 329 RIBA-ROJA DE TURIA (VALENCIA)	PENINSULAR	05/02/2016	CARRETERA REVA 2 Esc. PG	RIBA-ROJA DE TURIA VALENCIA	COMMUNITY OF VALENCIA
R4-0030	COMERCIAL SAMA S.A. C/ ANTONIO LÓPEZ, 8 MADRID	PENINSULAR	23/11/2016	C/ ANTONIO LOPEZ 8	MADRID	MADRID
R4-0031	SOCIEDAD MUNICIPAL DE APARCAMIENTOS Y SERVICIOS S.A.(SMASSA) PLAZA DE LA ALCAZABA MÁLAGA	MALAGA	14/01/216	PLAZA DE LA ALCAZABA S/N	MALAGA	ANDALUCIA
R4-0032	APOLOCUATRO, S.L. C/ SUDIERA, 34 AINSA (HUESCA)	PENINSULAR	03/05/2016	C/ PINETA Nº4	AINSA (HUESCA)	ARAGON
R4-0033	SOCIEDAD ESPAÑOLA DE CONSTRUCCIONES ELÉCTRICAS, S.A. C/ ROSSELLÓ I PORCEL Nº21 PLANTA 7 BARCELONA	NACIONAL	02/05/2016	PASEO DE LA ZONA FRANCA Nº142-144	BARCELONA	CATALONIA
				C/ MINYO, 112 NAVE 8	TERRASSA (BARCELONA)	
R4-0034	EDP EMPRESA DE SERVICIOS ENERGÉTICOS, S.L. PLAZA DE LA GESTA, 2 OVIEDO (ASTURIAS)	NACIONAL	18/05/2016	AVENIDA DE OVIEDO, 176	GIJÓN (ASTURIAS)	ASTURIAS

Source: CNMC. Data to July 1, 2016.

Appendix Table B-4. Recharging points in registration process in the CNMC broken down by province, type of outlet and type of existing location in June 2016

AUTONOMOUS COMMUNITY	PROVINCE	RECHARGE POINTS	LOCATIONS	TOTAL POINTS/RECHARGING PLUGS	TOTAL LOCATIONS
Andalusia	Almería	15	9	320	154
	Cádiz	24	13		
	Cordova	22	7		
	Granada	57	30		
	Huelva	14	8		
	Jaén	6	4		
	Malaga	80	35		
	Seville	102	48		
Aragon	Huesca	9	6	119	41
	Teruel	26	9		
	Zaragoza	84	26		
Asturias	Asturias	49	29	49	29
Cantabria	Cantabria	41	24	41	24
Castile la Mancha	Albacete	21	8	85	35
	Real Ciudad	5	3		
	Cuenca	14	6		
	Guadalajara	17	7		
	Toledo	28	11		
Castile and Leon	Ávila	8	6	227	108
	Burgos	25	12		
	Leon	49	13		
	Salamanca	9	6		
	Segovia	10	6		
	Soria	13	7		
	Palencia	28	16		
	Valladolid	76	39		
	Zamora	9	3		
Catalonia	Barcelona	1257	330	1447	418
	Girona	88	45		
	Lleida	24	11		
	Tarragona	78	32		
C. Valenciana	Alicante	220	61	415	132
	Castellón	40	19		
	Valencia	155	52		
Estremadura	Badajoz	75	32	79	3.4
	Caceres	4	2		
Galicia	A Coruna	52	18	127	45
	Lugo	4	3		
	Ourense	9	5		
	Pontevedra	62	19		
La Rioja	La Rioja	19	10	19	10
Madrid	Madrid	753	216	753	216

Murcia	Murcia	61	30	61	30
Navarre	Navarre	63	26	63	26
Basque Country	Álava	2.3	9	179	66
	Viscaya	82	32		
	Guipúzcoa	74	25		
Balearic Islands	Balearic Islands	393	212	393	212
Canary Islands	Las Palmas	65	33	170	79
	Santa Cruz de Tenerife	105	46		
TOTAL		**4 547**	**1 659**	**4 547**	**1 659**

	LOCATIONS	**RECHARGING POINTS**
Car park	369	1483
Surface	410	941
Shopping Centre	143	489
With limited accessibility	179	408
Concession-holder	189	398
Hotel	131	2.3.4
Restaurant	85	172
Service station	64	144
Shop	31	143
Workshop	35	88
Campsite	14	30
Reserved for taxis	5	9
Airport	4	8
TOTAL	**1 659**	**4 547**

TYPE OF PLUG	**No.**
Schuko (EU Plug)	2 730
MENNEKES (Type 2)	1 182
EEC 2P + E (blue - camping)	149
CHAdeMO (DC)	141
CEE 3P + N + E (red - 3-phase)	109
Unknown	88
CCS Combo (DC)	43
SAE J1772 (Type 1)	42
CEE 3P + E (blue - 3-phase)	2.3
Tesla Dest. Charger (Mod S)	20
Tesla Supercharger (Mod S)	18
SCAME (Type 3c)	2
TOTAL	**4 547**

Source: Electromaps.

Appendix Table B-5. Service stations with LPG refuelling points in June 2016

AUTONOMOUS COMMUNITY	LOCATION (PROVINCE)	LABEL
Andalusia	ALCALA DE GUADAIRA (SEVILLA)	AGLA
	NIJAR (ALMERÍA)	REPSOL
	MINAS DE RIOTINTO (HUELVA)	REPSOL
	JAEN	REPSOL
	LUISIANA (LA) (SEVILLA)	REPSOL
	EJIDO (EL) (ALMERÍA)	REPSOL
	GUARROMAN (JAÉN)	REPSOL
	SALOBREÑA (GRANADA)	REPSOL
	JEREZ DE LA FRONTERA (CÁDIZ)	REPSOL
	CORDOBA	REPSOL
	PUERTO DE SANTA MARIA (EL) (CÁDIZ)	REPSOL
	CHICLANA DE LA FRONTERA (CÁDIZ)	REPSOL
	JEREZ DE LA FRONTERA (CÁDIZ)	REPSOL
	LOJA (GRANADA)	REPSOL
	HUERCAL DE ALMERIA (ALMERÍA)	REPSOL
	LINARES (JAÉN)	REPSOL
	UBEDA (JAÉN)	CAMPSA
	CHUCENA (HUELVA)	REPSOL
	GRANADA	REPSOL
	MIJAS (MÁLAGA)	BP
	FUENGIROLA (MÁLAGA)	BP
	VERA (ALMERÍA)	REPSOL
	JEREZ DE LA FRONTERA (CÁDIZ)	REPSOL BUTANO
	CANTILLANA (SEVILLA)	A.S LA ESTACION-AGLA
	ESTEPA (SEVILLA)	REPSOL
	ESTEPA (SEVILLA)	REPSOL
	CAMAS (SEVILLA)	REPSOL
	SEVILLA	REPSOL
	FUENGIROLA (MÁLAGA)	REPSOL
	GINES (SEVILLA)	REPSOL
	MALAGA	REPSOL
	MALAGA	REPSOL
	HUELVA	REPSOL
	SEVILLA	E.S. PARQUE ALCOSA (PREMIUM)
	ANTEQUERA (MÁLAGA)	REPSOL
	GUILLENA (SEVILLA)	REPSOL
	JEREZ DE LA FRONTERA (CÁDIZ)	CEPSA
	JEREZ DE LA FRONTERA (CÁDIZ)	A3.81
	MARBELLA (MÁLAGA)	REPSOL
	GRANADA	REPSOL
	ALCALA DE GUADAIRA (SEVILLA)	REPSOL

	ROQUETAS DE MAR (ALMERÍA)	REPSOL
	BARRIOS (LOS) (CÁDIZ)	REPSOL
	GRANADA	REPSOL
	CORDOBA	REPSOL
	TORRECERA (CÁDIZ)	REPSOL
	ALMERIA	CEPSA
	TORREMOLINOS (MÁLAGA)	REPSOL
	MARBELLA (MÁLAGA)	REPSOL
	MARBELLA (MÁLAGA)	REPSOL
	SEVILLA	REPSOL
	TORRE DEL MAR (MÁLAGA)	REPSOL
	MALAGA	REPSOL
	MAIRENA DEL ALJARAFE (SEVILLA)	REPSOL
	HUELVA	CEPSA
	MALAGA	CEPSA
	DOS HERMANAS (SEVILLA)	CEPSA
	CORDOBA	CEPSA
	GRANADA	CEPSA
	CARMONA (SEVILLA)	AGLA
	SEVILLA	CEPSA
	BAZA (GRANADA)	REPSOL
	FUENTE DE PIEDRA (MÁLAGA)	AGLA
	HUELVA	GAS AUTO
	ANDUJAR (JAÉN)	EL BALCON DE ANDALUCIA
	ALHAURIN DE LA TORRE (MÁLAGA)	HIDROCARBUROS ALHAURIN - AGLA
	SAN ROQUE (CÁDIZ)	CODES
	SEVILLA	REPSOL
	SEVILLA	REPSOL
	ALMERIA	REPSOL
	MAIRENA DEL ALJARAFE (SEVILLA)	REPSOL
	LUCENA (CÓRDOBA)	REPSOL
	SEVILLA	GALP
	JAEN	BP QUESADA
Aragón	ALCAÑIZ (TERUEL)	REPSOL
	TERUEL	REPSOL
	SABIÑANIGO (HUESCA)	REPSOL
	ZARAGOZA	CEPSA
	FERRERUELA DE HUERVA (TERUEL)	REPSOL
	ZARAGOZA	REPSOL
	EPILA (ZARAGOZA)	CEPSA
	ZARAGOZA	REPSOL
	ZARAGOZA	COOPERATIVA AUTO-TAXI
	PUEBLA DE ALFINDEN (LA) (ZARAGOZA)	REPSOL
	PUEBLA DE ALFINDEN (LA) (ZARAGOZA)	REPSOL

	HUESCA	REPSOL
	ZARAGOZA	REPSOL
	CALATAYUD (ZARAGOZA)	REPSOL
Asturias	LLARANES (ASTURIAS)	REPSOL
	TAM ON (ASTURIAS)	PETRONOR
	MIERES (ASTURIAS)	REPSOL
	OVIEDO (ASTURIAS)	REPSOL
	TAM ON (ASTURIAS)	PETRONOR
	GIJON (ASTURIAS)	REPSOL
	POSADA (ASTURIAS)	EL CENTRO
	GIJON (ASTURIAS)	E.S. CEARES
	VIELLA (ASTURIAS)	REPSOL
	CANGAS DEL NARCEA (ASTURIAS)	FLOREZ COSMEN, S.L.
	CERDEÑO (ASTURIAS)	REPSOL
	GIJON (ASTURIAS)	REPSOL
Baleares	CIUTADELLA DE MENORCA (ISLAS BALEARES)	REPSOL
	EIVISSA (ISLAS BALEARES)	REPSOL
	LLUCMAJOR (ISLAS BALEARES)	REPSOL
	PALMA (ISLAS BALEARES)	REPSOL
	SANTA EULALIA (ISLAS BALEARES)	REPSOL
	INCA (ISLAS BALEARES)	REPSOL BUTANO
	PALMA	REPSOL
	PALMA (ISLAS BALEARES)	REPSOL
	MANACOR (ISLAS BALEARES)	REPSOL BUTANO
	PORT D'ALCUDIA (ISLAS BALEARES)	REPSOL
	SON SANT JOAN (ISLAS BALEARES)	REPSOL BUTANO
	PALMA (ISLAS BALEARES)	REPSOL BUTANO
	MAO (ISLAS BALEARES)	REPSOL
	COSTA DE LA CALMA (ISLAS BALEARES)	REPSOL
Canarias	CHAFIRAS (LAS) (SANTA CRUZ DE TENERIFE)	DISA LAS CHAFIRAS
	PALMAS DE GRAN CANARIA (LAS) (LAS PALMAS)	DISA EL SEBADAL
	PALMAS DE GRAN CANARIA (LAS) (LAS PALMAS)	DISA VEGUETA
	CANDELARIA (SANTA CRUZ DE TENERIFE)	DISA CANDELARIA
	LA LAGUNA (SANTA CRUZ DE TENERIFE)	DISA PADRE ANCHIETA
	TELDE (LAS PALMAS)	SHELL TELDE
	ARUCAS (LAS PALMAS)	SHELL AUTOVIA ARUCAS
	CUESTA, LA (SANTA CRUZ DE TENERIFE)	DISA OFRA
	SAN FERNANDO (LAS PALMAS)	DISA MASPALOMAS
	ARRECIFE (LAS PALMAS)	DISA NUEVA AEROPUERTO
	COSTA TEGUISE (LAS PALMAS)	DISA COSTA TEGUISE
Cantabria	LAREDO (CANTABRIA)	REPSOL
	CARTES (CANTABRIA)	REPSOL

	SANTANDER (CANTABRIA)	MEROIL
	CUDON (CANTABRIA)	EL CENTRO
	SANTANDER (CANTABRIA)	REPSOL
	PESUES (CANTABRIA)	AVIA
	HOZNAYO (CANTABRIA)	REPSOL
	CABROJO (CANTABRIA)	REPSOL
	LOS CORRALES DE BUELNA (CANTABRIA)	E.S. SOMAHOZ
	PUENTE SAN MIGUEL (CANTABRIA)	SHELL
	HOZNAYO (CANTABRIA)	REPSOL
	REQUEJADA (CANTABRIA)	E.S. POLANCO
Castilla la Mancha	ILLESCAS (TOLEDO)	REPSOL
	CIUDAD REAL	REPSOL
	CAZALEGAS (TOLEDO)	REPSOL
	CAZALEGAS (TOLEDO)	REPSOL
	BELINCHON (Cuenca)	REPSOL
	ALMANSA (Albacete)	REPSOL
	TOLEDO	REPSOL
	DAIMIEL (CIUDAD REAL)	REPSOL
	TALAVERA DE LA REINA (TOLEDO)	REPSOL
	CHINCHILLA DE MONTE-ARAGO (Albacete)	REPSOL
	CHINCHILLA DE MONTE-ARAGO (Albacete)	REPSOL
	Albacete	REPSOL
	ALCAZAR DE SAN JUAN (CIUDAD REAL)	REPSOL
	QUINTANAR DE LA ORDEN (TOLEDO)	REPSOL
	Cuenca	CAMPSA
	PUERTOLLANO (CIUDAD REAL)	REPSOL
	Guadalajara	REPSOL
	Albacete	REPSOL
	Guadalajara	REPSOL
	TEBAR (Cuenca)	REPSOL
	MALAGON (CIUDAD REAL)	CARBURANTES SEAL
	HONRUBIA (Cuenca)	REPSOL
	SESEÑA (TOLEDO)	REPSOL
	CALERA Y CHOZAS (TOLEDO)	GALP
	MOTILLA DEL PALANCAR (Cuenca)	LA GAVIOTA GASOLINERA 24 HORAS
	TOLEDO	PUNTO AZUL 24 HORAS
Castilla y León	VALDECARPINTEROS (SALAMANCA)	REPSOL
	ZAMORA	REPSOL
	VALLADOLID	REPSOL
	CALDAS DE LUNA (LEÓN)	REPSOL
	MIRANDA DE EBRO (BURGOS)	REPSOL
	MIRANDA DE EBRO (BURGOS)	REPSOL
	PALENCIA	REPSOL

	SORIA	REPSOL
	ARANDA DE DUERO (BURGOS)	REPSOL
	LEON	REPSOL
	VILLAYUDA O LA VENTILLA (BURGOS)	REPSOL
	VALLADOLID	REPSOL BUTANO
	BENAVENTE (ZAMORA)	CAMINO DE SANTIAGO
	SEGOVIA	REPSOL
	PALENCIA	AVIA
	SALAMANCA	REPSOL
	VILLAHERREROS (PALENCIA)	REPSOL
	SORIA	CEPSA
	CASTILLEJO DE MESLEON (SEGOVIA)	CEPSA
	ARAPILES(SALAMANCA)	REPSOL
	CIGALES (VALLADOLID)	E.S. REAL
	NAVALMANZANO (SEGOVIA)	NAVATRANS
	AVILA	REPSOL
	VEGA DE VALDETRONCO (VALLADOLID)	REPSOL
	BENAVENTE (ZAMORA)	REPSOL
	QUINTANAPALLA (BURGOS)	REPSOL
	DUEÑAS (PALENCIA)	REPSOL
	SALAMANCA	REPSOL
	VALLADOLID	REPSOL
	ESPINOSA DE LOS CABALLEROS (ÁVILA)	REPSOL
	PONFERRADA (LEÓN)	REPSOL
	ZAMORA	REPSOL
	LEON	REPSOL
	LEON	GASOLINERAS PECAFER S.L.
Catalonia	SABADELL (BARCELONA)	MEROIL
	BARCELONA	TORTUGA
	GAVA (BARCELONA)	PETROCAT
	GAVA (BARCELONA)	PETROCAT
	CASTELLO D'EMPURIES (GIRONA)	REPSOL
	MANRESA (BARCELONA)	PETROCAT
	BARCELONA	REPSOL
	FIGUERES (GIRONA)	REPSOL
	CUNIT (TARRAGONA)	REPSOL
	CALONGE	PETRONOR
	BARCELONA	REPSOL
	MONTORNES NORD (BARCELONA)	REPSOL
	MATARO (BARCELONA)	REPSOL
	SANTA MARIA DE PALAUTORDERA (BARCELONA)	REPSOL
	TARRAGONA	REPSOL
	HOSPITALET DE LLOBREGAT (L') (BARCELONA)	REPSOL
	CASTELL D'ARO (GIRONA)	REPSOL

	GIRONA	REPSOL
	BANYOLES (GIRONA)	REPSOL
	MONTCADA CENTRE (BARCELONA)	REPSOL
	GARRIGAS (GIRONA)	REPSOL
	BADALONA (BARCELONA)	REPSOL
	TERRASSA (BARCELONA)	REPSOL
	SALLENT (BARCELONA)	PETRONOR
	VILADECANS (BARCELONA)	REPSOL
	VIC (BARCELONA)	REPSOL
	TAGAMANENT (BARCELONA)	REPSOL
	OLOT (GIRONA)	REPSOL
	MOLINS DE REI (BARCELONA)	REPSOL
	CANOVELLES (BARCELONA)	REPSOL
	SALOU (TARRAGONA)	REPSOL
	SABADELL (BARCELONA)	REPSOL
	HOSPITALET DE LLOBREGAT (L') (BARCELONA)	REPSOL
	BARCELONA	REPSOL
	REUS (TARRAGONA)	REPSOL
	SANT CUGAT DEL VALLES (BARCELONA)	REPSOL
	SABADELL (BARCELONA)	REPSOL
	LA JONQUERA (GIRONA)	REPSOL
	BARBERA DEL VALLES (BARCELONA)	REPSOL
	MARTORELL (BARCELONA)	CEPSA
	PRAT DE LLOBREGAT (EL) (BARCELONA)	CEPSA
	SABADELL (BARCELONA)	REPSOL BUTANO
	MANRESA (BARCELONA)	REPSOL BUTANO
	RIPOLL (GIRONA)	REPSOL BUTANO
	FONOLLERES (LLEIDA)	REPSOL
	VILA-SECA (TARRAGONA)	ALAS
	PALAMOS (GIRONA)	REPSOL
	TORROELLA DE MONTGRI (GIRONA)	REPSOL
	LLEIDA	REPSOL
	SANT BOI DE LLOBREGAT (BARCELONA)	REPSOL
	PRAT DE LLOBREGAT (EL) (BARCELONA)	PETROCAT
	BASSELLA (LLEIDA)	REPSOL
	HOSPITALET DE L'INFANT (TARRAGONA)	PETROTAPIES
	TARRAGONA	EXOIL
	BLANES (GIRONA)	REPSOL BUTANO
	OLIUS (LLEIDA)	REDTORTUGA
	ESPLUGUES DE LLOBREGAT (BARCELONA)	OIL PRIX
	CORNELLA DE LLOBREGAT (BARCELONA)	OIL PRIX
	GAVA (BARCELONA)	REPSOL
	BELLVIS (LLEIDA)	GALP

	LLEIDA	REPSOL BUTANO
	GRANOLLERS (BARCELONA)	MEROIL
	VILAFRANCA DEL PENEDES (BARCELONA)	PETROMIRALLES
	IGUALADA (BARCELONA)	PETROMIRALLES
	AMPOSTA (TARRAGONA)	REPSOL
	BELLVEI (TARRAGONA)	REPSOL
	ESPARREGUERA (BARCELONA)	REPSOL
	SERRAT DE L'OCATA (BARCELONA)	PETROCAT
	CELRA (GIRONA)	REPSOL
	MAÇANET DE LA SELVA (GIRONA)	REPSOL
	BADALONA (BARCELONA)	REPSOL
	BARCELONA	REPSOL
	BLANES (GIRONA)	REPSOL
	SANTA AGNES DE MALANYANES (BARCELONA)	REPSOL
	SANTA PERPETUA DE MOGODA (BARCELONA)	REPSOL
	SANTA PERPETUA DE MOGODA (BARCELONA)	REPSOL
	SITGES (BARCELONA)	REPSOL
	VALLIRANA PARC (BARCELONA)	REPSOL
	BARCELONA	REPSOL
	VILANOVA I LA GELTRU (BARCELONA)	REPSOL
	SANTA PERPETUA DE MOGODA (BARCELONA)	REPSOL
	FONOLLERES (LLEIDA)	REPSOL
	SANT CUGAT DEL VALLES (BARCELONA)	REPSOL
	VILA-SECA (TARRAGONA)	REPSOL
	BARCELONA	MEROIL
	SANT ADRIA DE BESOS (BARCELONA)	GALP
	PRAT DE LLOBREGAT (EL) (BARCELONA)	GALP
	ESPLUGUES DE LLOBREGAT (BARCELONA)	DANFORD
	SANT ADRIA DE BESOS (BARCELONA)	MEROIL
Community of Valencia	VILLENA (ALICANTE)	REPSOL
	OLIVA (VALENCIA)	REPSOL
	JÁVEA/XÀBIA (ALICANTE)	REPSOL
	CREVILLENT (ALICANTE)	REPSOL
	SANTA POLA (ALICANTE)	REPSOL
	CAMPELLO (EL) (ALICANTE)	REPSOL
	TORRENT (VALENCIA)	REPSOL
	BENICARLO (CASTELLÓN)	REPSOL
	ALBALAT DELS SORELLS (VALENCIA)	REPSOL
	PATERNA (VALENCIA)	REPSOL
	ELCHE/ELX (ALICANTE)	REPSOL
	VALENCIA	REPSOL
	ALICANTE/ALACANT	REPSOL
	ALFAFAR (VALENCIA)	REPSOL

	CHIVA (VALENCIA)	REPSOL
	GUARDAMAR DEL SEGURA (ALICANTE)	REPSOL
	ORIHUELA (ALICANTE)	REPSOL
	CREVILLENT (ALICANTE)	REPSOL
	PATERNA (VALENCIA)	REPSOL
	SAN VICENTE DEL RASPEIG/SANT VICENT DEL RASPEIG (ALICANTE)	REPSOL
	VALENCIA	TAXCO
	BENIMAMET-BENIFERRI (VALENCIA)	REPSOL
	ALICANTE/ALACANT	REPSOL
	ALCOY/ALCOI (ALICANTE)	REPSOL
	TORREVIEJA (ALICANTE)	REPSOL
	BENIDORM (ALICANTE)	REPSOL
	VILLARREAL (CASTELLÓN)	COOPERATIVA CATOLICO AGRARIA COOP.V.
	GUADASSUAR (VALENCIA)	SERVICOOP
	ALICANTE/ALACANT	CEPSA
	SANTA POLA (ALICANTE)	EA SANTA POLA
	ALICANTE/ALACANT	PETRO ALACANT
	CASTELLON DE LA PLANA (CASTELLÓN)	REPSOL
	ALBORAYA (VALENCIA)	REPSOL
	TORREVIEJA (ALICANTE)	REPSOL
	CASTELLON DE LA PLANA (CASTELLÓN)	BENCINAS MESTRETS
	POBLA TORNESA (LA) (CASTELLÓN)	REPSOL
	VALENCIA	REPSOL
Extremadura	DON BENITO (BADAJOZ)	REPSOL
	BADAJOZ	REPSOL
	VALDESALOR (CÁCERES)	REPSOL
	CACERES	REPSOL
	PLASENCIA (CÁCERES)	REPSOL
	MALPARTIDA DE PLASENCIA (CÁCERES)	REPSOL
	MERIDA (BADAJOZ)	REPSOL
	TRUJILLO (CÁCERES)	CEPSA
Galicia	PUENTE NUEVO (PONTEVEDRA)	SERTUY
	POIO (PONTEVEDRA)	REPSOL
	CORUÑA (A)	REPSOL
	CATABOIS (CORUÑA (A))	REPSOL
	MUXA DE ABAIXO (LUGO)	REPSOL
	VIGO (PONTEVEDRA)	REPSOL
	CORUÑA (A)	REPSOL
	AMEIXEIRA (CORUÑA (A))	REPSOL
	CAÑIZA (A) (PONTEVEDRA)	REPSOL
	VIGO (PONTEVEDRA)	REPSOL
	OURENSE	REPSOL
	LALIN (PONTEVEDRA)	REPSOL

	VILABOA (PONTEVEDRA)	REPSOL
	VILABOA (PONTEVEDRA)	REPSOL
	POBRA DO CARAMIÑAL (CORUÑA A)	REPSOL
	CORUÑA (A)	PETRONOR
	SAN CIBRAO DAS VIÑAS (OURENSE)	REPSOL
	BERGONDIÑO (CORUÑA A)	E.S. CORTIÑAN
	CABANELAS (PONTEVEDRA)	REPSOL BUTANO
	CERVO (LUGO)	REPSOL
	PERILLO (CORUÑA A)	REPSOL
	O'VAL-NARÓN (CORUÑA A)	ORTEGAL OIL
	LAPIDO (CORUÑA A)	GALP
	PERILLO (CORUÑA A)	GALP
	CABANA (CORUÑA A)	REPSOL BUTANO
	ARZUA (CORUÑA A)	REPSOL
	BOIRO (CORUÑA A)	CEPSA
	SANTIAGO DE COMPOSTELA (CORUÑA (A))	REPSOL
	RIOS (OURENSE)	REPSOL
	FEANS (CORUÑA (A))	REPSOL BUTANO
Madrid	MADRID	REPSOL
	AJALVIR (MADRID)	REPSOL
	AJALVIR (MADRID)	CAMPSA
	COLMENAR VIEJO (MADRID)	REPSOL
	ALCALA DE HENARES (MADRID)	REPSOL
	MADRID	REPSOL
	VALDEMORILLO (MADRID)	REPSOL
	ROZAS DE MADRID (LAS) (MADRID)	REPSOL
	FUENLABRADA (MADRID)	REPSOL
	MADRID	REPSOL
	ALCOBENDAS (MADRID)	REPSOL
	MOSTOLES (MADRID)	REPSOL
	MADRID	REPSOL
	MADRID	REPSOL
	PINTO (MADRID)	REPSOL
	GALAPAGAR (MADRID)	REPSOL
	SAN SEBASTIAN DE LOS REYES (MADRID)	REPSOL
	GALAPAGAR (MADRID)	REPSOL
	MOSTOLES (MADRID)	REPSOL
	MADRID	REPSOL
	ARROYOMOLINOS (MADRID)	REPSOL
	ALCORCON (MADRID)	REPSOL
	SAN SEBASTIAN DE LOS REYES (MADRID)	REPSOL
	SAN FERNANDO DE HENARES (MADRID)	REPSOL
	ALCORCON (MADRID)	REPSOL
	MADRID	REPSOL
	PINTO (MADRID)	REPSOL

	ALCORCON (MADRID)	LISBOA
	MADRID	CEPSA
	MADRID	REPSOL BUTANO
	MADRID	REPSOL BUTANO
	MOSTOLES (MADRID)	REPSOL
	MADRID	REPSOL
	MADRID	REPSOL
	MADRID	REPSOL
	MADRID	REPSOL
	MADRID	REPSOL
	MADRID	REPSOL
	MADRID	REPSOL
	MOLAR (EL) (MADRID)	REPSOL
	ALCALA DE HENARES (MADRID)	REPSOL
	FRAILES (LOS) (MADRID)	GASOLEOS DAGANZO
	MADRID	CEPSA VALLECAS-LA ATALAYUELA 365
	GETAFE (MADRID)	CEPSA
	MADRID	REPSOL
	MADRID	REPSOL
	FUENLABRADA (MADRID)	REPSOL
	TRES CANTOS (MADRID)	REPSOL
	VILLAVICIOSA DE ODON (MADRID)	REPSOL
	VILLAVICIOSA DE ODON (MADRID)	REPSOL
	ALCALA DE HENARES (MADRID)	GALP
	ALCALA DE HENARES (MADRID)	GALP
	MADRID	GALP
	MADRID	GALP
	ALCORCON (MADRID)	CEPSA URTINSA 365
	SAN AGUSTIN DEL GUADALIX (MADRID)	REPSOL
Murcia	CARTAGENA (MURCIA)	REPSOL
	CARTAGENA (MURCIA)	REPSOL
	CARTAGENA (MURCIA)	SHELL
	MURCIA	REPSOL BUTANO
	ALGAR (EL) (MURCIA)	ADRIDAN
	CHURRA (MURCIA)	CEPSA
	AGUILAS (MURCIA)	ANIBAL
	MURCIA	REPSOL
	MOLINA DE SEGURA (MURCIA)	APELLAN
Navarra	ESTELLA O LIZARRA (NAVARRA)	REPSOL
	ZUASTI (NAVARRA)	REPSOL
	FONTELLAS (NAVARRA)	REPSOL
	NOAIN (NAVARRA)	REPSOL
	TAFALLA (NAVARRA)	REPSOL
	PAMPLONA/IRUÑA (NAVARRA)	REPSOL

	AIZOAIN (NAVARRA)	ESTACION DE SERVICIO ARALAR
	DANTXARINEA (NAVARRA)	REPSOL
	TUDELA (NAVARRA)	REPSOL
	PAMPLONA/IRUÑA (NAVARRA)	CEPSA
	PAMPLONA/IRUÑA (NAVARRA)	ARALAR
	PAMPLONA/IRUÑA (NAVARRA)	EUROCAM
Basque Country	DONOSTIA-SAN SEBASTIAN (GUIPÚZCOA)	REPSOL
	DONOSTIA-SAN SEBASTIAN (GUIPÚZCOA)	REPSOL
	ALTUBE (ÁLAVA)	PETRONOR
	DERIO (VIZCAYA)	PETRONOR
	OIARTZUN (GUIPÚZCOA)	REPSOL
	TOLOSA (GUIPÚZCOA)	REPSOL
	AMOREBIETA (VIZCAYA)	PETRONOR
	ARRIGORRIAGA (VIZCAYA)	PETRONOR
	ERANDIO-GOIKOA (VIZCAYA)	PETRONOR
	BEASAIN (GUIPÚZCOA)	REPSOL
	ABANTO (VIZCAYA)	PETRONOR
	SAN VICENTE DE BARAKALDO (VIZCAYA)	REPSOL
	VITORIA-GASTEIZ (ÁLAVA)	REPSOL
	LOPIDANA (ÁLAVA)	REPSOL
	IRUN (GUIPÚZCOA)	CEPSA
	IRUN (GUIPÚZCOA)	CEPSA
	ELBURGO/BURGELU (ÁLAVA)	REPSOL
	SESTAO (VIZCAYA)	REPSOL
	AMOREBIETA (VIZCAYA)	PETRONOR
	ARRASATE/MONDRAGON	REPSOL
	APOTZAGA	REPSOL
	VITORIA-GASTEIZ (ÁLAVA)	CEPSA
	AMASA (GUIPÚZCOA)	CEPSA
	VITORIA-GASTEIZ (ÁLAVA)	AVIA
	HERNANI (GUIPÚZCOA)	REPSOL
	HERNANI (GUIPÚZCOA)	REPSOL
	OLABERRIA(GUIPÚZCOA)	AVIA
Rioja (La)	LOGROÑO (LA RIOJA)	REPSOL
	LOGROÑO (LA RIOJA)	REPSOL
	TRICIO (LA RIOJA)	REPSOL
	HORMILLA (LA RIOJA)	VALCARCE

Source: Geoportal of the Ministry of Industry, Energy and Tourism.

Appendix Table B-6. Hydrogen refuelling stations existing in Spain in June 2016

AC	LOCATION	OPENING YEAR	OPERATING STATUS	TYPE OF ACCESS	STATION OPERATOR
Andalusia	Sanlúcar la Mayor (Seville)	2010	In operation	Accessible to the public	Abengoa
	Puerto de Seville (Seville)	2015	In operation	Accessible to the public	Abengoa
Aragon	Valderespartera (Zaragoza)	2008	In operation	Restricted use	Expo Zaragoza Empresarial, SA
	Walqa Technology Park Ctra Zaragoza-Huesca 75 km (Huesca)	2010	In operation	Accessible to the public	Aragon Hydrogen Foundation
Castile la Mancha	La Torrecica (Albacete)	2012	In operation		AJUSA
	Puertollano (Ciudad Real)	2016	In operation	Accessible to the public	CNH 2

Source: Spanish Hydrogen Association

Appendix Table B-7. Technical characteristics of the existing hydrogen refuelling points in June 2016

Location	Outfitted for cars	Outfitted for buses	Outfitted for other vehicles	No. refuelling points	Type H_2 production	Source of H_2	Delivery form	Pressure (bar)
Sanlúcar la Mayor (Seville)	Yes	Yes	Yes	1	It supports supply pressure, but has production 'in situ' using renewable electrolysis	renewable electrolysis	Under pressure	350
Puerto de Seville (Seville)	Yes	Yes	Yes	1	It supports supply pressure, but has production 'in situ' using renewable electrolysis	renewable electrolysis	Under pressure	350
Valderespartera (Zaragoza)	Yes	Yes	Yes	2	Supplier and in situ production.		Under pressure	200-350
Walqa Technology Park (Huesca)	Yes	Yes	Yes	2	In situ production from solar/wind power by electrolysis Production in situ	renewable electrolysis	Under pressure	200-350
La Torrecica (Albacete)	Yes	Yes			Supplier and in situ production.			350
Puertollano (Ciudad Real)	Yes	No	according to tank	1	In situ production from solar energy by electrolysis	Solar	Under pressure	350

Source: Spanish Hydrogen Association

Appendix Table B-8. Refuelling stations that supply blends of biofuels higher than B7 and E5 existing in June 2016

AUTONOMOUS COMMUNITY	LOCATION	LABEL	BIODIESEL	BIOETANOL
Andalusia	JAEN	TAMOIL	X	
	GRANADA	TAMOIL	X	
	JEREZ DE LA FRONTERA (CÁDIZ)	TAMOIL	X	
	MARMOLEJO (JAÉN)	TAMOIL	X	
	BOLLULLOS PAR DEL CONDADO (HUELVA)	AGLA	X	
	UTRERA (SEVILLA)	TAMOIL	X	
	ALJARAQUE (HUELVA)	TAMOIL	X	
	SAN ROQUE (CÁDIZ)	CODES	X	
	SEVILLA	SANCARISA	X	
	VILLANUEVA DEL ARZOBISPO (JAÉN)	AGLA	X	
Aragón	ANGUES (HUESCA)	COMBUSTIBLES DEL PIRINEO	X	
	ALMUDEVAR (HUESCA)	VIRGEN DE LA CORONA	X	
	JACA (HUESCA)	EROSKI	X	
	ZUERA (ZARAGOZA)	COOP.SAN LICER - ARENTO	X	
	VILLAMAYOR DE GALLEGO (ZARAGOZA)	EL PUEYO	X	
	NOVALLAS (ZARAGOZA)	COOP. NTRA.SRA. PILAR	X	
Asturias	CORUÑO (ASTURIAS)	ASIPO SERVICIOS		X
	SALINAS (ASTURIAS)	GF	X	
Cantabria	GUARNIZO (CANTABRIA)	AREA DE SERVICIO LA PALMERA	X	
	CARTES (CANTABRIA)	MEROIL	X	
	BOO (CANTABRIA)	G2	X	
Castilla y León	ZARATÁN (VALLADOLID)	REPOSTAR--ZARATAN	X	
	ARANDA DE DUERO (BURSOS)	DACAR	X	
	REVILLA (LA) (BURSOS)	PINAROIL S.L.	X	

	BURGOS	AVIA VISTA ALEGRE	X	
	PALENCIA	SUANCES	X	
	BARCO DE AVILA (EL) (ÁVILA)	BELLAVISTA S.L.	X	
	VALENCIA DE DON JUAN (LEÓN)	SAENZ DE MIERA SL	X	
Catalonia	CERDANYOLA DEL VALLES (BARCELONA)	SABATER NURI CARBURANTS SA	X	
	CERDANYOLA DEL VALLES (BARCELONA)	SABATER NURI CARBURANTS SA	X	
	SANT JOAN DE VILATORRADA (BARCELONA)	TAMOIL	X	
	ARBOÇ (L') (TARRAGONA)	TAMOIL	X	
	HOSPITALET DE LLOBREGAT (L') (BARCELONA)	TAMOIL	X	
	SABADELL (BARCELONA)	COBASA	X	
	SANT BOI DE LLOBREGAT (BARCELONA)	E.S.OASIS	X	
	ALCANAR (TARRAGONA)	TAMOIL	X	
	FOGARS DE LA SELVA (BARCELONA)	CEPSA	X	
	BARCELONA	PETROZAL	X	
	ALCOVER (TARRAGONA)	ESTACIO SERVEI ALCOVER	X	
	TARRAGONA	TAMOIL	X	
	BARCELONA	TAMOIL	X	
	FULIOLA (LA) (LLEIDA)	XOPLUC-PETROMIRALLES	X	
	POLIGON EMPORDA INTERNACIONAL (GIRONA)	IS-XXI	X	
	TARRAGONA	BIONET	X	
	SANT JOAN DESPI (BARCELONA)	OIL PRIX	X	
	OLIANA (LLEIDA)	ESTACIO SERVEI OLIANA	X	
	VILAFRANCA DEL PENEDES (BARCELONA)	PETROMIRALLES	X	
	IGUALADA (BARCELONA)	PETROMIRALLES	X	X
	TARREGA (LLEIDA)	PETROMIRALLES	X	
	AVINYONET DE PUIGVENTOS (GIRONA)	E.S.AVINYONET	X	

	ESPARREGUERA (BARCELONA)	REPSOL	X	
	BARCELONA	MEROIL	X	X
	BARCELONA	GALP	X	
	MATARO (BARCELONA)	GALP	X	
	MALLA (BARCELONA)	ESCLATOIL	X	
	MONJOS (ELS) (BARCELONA)	GALP	X	
Community of Valencia	PICASSENT (VALENCIA)	TAMOIL	X	
	ONDA (CASTELLÓN)	BDMED	X	
	CASTELLON DE LA PLANA (CASTELLÓN)	BDMED	X	
	APEADERO DE BECHI (CASTELLÓN)	BDMED	X	
	ALICANTE	TAMOIL	X	
	VALENCIA	SHELL		X
	CORBERA (VALENCIA)	COOPERATIVA DE CORBERA	X	
Extremadura	BATAN (EL) (CÁCERES)	BATAN	X	
Galicia	SOBREIRA (LUGO)	ICOS OIL	X	
	GUDIÑA (A) (OURENSE)	STAROIL	X	
	O'VAL-NARÓN (A CORUÑA)	ORTEGAL OIL	X	
	SANTIAGO DE COMPOSTELA (A CORUÑA)	STAROIL		X
	ACEA DE AMA (A CORUÑA)	GALP	X	
	FENE (A CORUÑA)	ORTEGAL OIL	X	
	CORGO (A CORUÑA)	LOW COST ATENDIDO O CORGO	X	
Madrid	MIRAFLORES DE LA SIERRA (MADRID)	EDV	X	
	MADRID	SHELL	X	X
	TORREJON DE ARDOZ (MADRID)	SHELL	X	X
Murcia	TOTANA (MURCIA)	COATO	X	
	CHURRA (MURCIA)	THADER	X	

	CHURRA (MURCIA)	THADER	X	
Navarra	MILAGRO (NAVARRA)	AVIA	X	
	LARRAGA (NAVARRA)	AN ENERGETICOS LARRAGA	X	
Basque Country	DONOSTIA-SAN SEBASTIAN (GUIPÚZCOA)	AVIA	X	X
	ARANGUIZ (ÁLAVA)	AVIA		X
	EIBAR (GUIPÚZCOA)	AVIA-KANTOI	X	
	LAZKAO (GUIPÚZCOA)	AVIA	X	
	ZURBANO (ÁLAVA)	AVIA	X	X
	IRUN (GUIPÚZCOA)	AVIA		X
	VITORIA-GASTEIZ (ÁLAVA)	ESASA	X	
	RIBABELLOSA (ÁLAVA)	EESS ROMPETROL	X	
	DURRUMA/SAN ROMAN DE SAN (ÁLAVA)	IS-XXI	X	
	ALDEKONA (SAN ISIDRO) (VIZCAYA)	AVIA USOA	X	X
	ARROA-BEKOA (GUIPÚZCOA)	AVIA	X	X
	VITORIA-GASTEIZ (ÁLAVA)	AVIA	X	
Rioja (La)	LOGROÑO (LA RIOJA)	EROSKI	X	

Source: Geoportal of the Ministry of Industry, Energy and Tourism.

APPENDIX C. COLLECTION OF MEASURES IMPLEMENTED AT REGIONAL LEVEL

ANDALUSIA

9 From 2005 to 2014, the Andalusian Energy Agency encouraged[177] both the production of biofuels and their distribution and logistics, subsidising E85 pumps at service stations and warehouses and suppliers of biodiesel companies for their own consumption. It will issue a temporary order of support in the field until 2020 so that the production of second-generation biofuels will be encouraged, and also investment in distribution and logistics.

ARAGON

10. From 2008 to 2011 the Government of Aragon and the Institute for Diversification and Saving of Energy (IDAE) signed collaboration agreements to provide subsidies for saving and energy efficiency in different fields, including the transport sector.

11. From 2008 to 2011 the Government of Aragon, through the Department of Industry, Trade and Tourism awarded grants for efficient use of energy and use of renewable energies; among other actions, they encouraged the purchase of electric vehicles and the installation of recharging points.

12. Grants were awarded in 2010 and 2011 to promote the use of biofuels in road transport.

CANTABRIA

13. In 2012 the Government of Cantabria installed through the project e-Aire[178] 7 electric recharging points (4 in Santander, 1 Camargo, 1 in Torrelavega and 1 in Laredo).

CASTILE LA MANCHA

14. The Ministry of Public Works established aid for the purchase of vehicles powered by alternative energy, electricity, LPG, CNG and LNG through the following orders: Order of 30 November 2011 published in the DOCM No. 236 of 2 December, 2011 and the Order of 16 April 2014 published in the DOCM No. 84 of 6 May, 2014.

15 Assistance organised in 2011 supported the conversion of 10 passenger vehicles to natural gas between 2/12/2011 and 1/10/2012 and the construction of 2 refuelling stations. Meanwhile in 2014 30 CNG cars were converted, each one being granted a maximum of €800 or 50 % of the cost of conversion. There were also grants for the purchase of passenger cars or commercial vehicles converted in the factory to a maximum of €1 200 per vehicle as well as buses and vehicles for the transport of goods (€15 000 for new vehicles and €3 000 for vehicles converted to a limit of 50 % of the cost of conversion), if no earlier grant application had been approved for this type of vehicle.

16 In 2014 the Ministry of Public Works granted aid for the purchase of vehicles powered by alternative energy and power system conversion by order of 16.04.2014 by which the regulatory

[177] Order of 18 July 2005 laying down the rules for an incentive programme for sustainable energy development in Andalusia established and its call is performed for the years 2005 and 2006.
Order of 11 April 2007 laying down the rules for an incentive programme for sustainable energy development in Andalusia and its call for the year is done.
Order of 4 February 2009 laying down the rules for an incentive programme for sustainable energy development in Andalusia and its call for the years 2009-2014.

[178] The project E-AIR, part of an initiative of the Environment of the Government of Cantabria which has been joined by the Ministry of Agriculture, Livestock and Environment of La Rioja, the DG Energy Agency of the Provincial de Ávila , the Municipality of Loures (Portugal) and the city of Aranjuez.

basis of aid for savings and energy efficiency are established in the transport sector in Castile-La Mancha (published in DOCM # 84 of 06.05. 2014). The purchase of 6 hybrid vehicles was supported.

CASTILE AND LEON

17 Order EYE/1592/2011 of 23 December, which co-funded public subsidies held with the European Regional Development Fund aimed at making investments in energy saving and efficiency in the transport sector except for acquisition of vehicles of Castile and Leon (BOCYL of December 29, 2011) to promote, among other actions, the conversion of internal combustion vehicles less than 5 years old to electric vehicles.

18. The total budget for this line is €100 000. The maximum amount eligible for the transformation of the vehicles was 3 000 Euros per unit.

19 Order EYE/1135/2014 of 22 December supported the installation of 17 electric recharging points by municipalities, businesses and individuals.

20 The Government of Castile and Leon is aware of the installation of 200 electric recharging points (public and private) in the region.

21 Agreements for public-private partnerships:

SIGNATURE YEAR	PARTICIPATING ENTITIES	BUDGET	OBJECT
2013	Nissan International SA and the Government of Castile and Leon		Quick recharge: DQ Programme Launch Programme
2012	Cooperation agreement between Iberdrola, SA and the Administration of the Autonomous Community of Castile and Leon	€130 000	Installation of recharging points in 60 public buildings in the administration of the Board of Castile and Leon
2010	Specific collaboration agreement between the Regional Energy Body of Castile and Leon, the city of Valladolid, Palencia City Council and Iberdrola, SA for	€276 000	Implementation of the pilot scheme 'Installation of Recharging bases for Electric Vehicles'

22. Dissemination activities:

On 16 January, 2013 at the headquarters of the City of Palencia the presentation event was held for the Electric Vehicle (EV) Guide for Castile and Leon. In developing the Electric Vehicle Guide for Castile and Leon representatives participated from: the municipalities of the Network of Municipalities of Castille and Leon ADE Sector Policy department, the Regional Energy Agency, the company Tool Alfa and General Directorate of Industry and Technological Innovation.

The Regional EV Guide of Castile and Leon was presented in the following locations: Palencia, Soria, Bejar, Leon, Laguna de Duero, Salamanca, Miranda de Ebro, Ponferrada, Medina del Campo and Benavente.

In addition, since 2014, a specific section on the portal of electric vehicles in Castile and Leon has been being developed and implemented: http://www. vehiculoelectrico. jcyl. es/ for members of the Network of Municipalities, where information is exchanged, knowledge of good practices is shared, and direct contact with other representatives of the municipalities of the Network of Municipalities is maintained.

23 Training activities:

Decree 27/2011 of 9 June has been promoted, establishing the corresponding curriculum for the Diploma of Technician in the Electromechanics of Motor Vehicles in the Community of Castile and Leon. This measure aims to meet the general needs for qualification of human resources for incorporation into the productive structure of the Community of Castile and Leon.

During the year 2012-2013, a total of 27 centres spread across all provinces of the Community offered such training courses, with 1 254 students.

During the year 2013-2014, a total of 27 centres spread across all provinces of the Community offered such training courses, with 1 423 students.

During the year 2014-2015, a total of 26 centres spread across all provinces of the Community offered such training courses, with 1 355 students.

24 In 2014 The Ministry of Economy and Employment of the Government of Castile and Leon signed an agreement with the company REPSOL to promote and support the use of LPG which has included the following actions:

- The conversion of four official vehicles of the Government of Castile and Leon (Avila, Burgos, Soria and León) for monitoring and analysis of this technology.
- Support for the purchase of AutoGas vehicles in the Autonomous Community of Castile and Leon through
- A maximum contribution of €500 LPG by customer loyalty card for a new vehicle purchased by the Government of Castile and Leon.
- Contributions to different sectors and individuals in the Community of Castile and Leon to acquire new LPG vehicles under certain conditions

25 ORDER EYE/1591/2011 of 23 December, which co-funded subsidies convened with the European Regional Development Fund for the purchase of automobiles, motorcycles, buses, lorries and other mobility equipment using more energy-efficient technology. (REAY IND041 Code). (BOCYL 29 December, 2011)

Such aid could finance the purchase of new vehicles with different technology, either: passenger cars or commercial vehicles up to 3 500 kg GVW, new motorcycles, buses and/or new lorries and replacement of rolling a new one. The total budget for this line is €250 000, highlighting the amount of €7 000 for passenger cars or commercial vehicles up to 3 500 kg MMA, among others. The results of such aid are:

- 94 Hybrids, 1 GN. €213 964 aid.
- 2 electric bikes. Investment €9 900/€1 402 aid.
- 15 LPG vehicles (ambulances). Investment of €1 024 664/€138 200 aid.

VALENCIAN COMMUNITY

26 The now defunct Valencian Energy Agency (AVEN) supported the installation of three recharging stations for natural gas until 2011.

27 The AVEN Agency in 2011 under an agreement signed with the IDEA supported conversions of passenger cars to LPG.

. EXTREMADURA

28 Until 2012 the Government of Extremadura and the Institute for Diversification and Saving of Energy (IDAE) signed collaboration agreements for grants to purchase vehicles powered by

alternative energies. However, no requests for assistance concerning natural gas were submitted.

29 The Government of Extremadura signed an agreement with the Institute for Energy Diversification and Saving (IDAE) for the Development Action Plan 2008-2012 (PAE4 +), as a result of which the Ministry of Agriculture, Rural Development, Environment and Energy issued the public Decree 151/2012 of 27 July, establishing the regulatory bases for granting subsidies for the purchase of hybrid vehicles and others powered by alternative energy and made a call for the year 2012.

30 In 2013 Endesa was awarded the open competition organised by the Extremadura Energy Agency to install 40 recharging points for electric vehicles in the province of Badajoz, 22 of which were expected to be located in the city of Badajoz and the remaining 18 in the city of Merida. This measure was developed by the Extremadura Energy Agency, through management entrusted to the Ministry of Agriculture, Rural Development, Environment and Energy of the Government of Extremadura and the Extremadura Energy Agency for the implementation of the actions of public support in the Plan of Action for the Strategy of Savings and Efficiency. Finally, the outcome of this contest awarded to Endesa materialised with 9 recharge points in the city of Merida and 13 in Badajoz, according to the following relationship:

CITY OF BADAJOZ		MERIDA	
NO.	**LOCATION**	**NO.**	**LOCATION**
1	IFEBA	1	Polytechnic
2	University	2	Felix Valverde Lillo
3	Old Nursery	3	Plaza de Roma
4	Train station	4	Avenida de la Libertad
5	Plaza Alta	5	Atarazanas
6	Parking Luis de Morales Museum	6	Plaza margartita Xirgú
7	Parking Menacho	7	Avenida Juan Carlos I
8	Parking Conquistadores	8	Tourist Centre (MAM)
9	Parking San Aton	9	Calle Trébol (Edificio Emergencias 112)
10	Lighting Service		
11	San Roque pool		
12	Sports Area of La Granadilla		

GALICIA

31 Resolution of 1 December 2011 establishing the regulatory basis for awarding grants, on a non-competitive basis, related to the Plan of efficient vehicles, and regulating the selection of associate bodies which participated in its management.

32 According to the BOP 21/05/2013 the Concello A Coruña established a call for subsidies for motor vehicles for taxi service that were hybrid vehicles or used LPG, natural gas or electricity, whether they were taxis or vehicles installing GPS or other systems.

BALEARIC ISLANDS

33 In 2014 the Balearic Government signed an agreement with REPSOL, without any associated public budget, which involved the transformation of two vehicles to LPG.

CANARY ISLANDS

34 In November 2013 the Canary Islands government promoted a study for the introduction of electric vehicles in the Canaries.

35 In 2014 and 2015 the Island Energy Agency of Tenerife and the Energy Agency of the Canaries jointly launched a line of grants for: (1) the replacement of cars by others fuelled by liquefied gas and (2) the adaptation of vehicles to use this fuel. The maximum grants were set at 600 and 450 Euros per vehicle, respectively, and they went exclusively to councils and city councils.

NAVARRE

36 In 2011 the Directorate General for Enterprise and Innovation through Resolution 02532 DGE/2011 of 15 December, supported six changes to vehicles powered by LPG through an agreement between the Government of Navarre and the IDAE.

37 In 2011 the Directorate General of Enterprise and Innovation called for subsidies for the purchase of passenger and commercial vehicles powered by alternative fuels.

BASQUE COUNTRY

38 In 2013 an agreement of public-private partnership was signed to promote alternative fuels in the taxi sector.

39 In 2014 they reached agreements of public-private partnership to install electric recharging points. The object was to develop a novel solution for fast, smart, flexible and manageable recharge through research and development of the most advanced recharging and communications technologies (EV charger - and Charger-Manager), energy management and the associated charges, obtaining as a result a single final advanced product for fast recharging of electric vehicles that is a world-level indicator of the know-how of the Basque Country. The budget was €4 001 444.18.

The participating institutions were: INGETEAM POWER TECHNOLOGY, S.A., ASOCIAC DE PROMOCIÓN E INVESTIGACIÓN CLUSTER DE ENERGÍA, EDS INGENIERIA Y MONTAJES S.A., IBERDROLA GENERACION S.A., IBIL GESTOR DE CARGA DE VEHÍCULO ELÉCTRICO, S.A., ZIV METERING SOLUTIONS.

40 From 2011 to 2015 various agreements have been made for public-private partnerships to encourage electric mobility in different areas at recharging points.

PRINCIPALITY OF ASTURIAS

41 From 2008 to 2011 the Ministry of Economy and Employment together with the IDAE granted aid for the purchase of electric vehicles within the E4 Strategy 2008-2012. So in the year 2008, four cars were supported, in 2009 one car, in 2010 two cars and one motorcycle and in 2011 one car.

42 From 2010 to 2012 the Ministry of Economy and Employment together with the IDAE granted aid to the installation of electric recharging points within the E4 Strategy 2008-2012. So support was given to 13 points in 2010, 29 points in 2011 and 10 points in 2012.

43 From 2008 to 2011 the Government of the Region of Murcia, in conjunction with the IDAE, granted aid for the purchase of electric vehicles within the E4 Strategy 2008-2010.