NATIONAL POLICY FRAMEWORK

for the deployment of alternative fuels infrastructure

(**ANNEX referenced in N°**1 **of** Resolution No 88/2017 of the Council of Ministers of 26 June 2017)

BACKGROUND

Alternative energy and fuels for transport

Over the last few years, Portugal has implemented an energy policy based on improving energy efficiency and promoting energy from renewable sources as a tool to tackle climate change, reduce external energy dependence and contribute to security of supply.

Indigenous renewable energy sources have played a leading role in promoting a balanced energy matrix, and have also played a part in reducing the risk of changes in the price of some commodities and the resulting implications for the energy bill.

It is also worth pointing out this energy sector's contribution to the national economy in establishing a whole new industrial and business sector which creates jobs, promotes regional development, boosts exports of goods and services, drives scientific innovation and research, and is capable of attracting international investment and encouraging national companies to go international.

With the publication of Resolution No 20/2013 of the Council of Ministers of 10 April 2013, the national renewable energies and energy efficiency strategy was revised by the approval of the National Energy Efficiency Action Plan for the period 2013-2016 (*Plano Nacional de Ação para a Eficiência Energética* - PNAEE) and the National Renewable Energy Action Plan for the period 2013-2020 (*Plano Nacional de Ação para as Energias Renováveis* - PNAER). This joint review made it possible to align the objectives of these two plans and, as a result, to adjust supply to energy demand, taking into account primary energy consumption and the contribution of the energy sector to reducing greenhouse gas emissions.

The implementation of these strategic energy plans aims to ensure that Portugal meets its commitments at national and EU level, in particular within the context of Directive 2009/28/EC on the promotion of renewable energy sources and Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, more specifically:

- To ensure the fulfilment of commitments made at EU level with regard to the promotion of renewable energy, i.e., meeting the target of incorporating 31% of energy from renewable sources into the gross final energy consumption in 2020 and ensuring that the share of energy from renewable sources in all forms of transport in 2020 is at least 10% of the final energy consumption in the transport sector;

- To contribute to achieving the objective of reducing the overall primary energy consumption by 25%, as well as the specific target of 30% for the Public Administration, by 2020;
- To reduce the country's energy dependence and ensure security of supply by promoting a balanced energy mix;
- To reduce greenhouse gas (GHG) emissions.

With regard to the overall target of incorporating energy from renewable sources into gross final energy consumption, Portugal has the fifth most ambitious target of all EU-28 countries, and this objective includes the electricity production, heating and cooling and transport sectors.

Directive 2009/28/EC also set a specific objective for all Member States to incorporate 10% of energy from renewable sources into transport. In view of the current state of the art, biofuels are expected to play a significant role in achieving this target.

Portugal has demonstrated positive results in the field of renewable energy, which has enabled it to reduce energy dependence from abroad on the one hand and, on the other, to contribute to the reduction of greenhouse gas emissions.

Oil and oil products continue to be the main source of primary energy, accounting for 42.8% of final primary energy consumption in 2015. In the same year, the consumption of renewable energy accounted for around 22.2% in real terms, while natural gas accounted for approximately 18.6%. However, there has been an overall decline in the consumption of oil as a primary energy source since 2005, while the contribution of renewable energy has been increasing over the last few years.

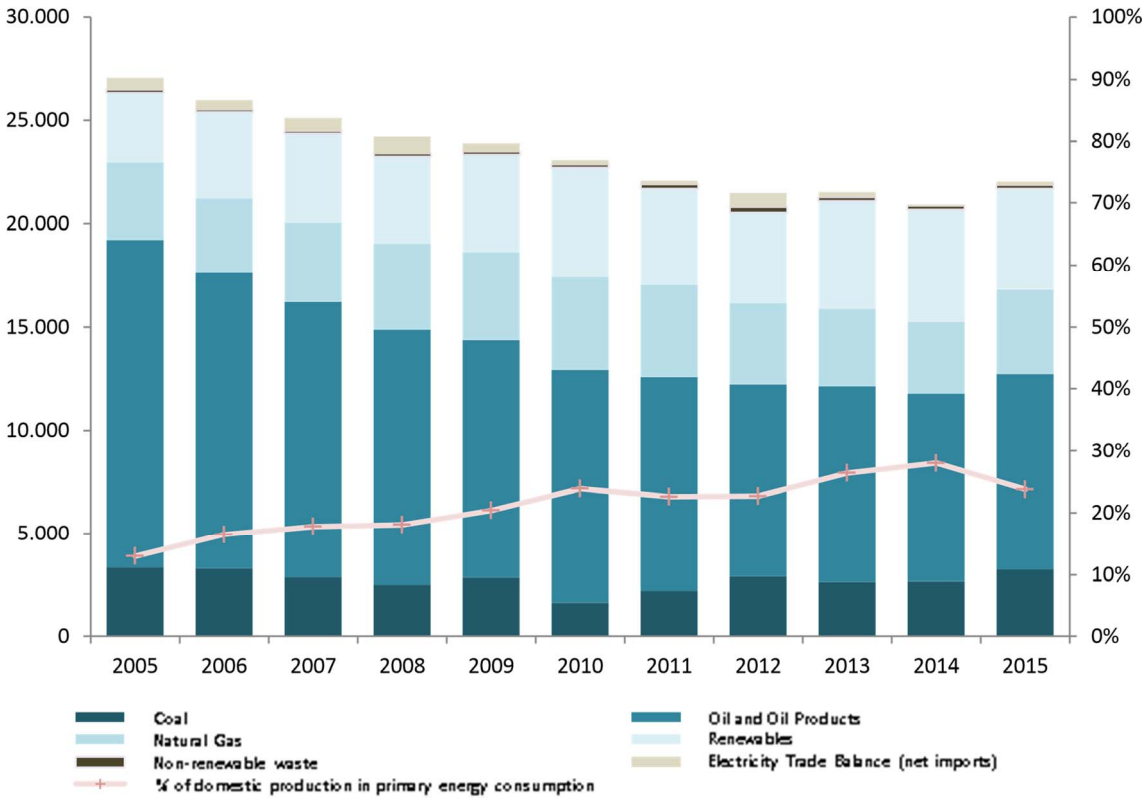


Figure 1 - Evolution of Total Primary Energy Consumption (ktoe). Source DGEG.

With regard to final energy consumption, a clear trend towards reduced consumption has been observed in recent years, accompanied by a reduction in the consumption of oil products.

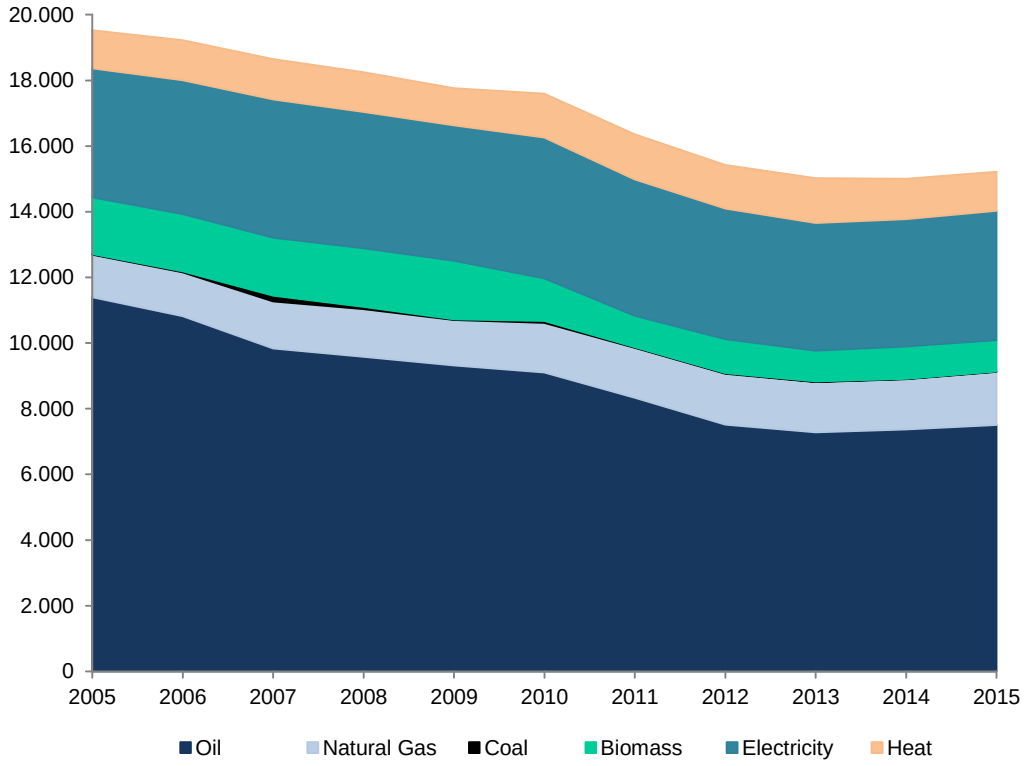


Figure 2 - Final Energy Consumption (ktoe). Source: DGEG.

In 2015, the overall rate of incorporation of renewable energy sources into gross final energy consumption was 28.0%, with Portugal having already achieved around 90% of the target for 2020.

As a result, energy dependence has gradually been reduced (the variations that have been seen are mainly associated with the annual water regime) and stood at 78.3% in 2015. This represented a 10.5% drop compared to 2005, when there was an energy dependence of around 88.8%. However, due to the period of drought in 2015, there was an increase in energy dependence of 5.9% compared to 2014.

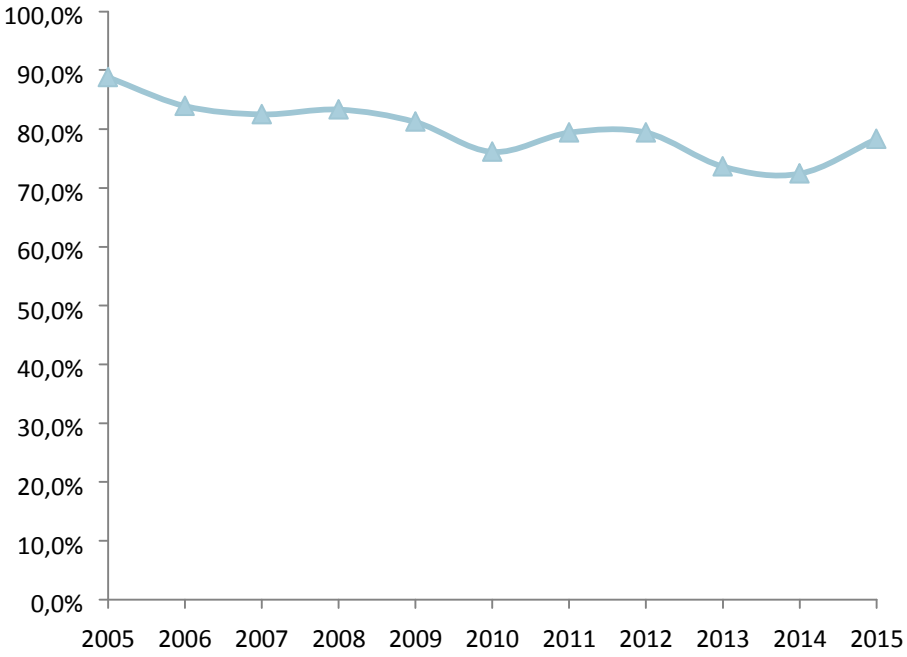


Figure 3 - Evolution of energy dependence. Source: DGEG.

With regard to GHG emissions, total emissions in Portugal in 2014 were around 64.5 Mtonnes CO_2eq (corresponds to the value of total emissions without accounting for the Land Use, Land-Use Change and Forestry (LULUCF) sector), which represents an increase of 6.4% compared to 1990, but a decrease of approximately 0.6% compared to 2013. Since 2005, when GHG emissions accounted for almost 90 Mtonnes of CO_2eq, there has been a gradual reduction in this figure, with around 44 Mtonnes CO_2eq of emissions associated with the energy sector, which represents a 31.6% reduction in the sector's emissions since 2005.

Transport remains the main energy-consuming sector, accounting for around 36.5% of final energy consumption in 2015, with road transport accounting for almost all emissions associated with the sector.

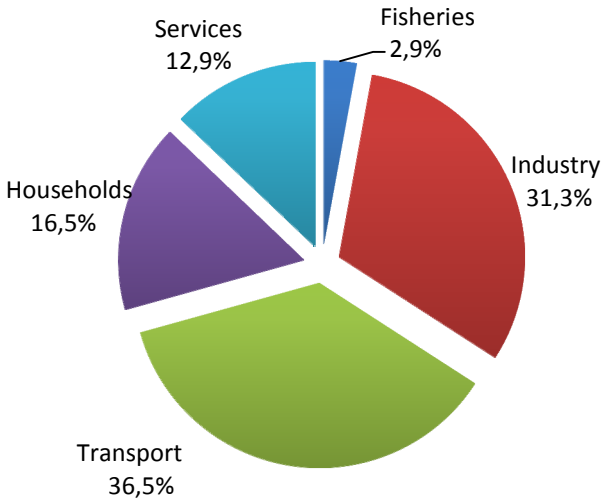


Figure 4 - Final energy consumption in 2015, by sector of activity. Source DGEG.

Oil is the main energy source consumed in this sector, with transport accounting for around 74% of the final oil product consumption, mainly diesel and petrol.

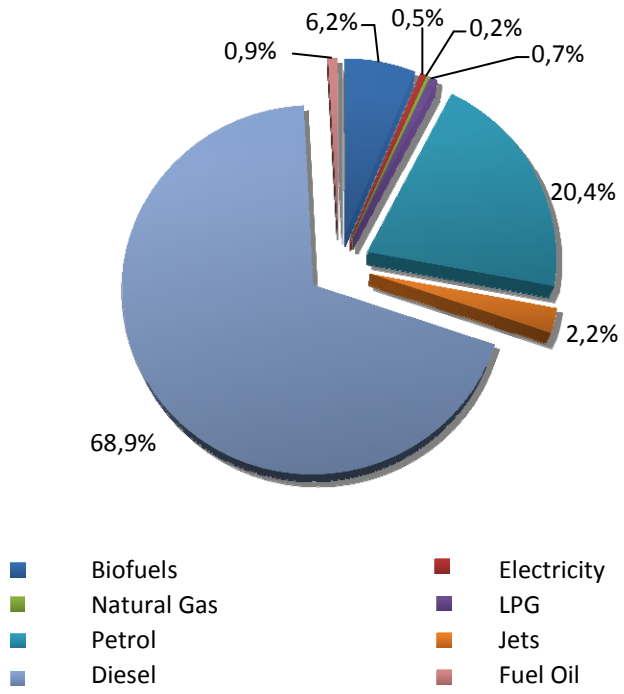


Figure 5 - Final energy consumption in 2015 in the transport sector, by fuel type. Source: DGEG.

Diesel consumption in this sector in 2015 was 4 187 ktoe, representing 86% of the total consumption of this oil product, while petrol consumption was approximately 1 136 ktoe.

The energy sector, including transport, remains the main sector responsible for GHG emissions, accounting for 68% of national emissions in 2014.

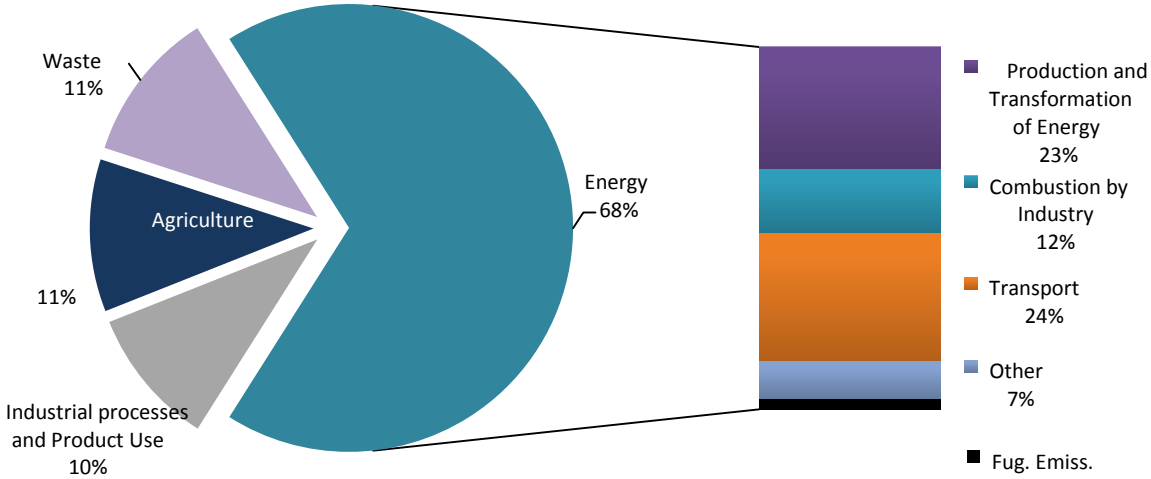


Figure 6 - GHG emissions by sector in 2014. Source: Portuguese Environment Agency (*Agência Portuguesa do Ambiente* - (APA, I. P.)/Own production.

Transport is the main source of GHG emissions, accounting for around 24% of total emissions in 2014, with road transport once again the main source of emissions associated with this sector.

The National Climate Change Programme 2020/2030 (*Programa Nacional para as Alterações Climáticas 2020/2030* - PNAC 2020/2030), approved by Resolution No 56/2015 of the Council of Ministers, is a strategic instrument for mitigating climate change, which aims to promote decarbonisation and ensure a sustainable path towards reducing national GHG emissions.

To this end, the PNAC 2020/2030 sets emission reduction targets for various sectors, including the transport sector: -24% in 2020 and -26% in 2030, compared to 2005.

In order to assess the progress in implementing this programme's policies and measures, the National System for Policies and Measures (SPeM) was created by Resolution No 45/2016 of the Council of Ministers.

In view of the significant energy consumption associated with transport (approximately 5 608 ktoe in 2015, mostly from oil-derived fuels) and the fact that this is an extensive and sensitive area which impacts on almost all other sectors of activity, a set of policies and measures were defined in the PNAER and the PNAEE aimed at promoting the use of energy from renewable sources and reducing consumption in this sector, thereby encouraging a shift to a policy of lower carbon intensity.

Transport therefore appears to be a priority sector for defining policies and measures aimed at promoting decarbonisation, and has enormous potential for improvement in the areas of energy diversification and efficiency.

On 28 March 2011, the European Commission, which had already proposed and adopted a 10% target for the share of renewable energy sources in gross final energy consumption in the transport sector with Directive 2009/28/EC, published the Commission White Paper entitled 'Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system', which called for a reduction in the dependence of transport on oil and proposed a reduction of 60% in greenhouse gas emissions from transport by 2050, as measured against 1990 levels. In that same document, the Commission proposed the adoption of a wide range of initiatives, including the development of a sustainable alternative fuels strategy and the appropriate infrastructure.

Two years later, in 2013, based on a consultation of stakeholders and national experts, as well as the expertise reflected in the Communication from the Commission of 24 January 2013 entitled ‘Clean Power for Transport: A European alternative fuels strategy’, electricity, hydrogen, biofuels, natural gas, and liquefied petroleum gas (LPG) were identified as currently the principal alternative fuels with a potential for the long-term substitution of oil.

It was in this context that Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure was published the following year, establishing a common framework of measures to promote and deploy alternative fuels infrastructure in the EU in order to minimise dependence on oil and mitigate the environmental impact of transport.

To this end, this Directive sets out minimum requirements for the building-up of alternative fuels infrastructure, including, in particular, recharging points for electric vehicles

and refuelling points for natural gas (CNG and LNG) and hydrogen, to be implemented by means of the mandatory approval of national policy frameworks by the Member States, as well as common technical specifications for such recharging and refuelling points, and user information requirements.

This National Policy Framework therefore includes an assessment of the current state and future development of the market for alternative fuels in the transport sector in Portugal and the development of alternative fuels infrastructure, considering, where relevant, cross-border continuity. National objectives and targets should be defined for the deployment of alternative fuels infrastructure, specifically in the field of electric mobility and natural gas, as well as measures necessary to ensure that these objectives and targets are reached.

PART A -
CURRENT SITUATION AND OUTLOOK

1 – ELECTRICITY

The national electricity generation system is characterised by its strong commitment to renewable technologies, which in 2015 accounted for around 60.9% of the total installed capacity for electricity generation, with an installed capacity of 12 293 MW from different renewable technologies (Hydro, Wind, Biomass, Solar, Geothermal and Wave). The remaining installed capacity of 7 908 MW uses fossil technologies (Coal, Oil and Natural Gas).

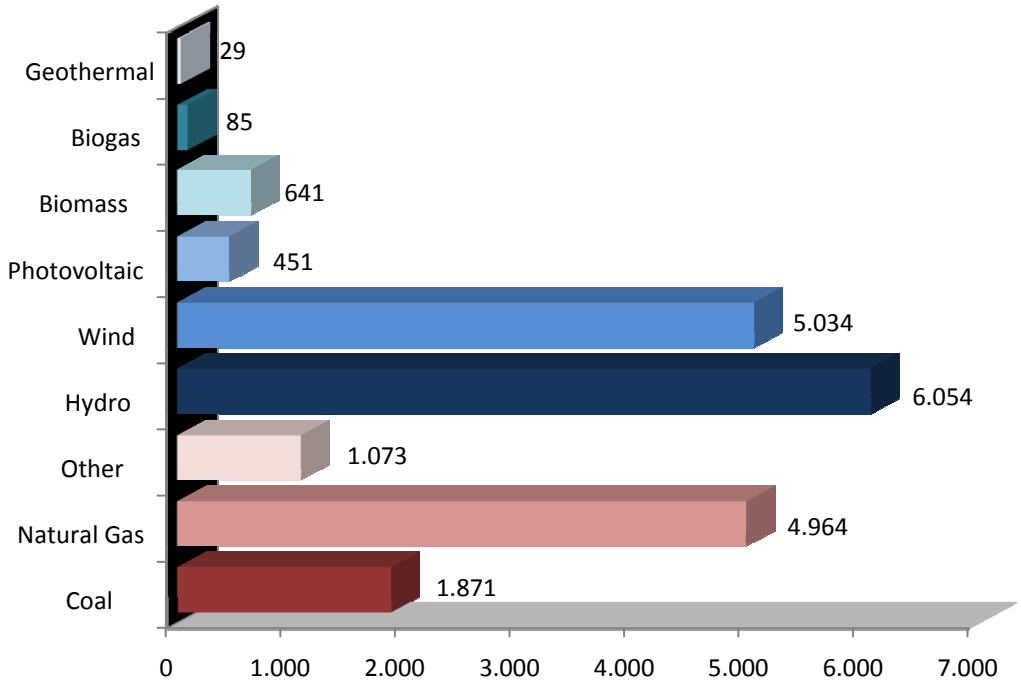


Figure 7 - Installed power in power stations in 2015, by technology (MW). Source: DGEG.

Renewable energy technologies include hydro and wind power sources, which account for approximately 49% and 41% of total renewable capacity respectively, and which together account for 55% of the total installed capacity in Portugal.

Through a commitment to the complementarity between hydro and wind power and with the installation of reversible hydro capacity, Portugal has been able to integrate significant percentages of electricity from intermittent renewable sources into the electricity generation system.

In 2015, total gross electricity generation was 52 421 GWh, of which 48.7% was from renewable sources. This had a positive and significant impact on reducing the electricity trade balance.

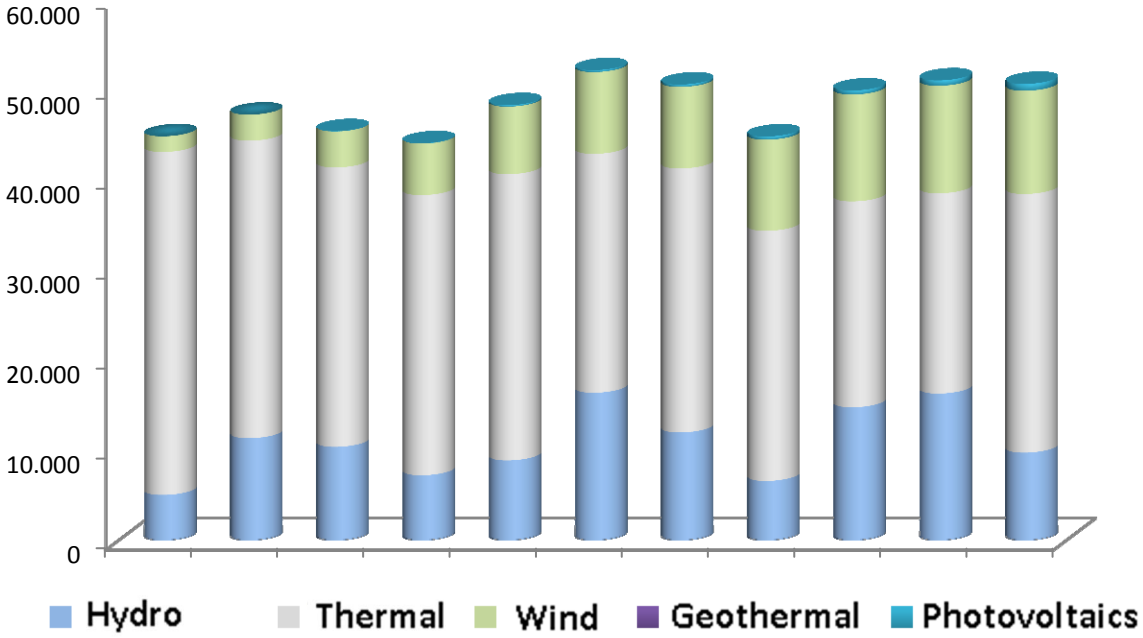


Figure 8 - Evolution of gross electricity generation (GWh). Source: DGEG.

In terms of fossil-based technologies, natural gas accounts for around 63% of total fossil capacity and around 25% of total installed capacity in Portugal. Despite its importance in the electricity generation sector, electricity generation from this energy source has been decreasing significantly over the last few years. It should be noted that, in the case of consumption for electricity generation, there was an AAGR of -18.7% in the period 2005-2014. This was a result of the continuous increase in renewable production and the increased use of coal-fired power stations (given the attractive price of this fuel), especially in recent years. However, in 2015, due to a decrease in energy generated from hydropower, the consumption of natural gas for electricity generation trebled compared to the previous year, with the AAGR rising to -6.7% in the period 2005-2015.

Furthermore, with the closure of some thermal power stations in mainland Portugal, such as the Carregado Power Station, and the conversion of cogeneration systems to natural gas, the component of the mix associated with oil has been decreasing. Currently, the only remaining oil-fired power stations are in the Autonomous Regions and there is some cogeneration capacity.

Electricity consumption amounted to 46 856 GWh (3 940 ktoe), with the industrial sector accounting for 37% (the main electricity consumer), followed by the services (34%) and household (26%) sectors. Transport accounts for virtually no consumption of this secondary energy source.

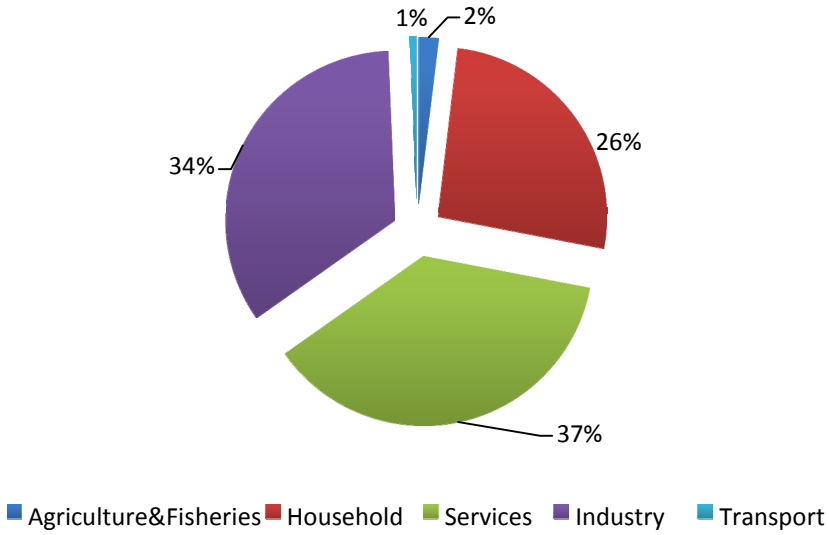


Figure 9 - Final consumption of electricity in 2015, by sector of activity. Source: DGEG.

With regard to the remuneration scheme, until 2012, electricity generation from renewable sources benefited from a special production system with feed-in tariffs (FITs), created by Decree-Law No 312/2001 of 10 December 2001. Electricity generators were then remunerated based on a formula established by specific legislation (Decree-Law No 189/88 of May 27 1988, as amended by Decree-Law No 225/2007 of 31 May 2007) and the FITs were updated at appropriate intervals to reflect the evolution in the investment and operational costs of each technology, as well as inflation and energy prices. Access to this support mechanism was subject to a limit, determined by the technical capability of the electricity transmission and distribution grids to absorb new capacity. However, once access to the grid had been granted, there was no limit to the output that could benefit from FITs, although it was limited to an overall energy value or a specific number of years (generally 15 years), whichever was reached first. After this limit, installations entered into the market system.

More recently, with the publication of a new regulatory framework for the electricity sector (Decree-Law No 215-A/2012 and Decree-Law No 215-B/2012 of 8 October 2012), any generator of electricity from renewable sources was now able to sell it immediately and directly on the market.

Until 2015, the decentralised generation of electricity from renewable resources, more specifically micro-generation (Decree-Law No 363/2007 of 2 November 2007, as amended by Decree-Law No 118-A/2010 of 8 October 2010 and Decree-Law No 25/2013 of 13 March 2013) and mini-generation (Decree-Law No 34/2011 of 8 March 2011, as amended by Decree-Law No 25/2013 of 19 February 2013), required the existence of an electricity-powered installation with actual consumption and an electricity supply agreement entered into with a supplier, with the energy generated being fed in full to the Public Service Electricity Grid (*Rede Elétrica de Serviço Público* - RESP) and remunerated under the general scheme or the subsidised scheme. Since 2008, these systems grew on average by 22.9 MW/year, reaching 171 MW in 2015. The energy produced in this decentralised generation system mainly uses photovoltaic technology (over 99%).

Decree-Law No 153/2014 of 20 October 2014 was published with a view to finding new solutions for the generation of decentralised energy and technological innovation. It changed the role of electricity producer-consumer (or self-consumption producer) by allowing

connections to be made to the public electricity distribution grid, in the context of self-consumption, supplying to third parties and feeding surplus production into the grid.

Ministerial Implementing Order No 14/2015 of 23 January 2015, as amended by Ministerial Implementing Order No 60-E/2015 of 2 March 2015, defined the procedure for submitting notification prior to commencing operation of self-consumption production units, as well as the procedure for obtaining a prior inspection certificate for self-consumption and small-scale production where all electricity produced will be fed into the Public Service Electricity Grid (*Rede Elétrica de Serviço Público* - RESP). Up to the end of 2015, 25 MW of power were generated by self-consumption, of which around 36% did not inject any surplus production into the grid.

The reference tariff applicable to electricity produced through small production units, as well as the percentages to be applied to the reference tariff depending on the primary energy used by those units, is set out in Ministerial Implementing Order No 15/2015 of 23 January 2015. The reference tariff applied in 2015 was EUR 95/MWh and the associated percentages are: Solar - 100%; Biomass - 90%; Biogas - 90%; Wind - 70%; and Hydro - 60%.

With regard to cogeneration, Decree-Law No 68-A/2015 of 30 April 2015 reinforced the maintenance of renewable and high-efficiency cogeneration, with the application of more sustainable remuneration schemes. It also considered an arrangement in which the energy produced could be totally or partially injected into the RESP and another that allows the self-consumption of this energy. For renewable cogeneration plants, the current reference tariff is: (*i*) P ≤ 2MW: EUR 82.90/MWh and (*ii*) 2MW < P ≤ 100 MW: EUR 67.26/MWh.

More recently, Ministerial Implementing Order No 173/2016 of 21 June 2016 was published, which set out the terms and conditions for awarding electricity injection capacity at a specific point on the Public Service Electricity Grid (*Rede Elétrica de Serviço Público* - RESP) applicable under the special remuneration scheme for licensed cogeneration production. This Ministerial Implementing Order also set out the terms under which the Supplier of Last Resort purchases the electricity produced in cogeneration not consumed in the associated unit, within the scope of application of subcategory A of the general remuneration scheme.

1.1 - ROAD TRANSPORT

1.1.1 - Programme for Electric Mobility in Portugal

As part of the implementation of the first PNAEE, approved by Resolution No 80/2008 of the Council of Ministers of 20 May 2008, which aimed to position Portugal as a pioneer in the adoption of new models of environmentally sustainable mobility capable of exploiting the connection to the electrical grid and maximising the advantages of energy from renewable sources, the Programme for Electric Mobility in Portugal was created through Resolution No 20/2009 of the Council of Ministers of 20 February 2009.

The targets, objectives and work plan of this programme were approved by Resolution No 81/2009 of the Council of Ministers of 7 September 2009, which included measures to encourage the Electric Mobility Programme in its pilot phase and to promote the widespread use of electric vehicles, including the creation of a EUR 5 000 subsidy for the purchase of electric vehicles by individuals which could increase to as much as EUR 6 500 if an internal combustion vehicle was also scrapped.

As a result, and with a view to '*creating conditions for the widespread use of electric vehicles, ensuring an infrastructure which is appropriate for the evolution of the electric vehicle fleet and the development of a service model that allows any citizen or organisation to access each and every electric mobility solution provided by any electric vehicle manufacturer*', a strategy comprising three main points was outlined:

- Creation of a pilot infrastructure of publicly accessible recharging points. These recharging points will be installed at national level through high power recharging points (rapid recharging points) on the main national roads, and at local level (through an agreement with 25 municipalities),
- Promotion of electric vehicles, by defining financial and tax incentives and other benefits associated with ease of driving and parking (free parking, etc.),
- Commitment to technological development and research in the context of creating the conditions for an electric mobility pilot project, including the electric vehicle and battery components.

This programme was aligned with national energy and climate objectives, and the electric mobility model developed and adopted focused on interoperability and centralisation of services with a view to putting the user first. Portugal therefore became the first country to guarantee that any electric vehicle user could recharge their vehicle at any publicly accessible recharging point operated by any recharging point operator.

In summary, the electric mobility model adopted in Portugal - MOBI.E consisted of a nationwide recharging system accessible to all users. This competitive and open system with low barriers to entry also guarantees technical interoperability (option to recharge any type of vehicle) and service interoperability (access to any recharging point through a single registration or contract and authentication and access mechanism).

Decree-Law No 39/2010 of 26 April 2010 regulates the organisation of, access to and exercise of electric mobility activities and establishes a pilot electric mobility network with 1,350 recharging points installed in 25 municipalities, allowing universal access and the monitoring of the network and its consumption.

However, due to the small number of electric vehicles placed on the market, and the fact that the corresponding use of the infrastructure fell short of that initially forecast in the Government's targets, Order No 9220/2013, published on 15 July 2013, set out the need to carry out a critical analysis of the MOBI.E initiative.

In this context, it was decided to extend the pilot phase and review the programme. This involved several studies and the intervention of a significant number of stakeholders in order to identify the constraints that prevented electric mobility from developing more fully.

Decree-Law No 90/2014 of 11 June 2014 was published in 2014 and reassessed the adopted electric mobility model, with the purpose of '*making existing investments more sustainable, in line with the evolution of demand and associated economic benefit, and encouraging a more effective integration of this programme with energy and mobility systems from a global perspective for smart mobility*'.

In this same context and based on data compiled during the pilot phase, a further update was made to the studies on the location of the normal and high power recharging points (normal and rapid recharging points) submitted in December 2014 to update some of the proposed recommendations regarding the recharging network yet to be completed within the context of the MOBI.E pilot network.

As a result, the current national network, consisting of a fully interoperable recharging infrastructure, will have a first pilot phase with a total of 1,200 normal power recharging points (normal recharging points) and 50 high power recharging points (rapid recharging points). Of these, 1,076 normal power recharging points and one high power recharging point had been installed by 2015. When this phase of the pilot network is completed (including the planned relocation of some recharging points), around 8.5 million citizens across 132 municipalities will be covered.

A combination of the changes that have taken place in recent years with the aim of boosting electric mobility in Portugal and bolstering the measures to be implemented to overcome the constraints identified led to the Electric Mobility Action Plan, which was approved by Order No 8809/2015 of 10 August 2015.

More recently, several Ministerial Implementing Orders provided for in Decree-Law No 39/2010 of 26 April 2010, as amended by Decree-Laws No 170/2012 of 1 August 2012 and 90/2014 of 11 June 2014, were published with a view to implementing this legislation, more specifically:

- Ministerial Implementing Order No 240/2015 of 12 August 2015, setting the amount of the fees due for dealing with applications to register as an electric mobility electricity retailer, for issuing licences to operate recharging points and for carrying out regular inspections;
- Ministerial Implementing Order No 241/2015 of 12 August 2015, on the technical requirements for granting licences to operate recharging points in the electric mobility network, as well as some procedural rules applicable to the filing of the respective application;
- Ministerial Implementing Order No 220/2016 of 10 August 2016, on the minimum powers and technical standards to be met by recharging facilities for electric vehicles in buildings and other urban developments;
- Ministerial Implementing Order No 221/2016 of 10 August 2016, setting out the technical and safety rules applicable to the installation and operation of electric vehicle recharging points;
- Ministerial Implementing Order No 222/2016 of 11 August 2016, setting out the terms applicable to licences for the private use of public land for installing electric vehicle recharging points in a publicly-accessible public place on public land.
- Ministerial Implementing Order No 231/2016 of 29 August 2016, defining the coverage, conditions and minimum amounts of compulsory civil liability insurance to be held for damages sustained in the marketing of electricity and the operation of recharging points for electric mobility.

Finally, as the market for light electric vehicles began to show sustained growth and electric vehicles became an increasingly competitive and rational option, Resolution No 49/2016 of the Council of Ministers of 1 September 2016 was published in order to improve the infrastructure for recharging these vehicles. This Resolution of the Council of Ministers therefore approved the completion of the first phase of the MOBI.E Pilot Network and launched the second phase of the Pilot Network to cover municipalities not included in the first phase, extending the Pilot Network to a total of 1 604 normal power recharging points (normal recharging points) and 50 high power recharging points (rapid recharging points), known as the MOBI.E Network+. The purchase, installation and connection of the recharging points in the second phase will be carried out by the end of 2018 by the MOBI.E company and will be financed by POSEUR, the Sustainability and Resource Use Efficiency Operational Programme 2020, with the national contribution covered by the Portuguese Carbon Fund, now part of the Environmental Fund.

1.1.2 - Recharging infrastructure

Network of normal power recharging points (normal recharging points)

By the end of 2015, normal power recharging points (normal recharging points) for the MOBI.E pilot network were spread across 28 municipalities: Lisbon, Loures, Cascais, Almada, Braga, Leiria, Viana do Castelo, Guimarães, Torres Vedras, Santarém, Setúbal, Porto, Vila Nova de Gaia, Sintra, Castelo Branco, Guarda, Évora, Beja, Faro, Coimbra, Aveiro, Portalegre, Vila Real, Viseu, Bragança, Anadia, Felgueiras and Oliveira de Frades.

In addition, there were 178 normal power recharging points which were connected to the MOBI.E network but were not part of the pilot network, with 53 located in public areas and 125 in private, publicly accessible locations.

With regard to the network of normal power recharging points (normal recharging points), according to the Electric Mobility Action Plan, there are still 124 recharging points to be installed in 62 new locations as part of this first phase of the Pilot Network. Of these 124 recharging points, 22 are in the municipality of Porto with the remainder in 51 new municipalities.

Recharging points were allocated based on a set of priorities:

Firstly, new recharging points should be considered in strategic municipalities, in addition to those already covered, thereby further minimising the distances between points.

In addition to the municipalities which initially joined the Portuguese Smart Cities Network (RENER) and, as a result, the MOBI.E pilot project, an additional group of municipalities also expressed an interest in joining. To this end, they drew up and submitted Municipal Electric Mobility Plans (*Planos Municipais de Mobilidade Elétrica* - PMME) for approval. As such, the allocation of a total of 20 recharging points to the following municipalities was considered: Abrantes, Alvaiázere, Chaves, Elvas, Estremoz, Seixal, Trofa, Valença, Vendas Novas, and Vila Nova da Barquinha.

Municipalities that have recently joined RENER, such as the municipalities of Albufeira, Baião, Maia, Portimão or Tavira, are also expected to be allocated new recharging points.

Plans are also in place to allocate recharging points to municipalities, such as Oeiras and Palmela, which showed an interest in electric mobility despite their PMME plans not having been approved.

With the publication of Resolution No 49/2016 of the Council of Ministers of 1 September 2016, a second phase of the MOBI.E Pilot Network was launched which includes the installation of a further 404 normal power recharging points (normal recharging points) in municipalities not covered in the first phase. The roll-out of this second phase of the pilot network will ensure that all municipalities will have access to an infrastructure with at least two recharging points, extending the MOBI.E network throughout the national territory.

Network of high power recharging points (rapid recharging points)

There are currently 21 high power recharging points (rapid recharging points) installed in 11 locations. One of these belongs to the pilot phase of the MOBI.E network, which includes the installation of 50 high power recharging points.

TABLE 1

Location of high power points already installed

Municipality	Road/Type of Location	Operator	Number of Points
Azambuja	A1 Service Area	Galp	2
Calheta (Madeira)	Urban	EEM	1
Oeiras	A5 Service Area	Galp	1
Lisbon	Urban	Prio E.	1
Pombal	A1 Service Area	Galp	2
Porto	Filling Station	Prio.E	1
Porto Moniz (Madeira)	Urban	EEM	1
Vila Nova de Gaia	Filling Station (1). Urban (1)	EDP MOP (1). Prio.E (1)	2
		Total	11

Furthermore, some limited-access high power recharging points (rapid recharging points) have also been installed in private locations, mainly by car manufacturers such as Nissan, Renault and Volkswagen.

Some entities, such as EDP, at the Sines plant, or Lisbon City Council, have also installed recharging points at their premises.

Under the MOBI2Grid project, attempts were made, together with the municipalities of Viana do Castelo and Valença, to define a strategic location for the new points, taking into account the needs associated with the Porto-Vigo cross-border corridor. There are, therefore, 49 high power recharging points (rapid recharging points) yet to be installed in the pilot phase, of which 46 already have a defined location, with 12 in cities and 34 on motorways.

TABLE 2

Planned location of high power points to be installed

Municipality	Road/Type of Location	Number of Points
Abrantes	A23	2
Alcácer do Sal	A2	2
Alcochete	A12	2
Aljustrel	A2	2
Aveiro	City	1
Barcelos	A11	2
Braga	City	1
Cascais	City	1
Celorico da Beira	A25	2

Coimbra	City	1
Estarreja	A1	2
Estremoz	A6	2
Évora	City	1
Fundão	A23	2
Lagos	A22	2
Lisbon	City	1
Loulé	A22	2
Loures	City	1
Matosinhos	City	1
Mealhada	A1	2
Palmela	A2	2
Porto	City	1
Santarém	A1	2
Torres Vedras	A8	2
Trofa	A3	2
Valença	City	1
Viana do Castelo	City	1
Vila Nova de Famalicão	A7	2
Vila Real	City	1

The locations were selected taking into account the following criteria: (i) Interurban pilot-network connection; (ii) Interurban convenience network; (iii) Mobility management point network; and (iv) Cross-border network.

The proposed locations also took some constraints into account. For example, in the case of motorways, options involving service areas were prioritised.

Private recharging

In addition to the approval of the Electric Mobility Action Plan, there were also several legislative updates in 2015 in relation to electric mobility, including the approval of a new legal framework enabling recharging points located in publicly accessible private spaces to be admitted to the MOBI.E network, such as points located in commercial premises.

Given that it is possible to differentiate energy associated with the recharging of electric vehicles in publicly accessible private spaces, as this infrastructure is integrated with MOBI.E and, via the latter, with the management of the electricity grid, Portugal is one of the first countries to have specific rules in this area, anticipating compliance with the objectives of Directive 2014/94/EU .

At the end of 2015, 149 recharging points (131 normal power and 18 high- power) in publicly accessible private spaces were connected to the MOBI.E network, out of a total of

1 275 recharging points, of which 1 254 were normal power recharging points and 21 were high power recharging points.

TABLE 3

Number of recharging points installed at the end of 2015. Source: MOBI.E

Scope of Installation	Type of Point	Portugal	
		Public Space	Private Space
MOBI.E Pilot Network	Normal Power (≤ 22kW)	1 070	6
	High Power (> 22kW)	1	0
Other Initiatives	Normal Power (≤ 22kW)	53	125
	High Power (> 22kW)	2	18
	Total	1 126	149

Electricity consumption by points connected to the national network has been increasing in recent years, with a total consumption of approximately 642,629 kWh by the end of 2015.

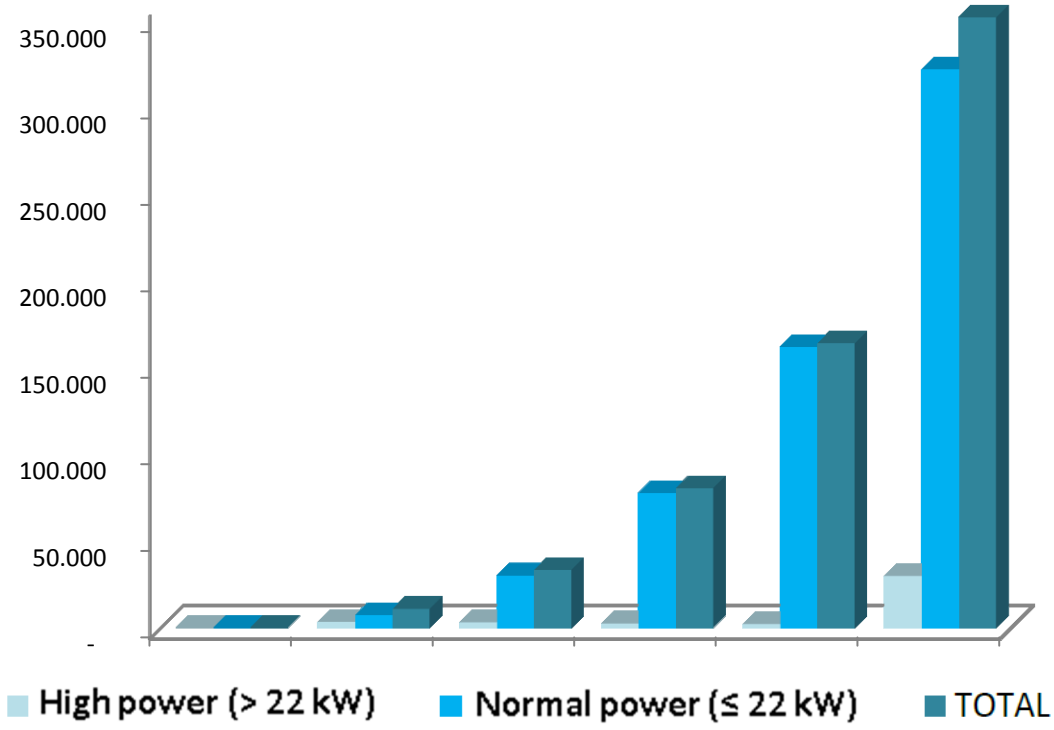


Figure 10 - Evolution of annual consumption by recharging points (kWh).
Source: MOBI.E/Own production.

Management systems

The management of the electric mobility network is based on the Centre for Excellence and Innovation in the Automobile Industry's (*Centro para a Excelência e Inovação na Indústria Automóvel* - CEIIA) MOBI.E platform, which is the result of a partnership between the CEIIA and MOBI.E. This electronic platform enables real-time monitoring of the entire network of

recharging points and is able to provide comprehensive information on network use, the energy profile and emissions associated with electric mobility.

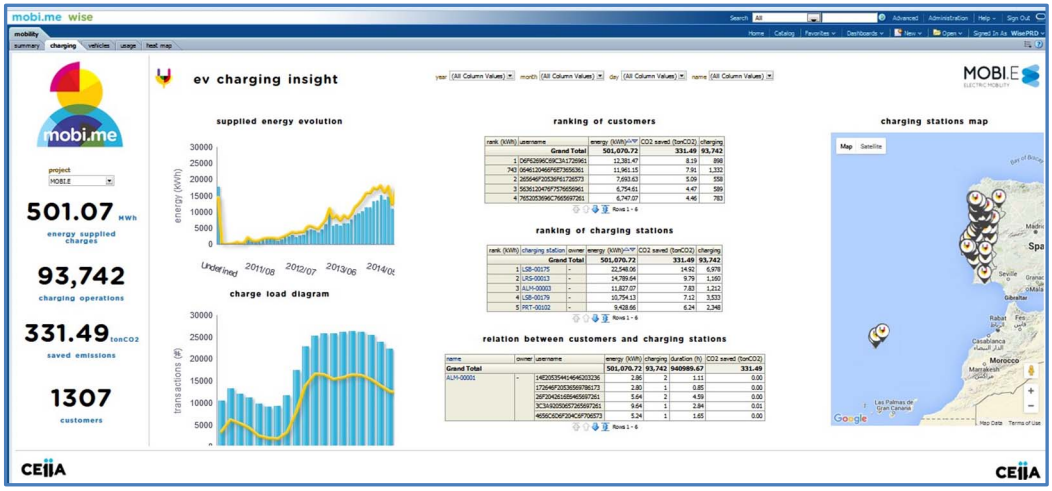


Figure 11 - MOBI.E Platform

As already mentioned, since the beginning of its Electric Mobility Programme, Portugal has sought to develop a system for integrating the entire network of smart and interoperable recharging points, capable of encouraging the use of electricity, mainly from renewable sources, to recharge electric vehicles, and allowing any user to access any recharging point belonging to any operator (roaming) and compatibility with all makes of vehicle, based on the smart management provided by MOBI.E, SA.

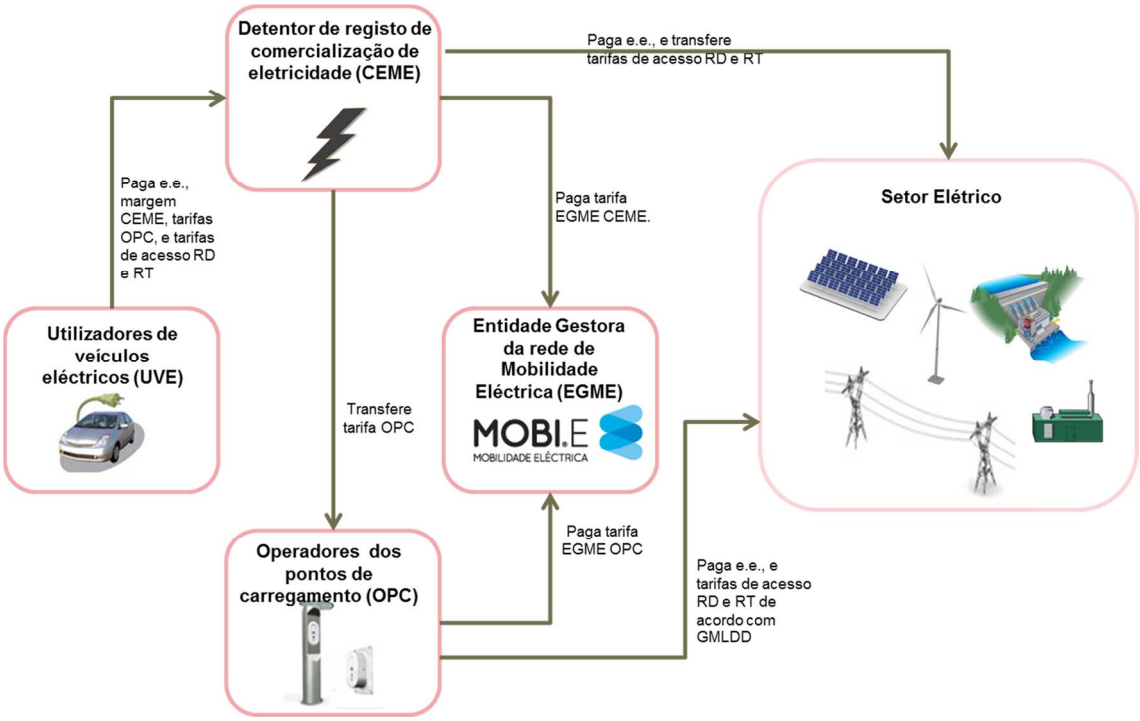


Figure 12 - Financial flow of the Electric Mobility network.

PT	EN
Detentor de registo de comercialização de eletricidade (CEME)	Electric Mobility Electricity Retailer (CEME)
Paga e.e., e transfere tarifas de acesso RD e RT	Pays for electricity and transfers tariffs to access the distribution and transmission networks
Paga e.e., margem CEME, tarifas OPC, e tarifas de acesso RD e RT	Pays for electricity, the CEME mark-up, OPC tariffs and tariffs to access the distribution and transmission networks
Paga tarifa EGME CEME	Pays the EGME's CEME tariff
Setor Elétrico	Electricity Sector
Utilizadores de Veículos Elétricos (UVE)	Electric Vehicle Users (UVE)
Transfere tarifa OPC	Transfers the OPC tariff
Entidade Gestora da rede de Mobilidade Eléctrica (EGME)	Managing Body of the Electric Mobility Network (EGME)
Operadores dos pontos de carregamento	Recharging point operators (OPC)
Paga tarifa EGME OPC	Pays the EGME's OPC tariff
Paga e.e., e tarifas de acesso RD e RT de acordo com GMLDD	Pays for electricity and tariffs to access the distribution and transmission networks in accordance with the GMLDD

Order No 6826/2015 established that the company MOBI.E, S.A. is the Managing Body of the Electric Mobility Network (*Entidade Gestora da Rede de Mobilidade Elétrica* - EGME) until 12 June 2018, renewable for a minimum period of one year.

This body is therefore responsible for managing and monitoring the electric mobility network, particularly in terms of the energy, information and financial flows necessary for its operation, and for ensuring the fulfilment of the obligations and rights of recharging point operators and electric mobility electricity retailers.

Electric Mobility Electricity Retailers (*Comercializadores de Eletricidade para a Mobilidade Elétrica* - CEME) are bodies that are licensed to operate recharging points and registered to sell electricity for electric mobility. Their activity consists of the wholesale purchase and retail sale of electricity for supply to Electric Vehicle Users (*Utilizadores de Veículo Elétrico* - UVE).

UVEs are customers of the electric mobility network that use the electric mobility network's recharging points for their vehicles and have established a contractual link with one or more CEMEs for that purpose.

Recharging Point Operators (*Operadores de Pontos de Carregamento* - OPC) are the licence holders whose role consists of the installation, provision, operation and maintenance of public or private access infrastructure belonging to the electric mobility network and enabling the recharging of electric vehicle batteries.

In summary, UVEs use the electric mobility network's recharging points to recharge their vehicle's batteries. For that purpose, they enter into a contract with one or more CEMEs, to whom they pay the fee stipulated in the contract for providing the service. This fee is freely negotiated between the parties.

CEMEs must ensure that their UVE customers have access to any recharging point located on the mainland, in the Autonomous Region of the Azores or in the Autonomous Region of Madeira.

Subject to a fee, CEMEs agree on access to the recharging points with the OPCs in order to enable their use by UVEs. This agreement is achieved through the services and communication

systems of the EGME, which must guarantee the necessary conditions to establish legal relationships to enable UVEs to access any recharging point.

CEMEs should provide the EGME with relevant information to enable the EGME to fulfil its obligations regarding the management and monitoring of energy and financial flows, in order to guarantee information on energy volumes and energy prices charged at any given time. For regulated services provided by the EGME to CEMEs, CEMEs are required to pay the regulated tariff, notwithstanding the fact that the commercial relationship between these bodies may include other services provided under conditions agreed between the parties.

Furthermore, OPCs are required to integrate their systems and recharging points into the electricity mobility network managed by the EGME and to cooperate with the EGME to enable it to monitor their recharging points. Regulated services provided by the EGME to OPCs are subject to payment of the tariff, notwithstanding other services provided under conditions agreed between the parties.

Lastly, it should also be noted that a private access recharging point can be operated by the owner or holder of a private access location. The holder may decide to integrate this recharging point into the electric mobility network, in which case the holder is responsible for informing and cooperating with the EGME so that it can monitor the recharging point in question, in order to ensure the correct energy adjustments for the local installation and its treatment in the context of electric mobility. The abovementioned electrical installation is subject to approval in accordance with the applicable legislation.

If the respective holder is responsible for the installation, provision, operation and maintenance of private access recharging points, the services provided by the EGME are subject to the payment of a tariff. The holder may, however, agree for an OPC to install, provide, operate and maintain their recharging points.

1.1.3 - Electric Vehicles

In view of the characteristics of the national electrical system, which features strong injection of energy from renewable sources, the use of electric vehicles and the design of new transport service models based on electric mobility are especially interesting from an environmental and energy point of view.

Given its geographical location, Portugal has only developed electrical interconnections with its neighbouring country, which means that it can only directly export electricity to Spain. This limits the potential of some renewable energy sources, in particular from intermittent sources such as wind or solar. A strengthening of the electrical interconnection between the Iberian Peninsula and the rest of Europe (as well as with North Africa) is an essential step to continue the expansion and development of renewable energy sources in Portugal and, therefore, to take full advantage of this country's natural potential.

However, to this end, it is also important to develop alternative solutions that enable the storage and use of renewable energy, while optimising the management of the electricity grid.

Electric vehicles can play an important role in improving the balance of the electrical system. For example, they can be recharged at night using energy from intermittent technology such as wind power, which is generally not fully utilised, or the electricity stored in their batteries while parked can be injected into the grid when necessary, particularly at peak periods. Electric vehicles could therefore be used as devices capable of storing electricity and balancing the grid's peak consumption.

TABLE 4 - Number of vehicles with electric motors in circulation at the end of 2015. Source: Institute for Transport and Mobility (*Instituto da Mobilidade e dos Transportes* - IMT)/Own production

Alternative fuel vehicles	Number of Vehicles	Comments
	2015	
Electric cars	1 417	Light passenger vehicles
Plug-in hybrid electric cars	664	Light passenger vehicles
Electric light commercial vehicles	145	
Heavy-duty electric vehicles	9	Heavy goods vehicles
Electric buses	23	Heavy goods vehicles
Electric motorcycles	1 833	Includes mopeds, motorcycles, tricycles and quadricycles
Plug-in hybrid electric motorcycles	15	Includes mopeds, motorcycles, tricycles and quadricycles

At the end of 2015, 2, 226 light vehicles had been registered in Portugal, along with 1,848 motorbikes (including mopeds, motorcycles, tricycles and quadricycles) with electric motors.

Although the national market for electric vehicles reflects the same market difficulties as elsewhere in the world, namely the lack of scale of supply and demand that determines the price of the vehicle, the costs and durability of the batteries and the range and recharging time, there has been a considerable increase in the number of electric vehicles registered in Portugal. In less than five years, the number of pure electric vehicles has increased more than sixfold compared to 2011.

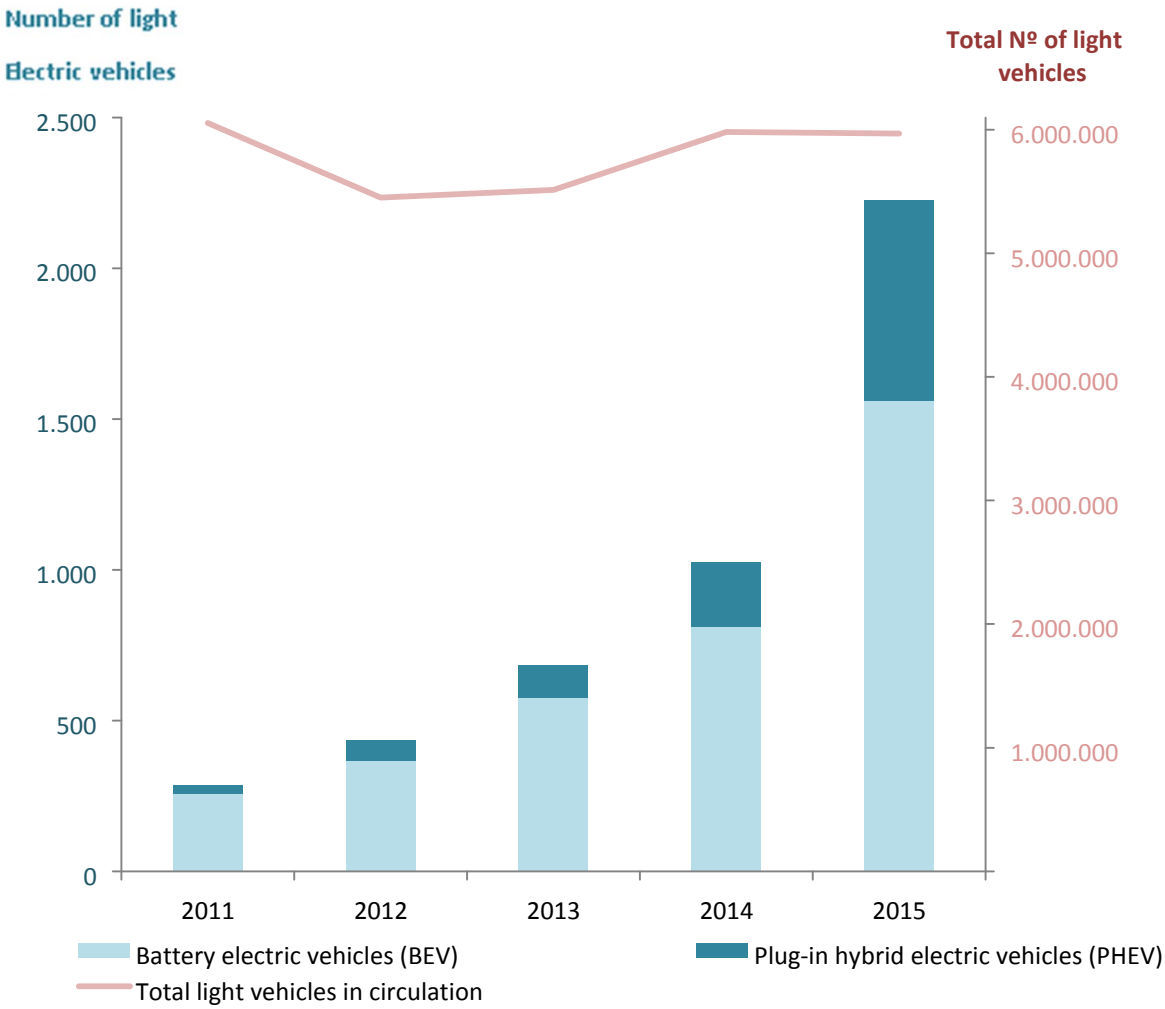


Figure 13 - Evolution in the number of light vehicles with electric motors in circulation. Source: Institute for Transport and Mobility (*Instituto da Mobilidade e dos Transportes* - IMT)/Own production.

The reduced relative weight of electric light vehicles in circulation compared to the total number of light vehicles in circulation is also confirmed by the reduced consumption of electricity for mobility. In fact, road transport consumes a very small amount of electricity. In 2015, electricity accounted for less than 0.001% of the total energy consumed in this sector, which still mainly uses oil-derived fuels, namely diesel and petrol. As a result, electricity consumption recorded for the transport sector was approximately 25,884 toe, with only 56 toe relating to consumption by road vehicles.

However, it should be noted that the electricity consumption indicated above for road transport only relates to consumption recorded in the MOBI.E public network of recharging points. At present, it is not possible to account for consumption at private recharging points that are not integrated into the electric mobility network, such as recharging at home by individuals.

1.1.4 - Incentives and Funding

Despite the strong constraints and limitations on the development of this market, the growth in the number of electric vehicles in circulation is mainly due to several measures to support electric mobility that have been implemented in Portugal.

For example, Decree-Law No 39/2010 of 26 April 2010 regulating the organisation of, access to and exercise of electric mobility activities and establishing a pilot network for electric mobility included a EUR 5 000 subsidy for the purchase of new electric vehicles by individuals, which could increase to as much as EUR 6 500 if an internal combustion vehicle was also scrapped. This subsidy was expected to be paid on the purchase of the first 5,000 electric vehicles and to be in force until the end of 2012.

More recently, the 'Green Tax' reform, approved by Law No 82-D/2014 of 31 December 2014, which amended a set of environmental tax rules in the energy and emissions, transport, water, waste, land-use planning, forests and biodiversity sectors, also provides for several tax incentives for the purchase and use of electric vehicles, namely:

- Granting of tax incentives for the purchase of electric and plug-in hybrid cars, through new amounts eligible for tax expenditure and autonomous taxation of Personal Income Tax and Corporate Income Tax;
- Extension of the possibility to deduct VAT from expenditure related to the purchase, manufacture or import, lease and conversion of electric or plug-in hybrid light passenger or mixed-use vehicles, when considered as passenger vehicles, the purchase cost of which does not exceed that defined in the Ministerial Implementing Order referred to in Article 34(1)(e) of the Corporate Income Tax Code;
- Possibility to deduct costs incurred for the purchase, in Portuguese territory, of electricity for recharging road passenger and freight transport vehicles;
- Tax incentive for scrapping end-of-life vehicles (≥ 10 years) when purchasing a new electric vehicle (EUR 4 500 subsidy), a new plug-in hybrid car (EUR 3 250 subsidy) or a new electric heavy quadricycle (EUR 1 000 subsidy). This incentive was extended in the State Budget Law for 2016 (Law No 7-A/2016 of 30 March 2016, with new incentive amounts of EUR 2, 250 and EUR 1,125 for new electric vehicles and new plug-in hybrid cars, respectively). However, the State Budget Law for 2017 (Law No 42/2016 of 28 December 2016) changed this incentive, which now only includes reducing Vehicle Tax to EUR 562.50 when a new and unregistered plug-in hybrid vehicle is introduced on the market;
- Exemption from paying any fee for converting vehicles with internal combustion engines into electric vehicles;
- Setting of new amounts above which the depreciation of light passenger or mixed-use vehicles is accepted as expenses for exclusively electric vehicles and plug-in hybrids.

The State Budget Law for 2017, approved by Law No 42/2016 of 28 December 2016, created an incentive for introducing low-emission vehicles on the market, financed by the Environmental Fund.

1.1.5 - Research and development

Support for innovation and development

A number of measures to encourage electric mobility under the 'Green Tax' Act, the 'Green Growth Commitment' and the Portugal 2020 programme also aim to stimulate the market for technologies associated with electric mobility and to exploit Portugal's role as a pilot market to encourage manufacturers and other companies to test new products and services in Portugal and at the same time improve the scope for Portuguese companies to develop new technologies, products and services.

To this end, agreements were also established with the automotive industry to conduct press tests in Portugal, associated with an aspect of their technological development.

Portugal 2020 is being implemented through 16 Operational Programmes, together with the Territorial Cooperation Programmes, in which Portugal will participate alongside other Member States. These Operational Programmes include the Sustainability and Resource Use Efficiency Operational Programme (*Programa Operacional Sustentabilidade e Eficiência no Uso de Recursos* - POSEUR). This programme mainly aims to contribute to the priority of sustainable growth, responding to the challenges of transitioning to a low carbon economy on the basis of a more efficient use of resources and the promotion of greater resilience to climate risks and disasters. The investment priorities include support for promoting the use of green transport and sustainable mobility.

Within the scope of this programme and in an effort to promote sustainable urban mobility through electric mobility, a Call for Applications (POSEUR-06-2016-52), addressed to the managing body of the electric mobility network - MOBI.E, S.A., was published for the expansion and technological upgrade of public electric recharging points and the development of solutions aimed at improving the electric mobility network.

More recently, a Call for Tender (POSEUR-07-2016-71) was published to promote energy efficiency in collective public passenger transport, with a view to encouraging the use of more efficient vehicles which use fuels with better environmental performance, in particular through the purchase of new vehicles powered by CNG, LNG, hydrogen, electricity or plug-in hybrids, and the installation of their respective recharging infrastructure.

Several initiatives in the field of electric mobility were also supported in Portugal in the period 2007-2013 under the previous strategic support framework, the National Strategic Reference Framework (*Quadro de Referência Estratégico Nacional* - QREN), which provided the rules for implementing the Community's economic and social cohesion policy.

In addition, it should be noted that several funds have been financing the rollout of different measures and programmes in the field of electric mobility:

» Portuguese Carbon Fund - Aims to support the transition to a resilient, competitive and low carbon economy by promoting measures to help meet national commitments made under the Kyoto Protocol or other international and community commitments with regard to climate change. Among the various projects supported by this fund in the field of electric mobility, the following should be highlighted:

i. Pilot Network for Electric Mobility in Portugal (MOBI.E Pilot Network), which started in 2011, with estimated funding of around EUR 9 million and a total amount validated and paid of EUR 7.1 million by 2015 (representing 78% of the project's overall budget).
ii. Pilot phase of the Programme to Support Electric Mobility in Public Administration, which continued in 2015 with the purchase of 30 electric vehicles, respective geo-referencing equipment and recharging points for the bodies involved. As a result, 30 electric vehicles and 25 recharging points were handed over to 12 bodies of the Ministries of the Environment and Finance.
iii. Incentive for scrapping end-of-life vehicles, created following the Green Tax Act for scrapping end-of-life cars and replacing them with new electric vehicles, supported in 2015 by the Portuguese Carbon Fund. The payments made up to 31/12/2015 totalled EUR 0.9 million, corresponding to the purchase of 168 cars

and two quadricycles. A further 150 applications were received in 2015 for which payments would only be made in the first quarter of 2016.

It should be noted that, as early as 2011, this fund supported a similar incentive for scrapping vehicles when purchasing electric vehicles.

» Energy Efficiency Fund (*Fundo de Eficiência Energética* - FEE) - This is a financial instrument designed to fund the programmes and measures provided for in the PNAEE, in all its lines of activity. Projects in the field of transport that contribute to reducing final energy consumption in an energy-efficient and optimal way are therefore supported through the FEE and through specific calls for tender. This fund may also finance projects not provided for in the PNAEE provided they are proven to contribute to energy efficiency.

» Innovation Support Fund (*Fundo de Apoio à Inovação* - FAI) - Created in December 2008 by the Ministry of the Economy and Innovation and set up under the aegis of the Portuguese Energy Agency – ADENE, it aims to support innovation and technological development projects and technological demonstration projects in the fields of renewable energy and energy efficiency, as well as investment projects in energy efficiency, and constitutes a public policy instrument to support the achievement of Portugal's energy strategy objectives. This fund has already approved several projects in the field of sustainable mobility, including:

i. The REIVE project, which aimed to develop and test an innovative technological platform for the integration of power grid management and control with advanced interface devices for electric vehicles and micro-generation systems. The project had a total planned investment of EUR 3,352,847, of which EUR 2,596,847.00 is considered eligible expenditure. The incentive contracted was EUR 1,298,423.00 of which EUR 1,129,101.25 was paid.
ii. The 'Electric Mobility Programme' project, which consisted of studying and creating a sustainable model for Electric Mobility, aimed to create conditions for the effective introduction of electric vehicles in Portugal by exploring a mobility model that promotes the use of energy from renewable sources. The project entailed a total investment of EUR 1,016,588, and the incentive contracted and paid was EUR 995,052.00.
iii. MOBI.E Pilot Production Project, whose main objective was to ensure a first phase, which was open to the public, of pilot production, roll-out and implementation of the components of the MOBI.E system, thereby initiating the testing and operation phase of the pilot network. The project's total investment amounted to EUR 3,260,425, for a contracted incentive of EUR 3,243,256, with the final incentive calculated at EUR 2,812,214.50.
iv. 'Electric Mobility Pilot Phase - IDT' Project (Electric Mobility Pilot Phase - Research and Technical Development of the MOBI.E Model), which aimed to develop innovation associated with slow and rapid rechargers and network and recharging management systems. The total investment planned for the project was EUR 3,501,760. The contracted incentive corresponded to 100% of the eligible investment expenditure, and EUR 2,790,295 was paid.
v. Recently, the FAI has been supporting the operation of the Electric Mobility Managing Body, MOBI.E, S.A., while the use of the network does not generate sufficient revenue to sustain its business. This temporary support across a three-year period (2015/2017) amounts to EUR 4 million.

Sustainable Mobility Programme for Public Administration 2015-2020 - ECO.MOB

In addition to its mission of promoting and defending the public interest, its size and widespread impact on society mean the State's Central Administration is also responsible for being efficient and setting an example of good organisational practices.

Due to its size and the territorial scope and spread of its services, the State is responsible for a significant amount of travel, and the State Vehicle Fleet (*Parque de Veículos do Estado* - PVE) is among the largest fleets in the country. The State should lead by example by encouraging support for the promotion of sustainable mobility and the transition to a low carbon society. It is important to make an effort to improve the environmental performance of vehicles in the PVE by adopting an intelligent renewal programme geared towards the economic efficiency and environmental sustainability of vehicles, in particular through the progressive rollout of electric vehicles.

In order to test the feasibility of using electric and hybrid vehicles in the State fleet, a protocol was signed on 7 May 2014 between the Ministry of Environment, Spatial Planning and Energy (*Ministério do Ambiente, Ordenamento do Território e Energia* - MAOTE), which was responsible at the time for the environment and energy departments, and the Portuguese Electric Vehicle Association (*Associação Portuguesa do Veículo Elétrico* - APVE). The purpose of the Protocol was to launch and define a programme to demonstrate electric mobility in the offices of the MAOTE's members of Government.

13 car brands (Audi, BMW, Citroën, Ford, Mercedes, Mitsubishi, Nissan, Opel, Peugeot, Renault, Smart, Toyota and Volkswagen) took part in this experiment between June 2014 and April 2015 to collect data and experience with a view to drawing up a sustainable mobility programme within the wider scope of the Public Administration.

The journeys made by these vehicles were monitored during the ten-month period, with the electric vehicles mainly being used for commuting within the city and within a radius of around 50 km (range of around 100 km) and the hybrid electric vehicles mainly being used for longer journeys throughout the country (usually over 150 km).

The experiment showed that electric vehicles have a good economic and electric performance in urban environments, with average costs for the use of electric vehicles, taking only energy into account, of around EUR 0.02/km, which corresponded to a reduction of around 81% compared to the replaced fleet and a reduction of 64% and 71% when compared to best-in-class diesel vehicles from segments C and D.

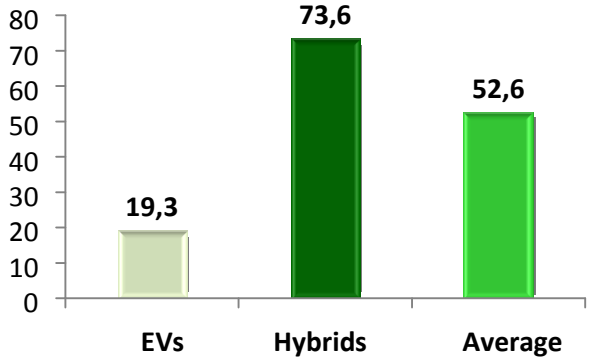


Figure 14 - Average consumption of vehicles used in the pilot experiment (kwh/100km).

In the context of the 'Green Growth Commitment', which, among its 83 initiatives, includes the promotion of electric mobility and the implementation of sustainable mobility programmes in public administration, the Sustainable Mobility Programme for Public Administration 2015-2020- ECO.mob was approved in July 2015, by means of Resolution No 54/2015 of the Council of Ministers of 28 July 2015.

This programme aims to reduce travel needs and promote the choice of more suitable means of transport, as well as the adoption of sustainable mobility solutions for the State fleet, in order to help achieve the specific objective of increasing energy efficiency in the State by 30%. to the specific plan is to add around 1,200 electric vehicles to the PVE by 2020, with the introduction of integrated smart recharging mechanisms and the network managed by MOBI.E.

A first batch of 30 electric vehicles, equipped with a monitoring system (which shows the journey details: distances, time, type of driving, etc.), had already been introduced as a pilot in October 2015. By June 2016, these vehicles had already covered more than 100, 000 kilometres, mainly in urban environments, and prevented the emission of more than 11 tonnes of CO_2.

The use of these vehicles has an average cost of EUR 0.03/km, which has already enabled cumulative savings in excess of EUR 6,000.

Given that the implementation of the ECO.mob programme involves a large number of bodies and the development of innovative initiatives in Public Administration, coordination between the various bodies involved is essential in order to ensure it is implemented smoothly. To this end, the Platform for Sustainable Mobility in the Public Administration, 'ECO.mob Platform', was created to monitor the implementation of this programme. The platform is made up of bodies representing the areas of environment, energy, transport and finance.

Alongside this action, several companies and municipalities have undertaken fleet renewal initiatives by introducing electric vehicles, with an emphasis on integration in research and innovation projects to increase the knowledge and development of the recharging point network and use of different types of electric vehicles for various uses in the areas of mobility and urban services.

Sustainable mobility corridors: France, Spain and Portugal, tackling the global challenge of electric mobility together

With a view to expanding and interconnecting its network of recharging points, Portugal signed a Declaration of Commitment to Decarbonisation of the Economy and Promotion of Electric Mobility together with Spain and France, which was intended to include the conclusions of the United Nations Climate Change Conference (COP21) held in Paris in December 2015. Portugal also prepared an application for European Funds under the Connecting Europe Facility (CEF) Programme for the implementation of a network of interoperable recharging points to be located on major roads linking the three countries, which was accepted by the Commission, as was a twin application submitted by Spain.

The CIRVE_PT project, which will run from June 2016 to December 2020, aims to increase the use of electric vehicles in these three countries in a fully interoperable cross-border framework that enables electric vehicle users to travel from Northern Europe to the Iberian

Peninsula, ensuring a link between the southern and northern regions of the EU. To this end, a study will be carried out starting with the installation of 58 high power recharging points (rapid recharging points) located along the Iberian (Mediterranean and Atlantic) corridors, with particular focus on the border areas between the three countries. This pilot project seeks to identify solutions to the current obstacles to electric mobility with a view to making progress, particularly in the provision of recharging points. A similar action will be carried out in Spain and France for the installation of the abovementioned recharging points.

This initiative aims to promote electric mobility and the interoperability of public recharging point networks in the three countries. To this end, ten proposals for the expansion of electric mobility were defined:

1) Launch information and awareness campaigns with a view to eliminating psychological barriers associated with electric vehicles and providing information on existing measures;
2) Promote training workshops and actions aimed at users of electric vehicles and electric mobility infrastructure;
3) Roll out benefits for electric vehicle users based on the identification of these vehicles by way of certificates or labels identifiable by local authorities, to facilitate the adoption of measures such as the reduction of public parking fees, tax rebates, preferential access to central urban areas, etc.;
4) Maintain demand-side policies so that the electric vehicle market ceases to be a niche market and targets as many people as possible;
5) Promote electric vehicles within business fleets and public procurement, acknowledging that fleets play a key role in introducing these vehicles on the market;
6) Facilitate the development of new batteries with greater range and at an affordable price;
7) Allow easy access to recharging points through a service roaming system;
8) Monitor measures to support increased demand and improve market supply with the development of appropriate public access infrastructure;
9) Strongly reaffirm, at the COP, the contribution of electric vehicles to energy transition and a low carbon society;
10) Promote and accelerate the deployment of international corridors.

1.2 - RAIL TRANSPORT

Almost all the electricity consumed by transport is associated with the rail sector, as the amount of electricity consumed by road transport is still negligible.

A large part of the national rail infrastructure is currently electrified, and electricity is the main energy source consumed by this means of transport.

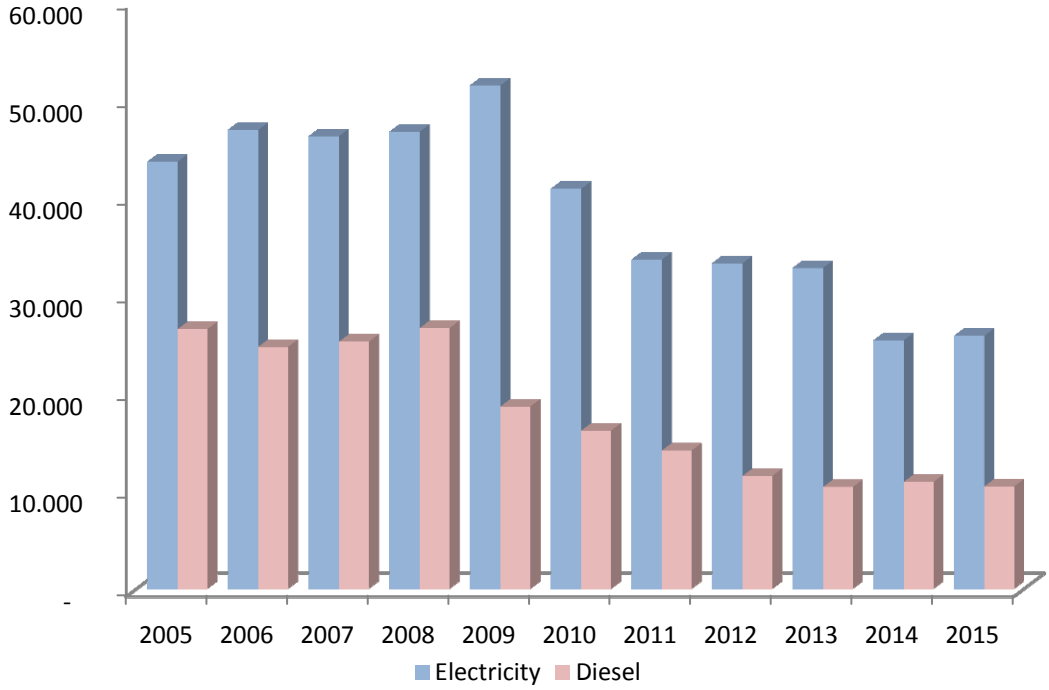


Figure 15 - Evolution of energy consumption by rail transport (toe). Source: DGEG.

Rail infrastructure for trains

The history of the railway in Portugal dates back to 1856, with the inauguration of the first stretch of Portuguese railway, which linked Lisbon to Carregado. Since then, the national railway has undergone many developments and expansions. New lines have been designed and built, and international train connections have been established. In 1886, Porto was connected to Galicia via Valença as the International Link between Valença and Galicia was opened to the public.

However, work on the first phase of electrifying the rail network only began a century later in 1954, with the Lisbon/Porto electrification completed in 1966.

However, since the 1990s, Portugal has essentially overhauled the entire national railway system, which corresponds to the Atlantic Arc seamlessly connecting Braga and Guimarães (in the North) to Faro (Algarve, in the South).

This rehabilitation of the line included, for the first time, the rail crossing of the Tagus, ensuring connections without the need for transhipment, on an electrified line, and with increased capacity and speed. This crossing enabled transport to transfer from road to rail on the commuter flows between the two banks of the Lisbon Metropolitan Area.

At present, the total length of the national rail network for passenger and/or freight transport trains is 2, 565 km, of which 1,633.7 km is electrified, with more than 500 stations.

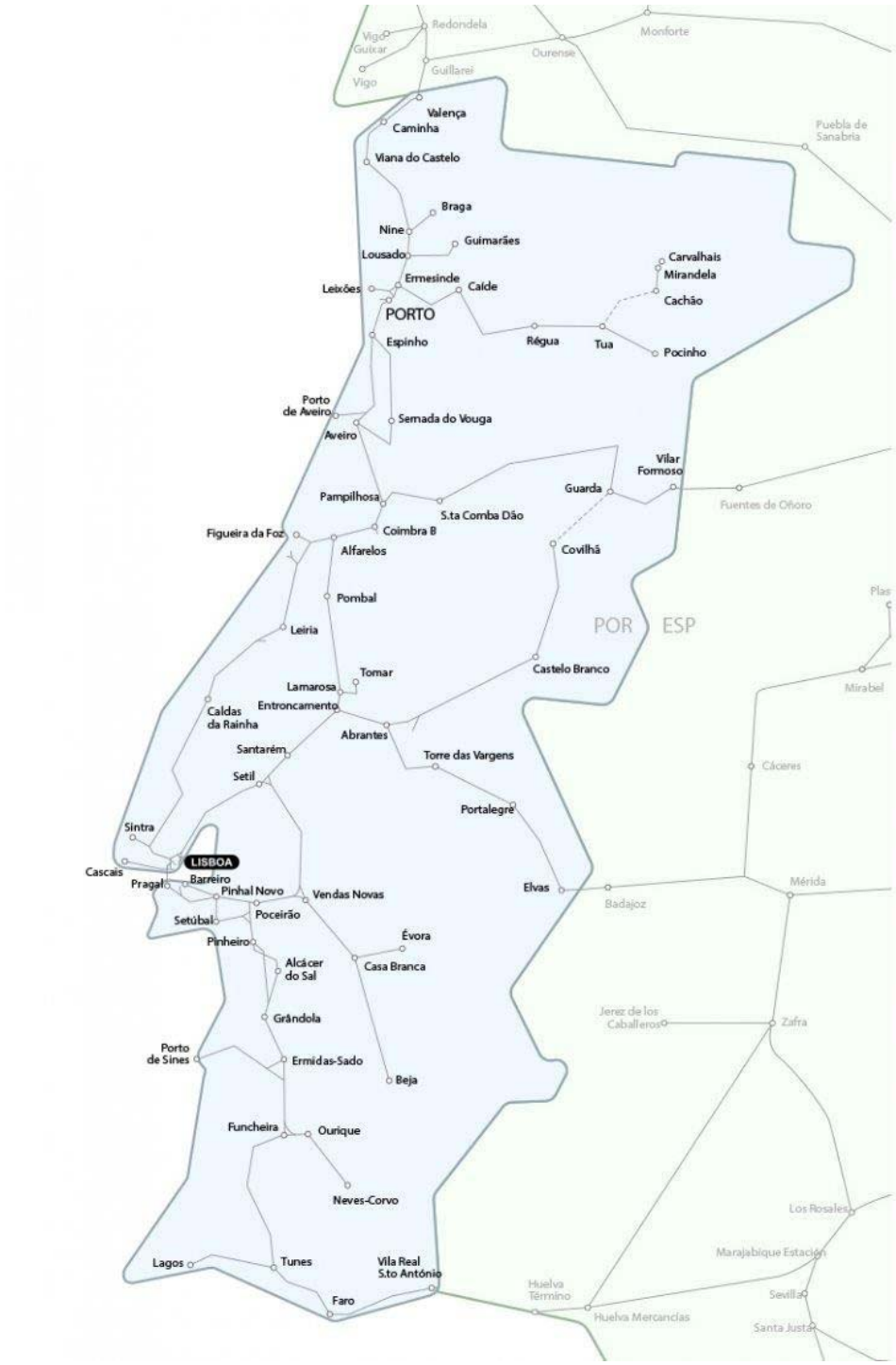


Figure 16 - Existing railway infrastructure. Source: *Infraestruturas de Portugal* - IP, S. A.

The Railway Investment Plan 2016-2020 is based on the PETI 3+ (*Plano Estratégico de Transportes e Infraestruturas* - Strategic Transport and Infrastructure Plan), which defined a set of priorities, namely, international commitments, including bilateral agreements with Spain and those resulting from the Atlantic Corridor, the promotion of freight transport, and in particular of export transport, and coordination between national ports and the main land borders with Spain.

In order to achieve these objectives, there is financial package made up of Community funds from the CEF programme and the Portugal 2020 programme, to which the Juncker Plan and the contribution of Infraestruturas de Portugal - IP, S. A. may be added.

As part of this plan, works will take place on 1, 193 km of the rail network, which will include modernisation, electrification and new construction on the various international corridors and lines.

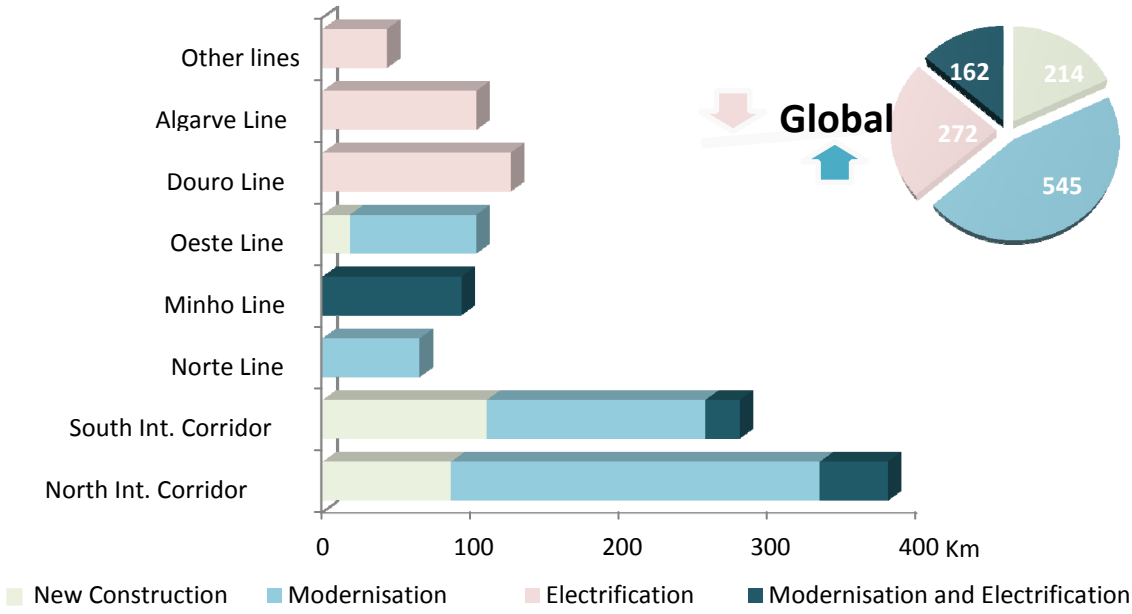


Figure 17 - Type of investment by Corridor/Line (km). Source: IP, S.A./Own production.

The operations planned for the international corridors aim to ensure the rail link between Portugal and Europe, in order to enable efficient rail freight.

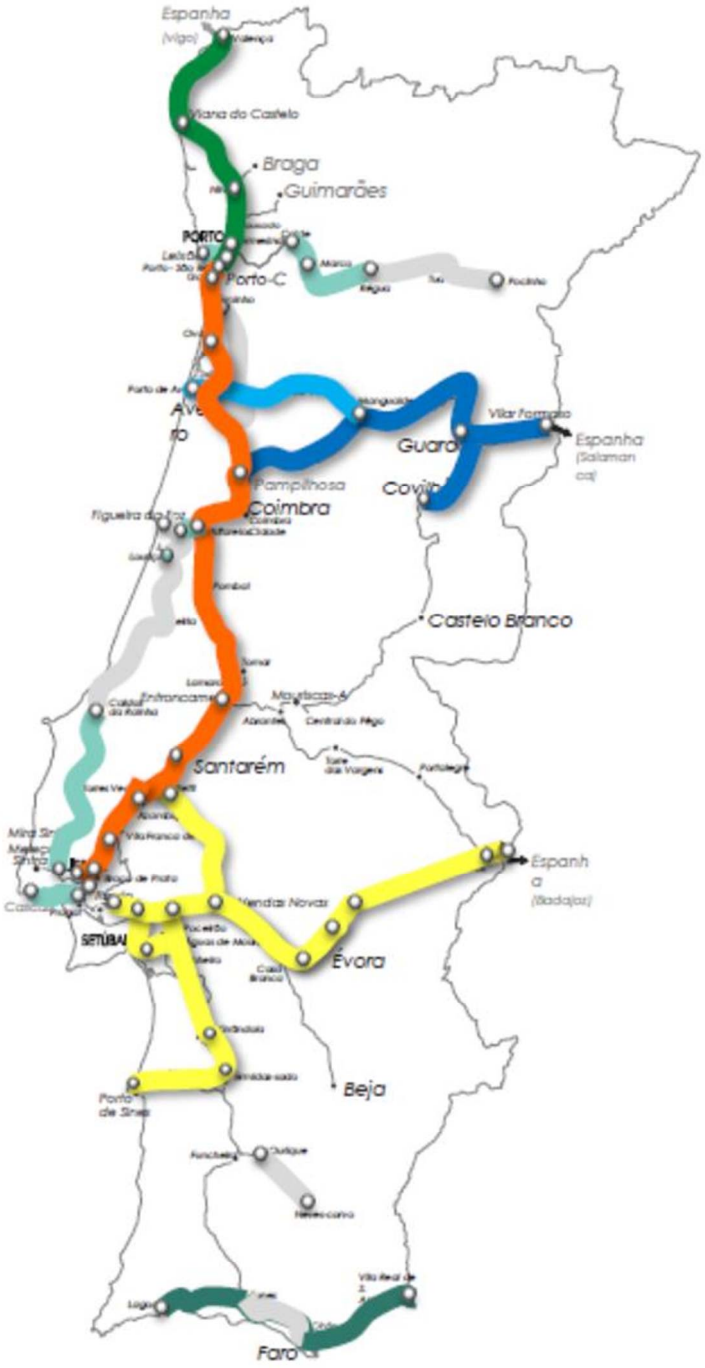


Figure 18 - Works on the various corridors and lines. Source: IP, S. A.

Trams in Lisbon

The city of Lisbon is served by a tramway network. This concept of tramways arguably dates back to 1872 with the creation of the Lisbon Tramways Company (*Companhia Carris de Ferro de Lisboa*), founded with a view to establishing this transport system in the capital. The vehicles were initially drawn by animals but this system was later replaced by electric traction. The electric tramway service, which has undergone various developments and changes over the years, commenced operations in 1901.

The tramway network now consists of five regular lines, running throughout the city of Lisbon for a total of 47.5 km, of which 15.0 km (31.5%) in on reserved tracks.

The current tram fleet consists of 53 trams.

The Lisbon Metro

At the same time, efforts have been made to develop and expand the metro network, always seeking to coordinate its development with that of the national rail infrastructure.

Although the idea to build an underground railway system for Lisbon first arose in 1888, the construction of the Lisbon Metro network only began in 1955 and it was opened to the public four years later at the end of 1959. The initial network consisted of a Y-shaped line linking Sete Rios (currently Jardim Zoológico station) to Rotunda station (currently Marquês de Pombal station) and Entre Campos to Rotunda station (now Marquês de Pombal). These two connections converged in a single stretch between Restauradores station and Rotunda station (now Marquês de Pombal). The inauguration of the Lisbon Metro was a very important event for the city, and it carried around 15.3 million passengers in its first year of operation.

Since its inauguration, the Lisbon Metro network has undergone several expansion processes. The current infrastructure has four autonomous lines (Blue, Green, Yellow and Red), a total length of approximately 44.2 km and a total of 56 stations which connect several points of Lisbon to the main train stations on the national and international network, to the main river terminals and, since 2012, to Lisbon Airport. In 2016, a new extension of the Blue line was opened to the public, between Amadora Este and Reboleira stations. Plans are also in place to build two new stations on the Yellow line, Estrela and Santos, and work is scheduled to be completed in 2021.

The Lisbon Metro infrastructure has therefore been developed from an intermodality perspective, with a view to optimising all of the Lisbon Metropolitan Area's mobility resources.

Figure 19 - Map of the Lisbon Metro network. Source: Metropolitano de Lisboa, E. P. E.

South Tagus Light Railway

A light rail service, the South Tagus Light Railway was created on the south bank of the Lisbon Metropolitan Area. This light rail service covers the municipalities of Almada and Seixal, running through the city of Almada, along the EN10 to Corroios and in the urban roads of Monte da Caparica.

This passenger transport system has been in full operation since 2008 and is made up of three lines which cover around 22 km, connecting several heavily populated areas to public transport, shopping areas and universities.

Figure 20 - Map of the South Tagus Light Railway network. Source: MTS - Metro Transportes do Sul, S. A.

PT	EN
Linha 1	Line 1
Linha 2	Line 2
Linha 3	Line 3
Interface	Interchange
Estações	Stations

The Porto Metro

The first metro system to run largely above ground was rolled out in the Porto Metropolitan Area.

The Porto Metro, inaugurated in 2002 with the entry into operation of Line A (Blue), currently has one of the largest light rail networks in Europe. In total, the network measures around 67 km and is divided into six lines which connect the main points of the city and cover seven municipalities in the Porto metropolitan area. The current metro system comprises 81 stations, of which 14 are underground stations.

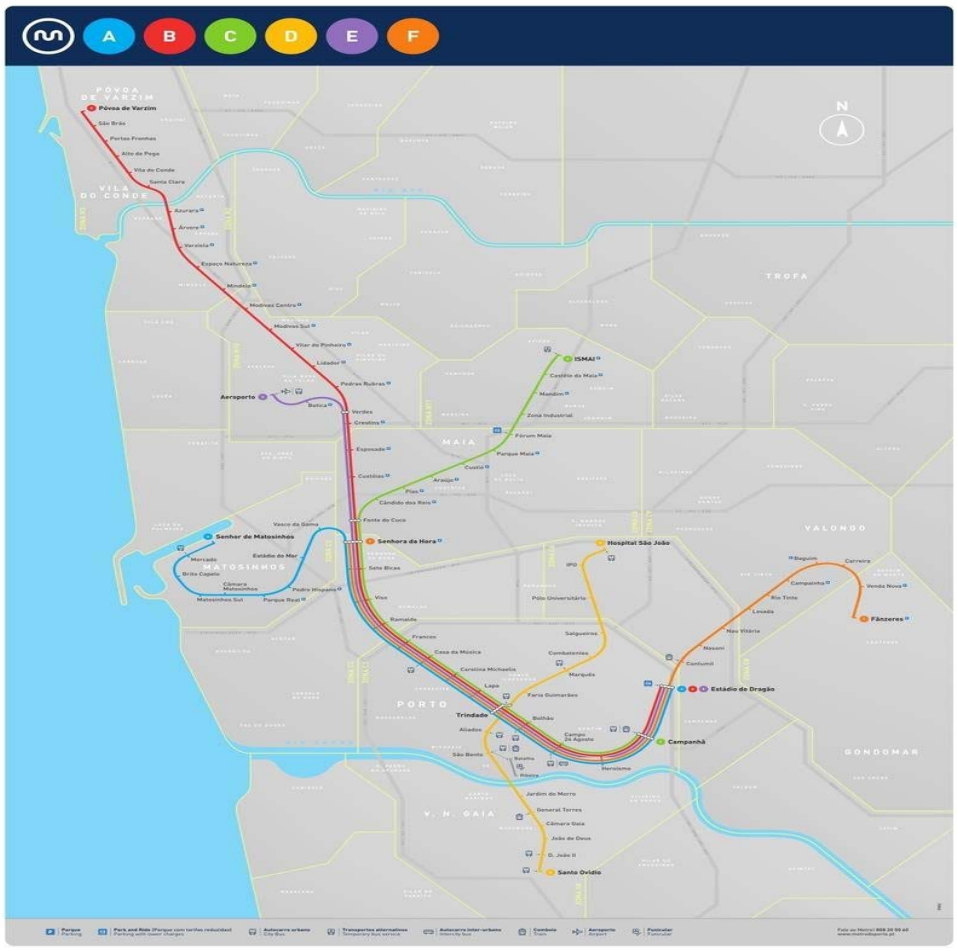


Figure 21 - Map of the Porto Metro network. Source: Metro do Porto, S. A.

Over the last 20 years, Portugal has seen a commitment to the national rail transport network, in combination with lines in metropolitan areas and in conjunction with the creation and expansion of metro networks, which has led to the essential electrification of transport.

In short, as far as electricity is concerned, along with a continued emphasis on rail infrastructure, it is important to prioritise electric mobility in road transport, with a view to maximising the introduction of electricity in the transport sector, thereby taking advantage of the potential of renewable sources in the national electrical sector.

2 - NATURAL GAS

Natural gas is a fossil fuel consisting primarily of methane (CH_4). It has non-toxic and non-corrosive characteristics and a calorific value ranging from 9, 000 kcal/m^3 to 12,000 kcal/m3, depending on its origin. In view of its colourless and odourless nature, for safety reasons, it is artificially odorised before being distributed to the final consumer. Compared with other fossil fuels, such as oil by-products, natural gas enables a reduction in the emission of greenhouse gases and other pollutants that are harmful to human health, such as particulates and nitrogen oxides (NOx).

Natural gas in Portugal dates back to 1993 with the signing of the first concession, transport, storage and supply contracts and to 1997 with its effective introduction on the national market. Liberalisation of the sector began in 2006, with the publication of Decree-Law

No 30/2006 of 15 February 2006, as amended by Decree-Law No 230/2012 of 26 October 2012 and Decree-Law No. 140/2006 of 26 July 2006, as amended by Decree-Law No 231/2012 of 26 October 2012, which established the general framework for the organisation and operation of the National Natural Gas System (*Sistema Nacional de Gás Natural* - SNGN), as well as the general rules applicable to the respective activities.

The business of supplying natural gas is free, subject only to the granting of a licence by the Directorate-General for Energy and Geology (*Direção-Geral de Energia e Geologia* - DGEG), and suppliers may freely purchase and sell natural gas and enjoy access to liquefied natural gas (LNG) storage facilities and terminals, transmission networks and distribution networks, paying a regulated tariff.

The SNGN is essentially based on the operation of the public natural gas network (*rede pública de gás natural* - RPGN), which consists of the National LNG Transmission, Storage Infrastructure and Terminals Network (*Rede Nacional de Transporte, Infraestruturas de Armazenamento e Terminais de GNL* - RNTIAT) and the National Natural Gas Distribution Network (*Rede Nacional de Distribuição de Gás Natural* - RNDGN).

The RNTIAT consists of all infrastructure intended for the reception and transmission of natural gas (NG) by gas pipeline, for underground storage (US) and for the reception, storage and regasification of liquefied natural gas (LNG). The map in the following figure shows the geographical location of the RNTIAT (RNTGN, LNG Terminals and Underground Storage) infrastructure in mainland Portugal.

Figure 22 - National Natural Gas Transmission Network. Source: REN.

The National Natural Gas Transmission Network (*Rede Nacional de Transporte de Gás Natural* - RNTGN), operated by REN Gasodutos, S.A., is the infrastructure used to receive, transmit and deliver natural gas at high-pressure, from entry points to exit points. In order to carry out these tasks, the RNTGN incorporates the following main facilities:

- 1, 375 Km of main high-pressure gas transmission pipeline and branch lines varying in diameter from 150 to 800 mm, intended for the transmission of natural gas;

- 85 Gas Regulation and Metering Stations (GRMS) at delivery points, which are used to regulate pressure and then meter the natural gas delivered to distribution networks and high pressure customers;
- 66 Junction Stations (JCT) for sectioning the main gas transmission pipeline and/or respective branch;
- 44 Block Valve Stations (BV) for sectioning the main gas transmission pipeline;
- 3 T Interconnection Junctions (ICJCT) which are intended for creating a T-junction in the main gas transmission pipeline, thus allowing the associated branch line to be sectioned;
- 2 Custody Transfer Stations (CTS) for metering and transferring custody to the interconnected Spanish network.

The following table shows the main features of the RNTGN, as at the end of 2014.

TABLE 5

Main features of the RNTGN.
Source: REN-PDIRGN 2015 (*Plano Decenal Indicativo de Desenvolvimento e Investimento da Rede Nacional de Transporte, Infraestruturas de Armazenamento e Terminais de GNL para o período 2016-2025* - Indicative 10-Year Development and Investment Plan for the National LNG Transmission, Storage Infrastructure and Terminals Network for the Period 2016-2025)

Lot	Locations	Diameter (mm)	Length (km)	GRMS	JCT	BV	ICJCT	CTS
RNTGN	-	150 to 800	1375	85	66	44	3	2
Lot 1	Setúbal – Leiria	700	174	24	16	11	1	
Lot 2	Leiria – Gondomar	700	164	32	27	6	2	
	Gondomar – Braga	500	50					
	Bidoeira - Carriço	700	19					
Lot 3	Campo Maior – Leiria	700	220	8	5	6		1
Lot 4	Braga - Valença	500	74	4	4	5		1
Lot 5	Monforte – Guarda	300	184	6	1	8		
Lot 6	Mealhada – Viseu	500	68	5	3	6		
Lot 7	Sines – Setúbal	800	87	6	8			
Lot 8	Celorico – Guarda	300	29			1		
	Mangualde – Celorico	700	48		2	2		
High-pressure links		150 to 700	258					

TABLE 6

Capacities associated with relevant RNTGN points. Source: REN-PDIRGN 2015

Relevant points	Daily capacity
Sines LNG Terminal	Input capacity: 222.8 GWh/day, equivalent to 780, 000 $m^{3(}$(n)/h
Carriço US	Output capacity (injection into US): 23.8 GWh/day, equivalent to 83,350 $m^{3(}$(n)/h Input capacity (withdrawal from US): 85.7 GWh/day, equivalent to 300,000 $m^{3(}$(n)/h
Campo Maior	Input capacity: 134.0 GWh/day, equivalent to 470,000 $m^{3(}$(n)/h Output capacity: 35.0 GWh/day, equivalent to 122,500 $m^{3(}$(n)/h in winter months (November to April the following year) Output capacity: 70.0 GWh/day, equivalent to 245,000 $m^{3(}$(n)/h in summer months (May to October)
Valença do Minho	Input capacity: 30.0 GWh/day, equivalent to 105,000 $m^{3(}$(n)/h in winter months (November to April the following year) Input capacity: 40.0 GWh/day, equivalent to 140,000 $m^{3(}$(n)/h in summer months (May to October) Output capacity: 25.0 GWh/day, equivalent to 87,500 $m^{3(}$(n)/h
Total delivery points (GRMS)	Output capacity: 643.5 GWh/day, equivalent to 2,253,000 $m^{3(}$(n)/h

Natural gas consumed in Portugal comes from third countries, with one part being received through a high-pressure gas pipeline and another by sea, in the form of LNG.

The national system is mostly supplied with gas from Algeria through the Campo Maior and Valença do Minho interconnections with Spain, accounting for 67% of the total, while the remaining 33% is supplied through the Sines LNG Terminal from various sources, particularly Nigeria, Qatar and Trinidad and Tobago.

Natural gas is stored at high pressure in gaseous form in caverns cut into the salt layer at depths of more than 1,000 metres. These underground storage facilities are located in the borough of Carriço, in the municipality of Pombal. The Carriço underground storage facility consists of six operational caverns, with a total storage capacity of 3,839 GWh (322.6 Mm^3). The six caverns use the same surface gas station that enables bi-directional flow. The injection capacity is 23.8 GWh/day (equivalent to 83,350 m^3(n)/h) and the withdrawal capacity is 85.7 GWh/day (equivalent to 300,000 m^3(n)/h).

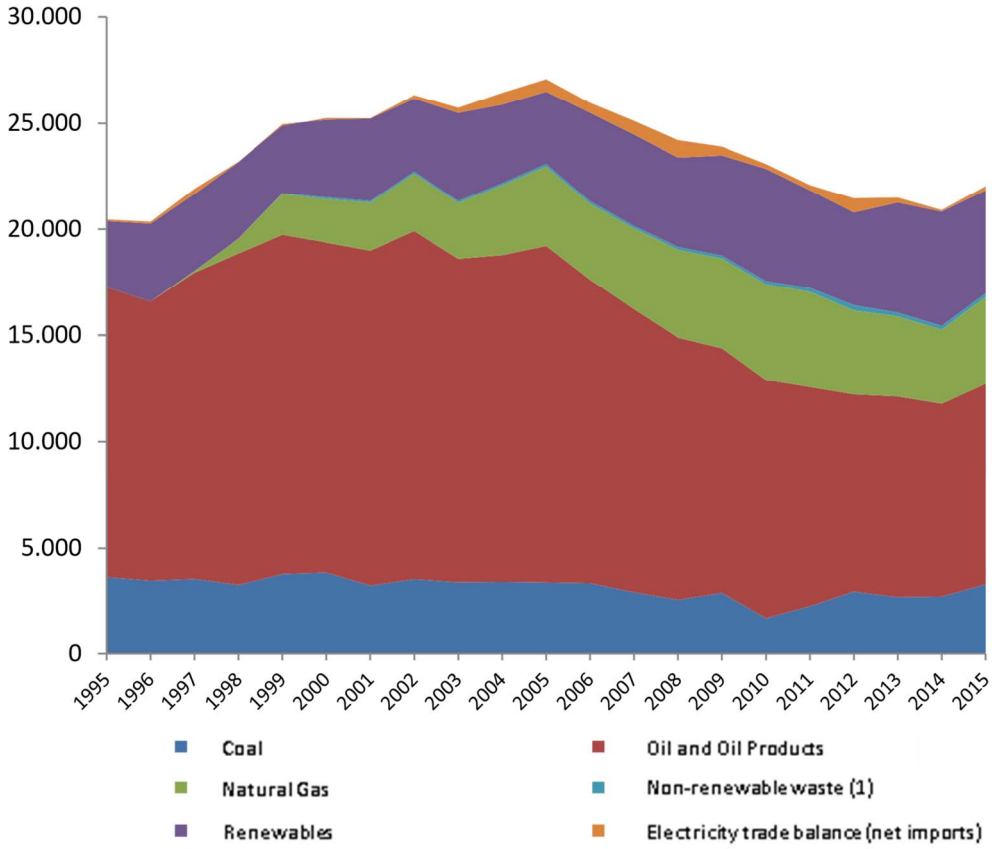
On the other hand, LNG arriving by sea is received at the Sines LNG Terminal, located in the industrial zone of the port of Sines. After being unloaded from the LNG carrier vessels, this LNG is stored in three LNG tanks where it is kept at a temperature of -160°C and at a pressure slightly higher than atmospheric pressure. It is kept here until the owner gives the order to begin the regasification process, after which the gas is compressed and injected into the high pressure network at the terminal delivery point.

The LNG Terminal therefore comprises port facilities for receiving and unloading LNG carrier vessels, with the capacity to receive 59 LNG carrier vessels per year with volumes between 40,000 and 216,000 m^3 of LNG, LNG storage tanks (two 120,000 m^3 tanks and one150,000 m^3 tank), LNG regasification facilities and facilities for dispatching natural gas to the pipeline connecting the Sines LNG Terminal to the natural gas transmission network. The terminal also allows LNG tanker trucks to be loaded, which transport gas to autonomous regasification units (*Unidades Autónomas de Regaseificação* - UAG) located in areas of Portugal not covered by the high pressure natural gas network. For this purpose, the terminal has three filling bays with a total capacity of 195 m^3/h of LNG.

To carry out the regasification process, the terminal has seven atmospheric vaporisers with a unit capacity of 64.3 GWh/day (equivalent to 225,000 m^3(n)/h), where LNG vaporisation occurs through heat exchange of the gas with sea water. The nominal emission capacity is 321 GWh/day (equivalent to 1,125,000 m^3(n)/h), with a peak hourly capacity of 1,350,000 m^3(n)/h).

REN ATLÂNTICO, Terminal de GNL, S. A. is responsible for operating the terminal.

The introduction of this fuel in Portugal has made a significant contribution to the diversification of the energy mix and security of supply, enabling the reduction of energy dependence on oil. Since 1997, the contribution of natural gas to total primary energy consumption has generally been growing, and it accounted for around 18.6% of total primary energy consumption in 2016.



(1) Includes Industrial Waste and non-renewable fraction of Municipal Solid Waste

Figure 23 - Evolution of Primary Energy Consumption (ktoe). Source: DGEG.

In terms of final energy consumption, natural gas accounted for around 10.5% of total consumption in 2015, with around 1,618 ktoe consumed, mostly by the industrial sector, and in particular the glass and ceramics sector.

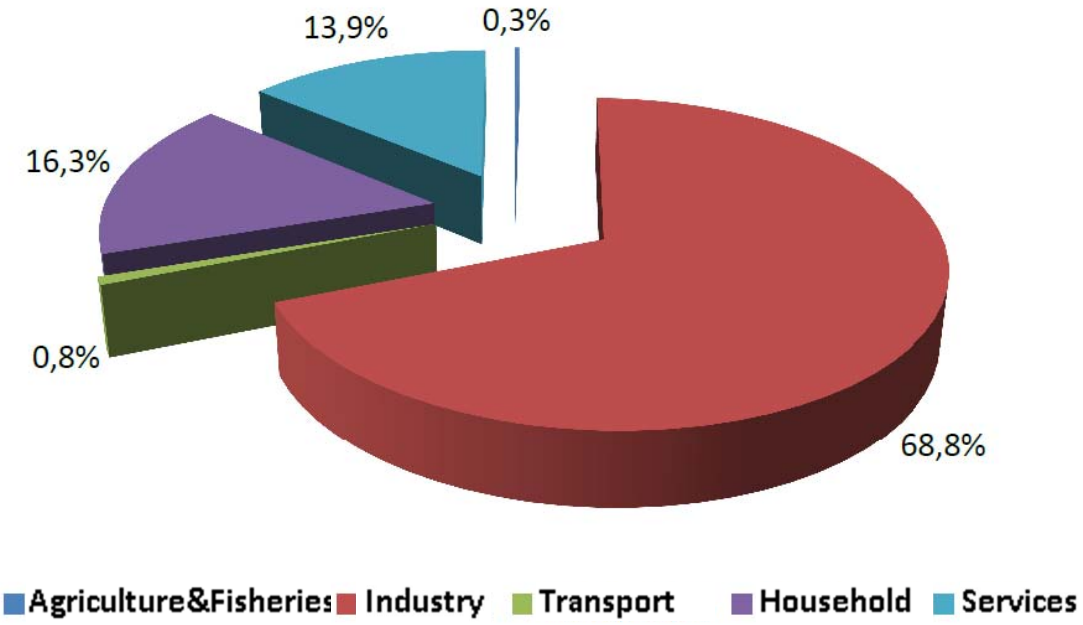


Figure 24 - Final consumption of Natural Gas in 2015, by sector of activity. Source DGEG.

There are three main groups of natural gas consumers in Portugal, namely combined cycle power stations, large industrial consumers and smaller consumers, which includes the household sector. The profile of natural gas consumption has undergone changes over the last few years, with a decrease in consumption by power stations due to the increasingly significant production of electricity from renewable sources, and an increase in the consumption recorded in the other two sectors.

Nevertheless, the demand for natural gas by power stations is subject to change, as it is influenced by the unpredictability of the hydrological regime and the resulting variation in the production of electrical energy using renewable sources. In 2015, power stations accounted for around 22% of natural gas consumption in Portugal.

Given the national natural gas consumption, the SNGN's installed capacity is underutilised, which leads to higher network unit costs than in many other EU countries. These costs are mainly borne by the industrial sector, which has a negative impact on the competitiveness of these companies at international level. Increasing natural gas consumption in other sectors of activity, such as transport, could therefore contribute towards improving the sustainability of the system.

As part of the 'Connecting Europe Facility - Energy' (CEF-E) programme, REN was able to obtain funding from the European Commission (EC) for the third Portugal-Spain natural gas interconnection project, which consists of studies on the new bi-directional gas transmission pipeline between Celorico da Beira and the Spanish border, in the Vale de Frades area.

With the entry into operation of the Celorico da Beira-Vale de Frades gas pipeline, a third interconnection with Spain is planned. This is justified by the fact that it will reinforce security

of supply, encourage competitiveness in Europe and consolidate the Internal Energy Market, although this should be coordinated with the gas connections between Spain and France. This investment is important for integrating the Iberian Peninsula markets, increasing the flexibility of the systems and contributing to the integration of European networks, creating the conditions to accelerate the enhancement of the available gas transmission capacity between the Iberian Peninsula and France. The final investment decision for this project should be fully coordinated with the development of the Midcat project, now known as STEP (concerning the construction of a new interconnection between Spain and France in the eastern Pyrenees), and both projects should be considered to be mutually dependent.

The Iberian Peninsula has a strategic geographical location and key natural gas infrastructure, with eight LNG terminals, which can position it as a European leader in the LNG sector. Increased underground storage capacity and enhanced interconnections between Portugal and Spain are a strategic step towards exploiting the Iberian Peninsula's potential as a gateway for natural gas to Europe by taking advantage of its LNG terminals and its proximity to Africa and, consequently, to natural gas producer countries.

2.1 - ROAD TRANSPORT

2.1.1 - Natural Gas Mobility in Portugal

Natural gas mobility can play an important role in the diversification of energy sources used in transport, and has emerged as an additional electric mobility policy.

The use of natural vehicle gas, in the form of CNG or LNG, may offer both financial and environmental savings. Natural gas costs significantly less than conventional fuels (diesel and petrol) and its features mean that it burns cleanly. In environmental terms, the emissions associated with this alternative fuel are also lower than those of traditional fuels.

As a result, a legal framework has been established in Portugal in recent years to promote the use of natural gas as an alternative to conventional fuels for the transport sector.

Following a review of Decree-Law No 374/89 of 25 October 1989, and subsequent amendments providing for new forms of natural gas activities, it was necessary to amend Decree-Law No 232/90 of 16 July 1990, which set out the principles to be complied with in the design, construction, operation and maintenance of the piped combustible gas supply system. Decree-Law No 232/90 of 3 February 2000 introduced changes to the abovementioned Decree-Law, as natural vehicle gas refuelling points became part of the piped combustible gas supply system. The conditions to be complied with in the design, construction, operation and maintenance of natural vehicle gas refuelling points were approved by Ministerial Implementing Order No 1270/2001 of 8 November 2001.

The possibility of using compressed natural gas (CNG) as fuel in motor vehicles dates back to 2001, with the publication of Decree-Law No 298/2001 of 21 November 2001. Decree-Law No 137/2006 of 26 July 2006 established the conditions under which compressed natural gas (CNG) would be admitted as fuel for use in cars.

The rules for granting licences to operate natural gas refuelling points had been approved by Ministerial Implementing Order No 468/2002 of 24 April 2002, repealed with the publication of Ministerial Implementing Order No 366/2013 of 23 December 2013. This Ministerial Implementing Order defined the new procedure for granting licences to operate natural vehicle gas (NVG) refuelling points, as a public or private service and in the form of

CNG and LNG, as well as establishing the safety regulations applicable to the design, construction, operation and maintenance of LNG refuelling points.

Law No 13/2013 of 31 January 2013 established the legal framework for the use of liquefied petroleum gas (LPG) and compressed and liquefied natural gas (CNG and LNG) as fuel in vehicles and repealed Decree-Law No 137/2006, while Ministerial Implementing Order No 207-A/2013 of 25 June 2013 approved the Regulation on the Use, Identification and Installation of LPG, CNG and LNG in vehicles.

The legal framework for the access to and pursuit of various trade, service and catering activities (*regime jurídico de acesso e exercício de diversas atividades de comércio, serviços e restauração* - RJACSR), approved with the publication of Decree-Law No 10/2015 of 16 January 2015, included, in particular, conditions for the professional training and certification of auto/gas mechanics and technicians, as well as the control of workshops for the adaptation and repair of vehicles using LPG or Natural Gas (CNG and LNG) as fuel.

In 2015, a number of Ministerial Implementing Orders were also approved, on the legal framework for certifying training bodies to provide training courses to obtain the professional title of auto/gas mechanics and technicians (Ministerial Implementing Order No 124-A/2015 of 5 May 2015), on certificate of conformity templates for the adaptation of vehicles to the use of LPG, CNG or LNG and the correct operation of each vehicle (Ministerial Implementing Order No 116-A/2015 of 29 April 2015) and on identification stickers/labels for vehicles that use LPG, CNG or LNG as fuel, as well as on recording the conformity of the installation on the registration certificate (Ministerial Implementing Order No 196-B/2015 of 2 July 2015).

Furthermore, Assembly of the Republic Resolution No 240/2016 was recently published, with recommendations for the Government on the implementation of measures aimed at reducing fuel costs, including the promotion of alternative fuel networks, namely:

- The installation of a national CNG network, guaranteeing at least one public refuelling point per district;
- The adaptation of current legislation on CNG-fuelled vehicles to facilitate their licensing, circulation and parking, within the framework of the necessary safety standards;
- The creation of conditions for the use of LNG in heavy road passenger and goods transport.

In spite of the increasing tendency to use natural gas in transport observed in recent years, consumption of this alternative fuel is still relatively minimal in this sector, with a consumption of just 13 ktoe in 2015 (representing around 0.8% of the final consumption of natural gas energy).

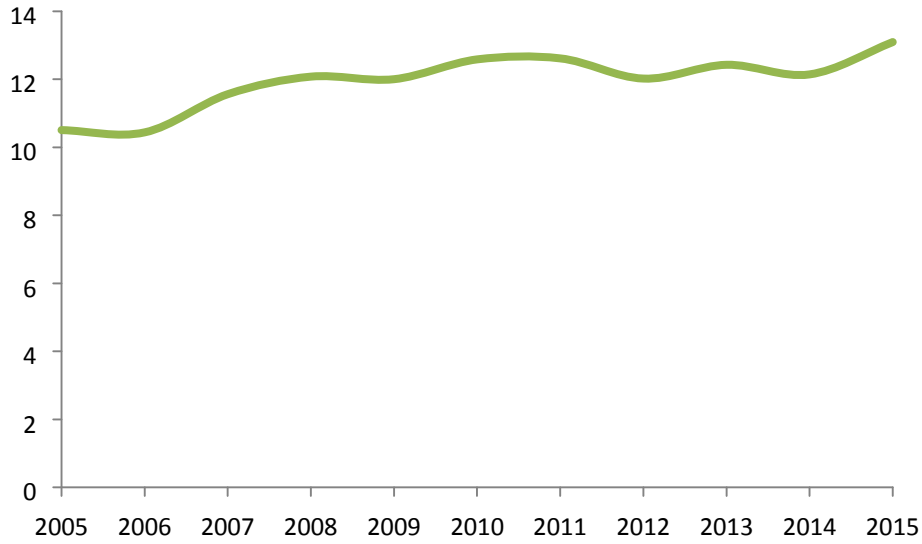


Figure 25 - Evolution of Natural Gas Consumption in Transport (ktoe). Source: DGEG.

This slight increase in natural gas consumption which has generally been observed is mainly due to recent technological developments, in particular for road transport, and has resulted in new solutions for NVG-fuelled passenger and goods vehicles. In terms of LNG-fuelled heavy-duty vehicles, commercial solutions with a power exceeding 400 hp are already available, which, in the context of international transport logistics, may facilitate the adoption of this alternative fuel. In the field of maritime transport, vessels that use natural gas have also begun to emerge, such as barges, tourist boats and even LNG transport vessels.

2.1.2 - Refuelling Infrastructure

The natural gas refuelling infrastructure in Portugal is still under development. At the end of 2015, six CNG refuelling points were available to the public, of which four also enable the refuelling of LNG.

In addition to these public refuelling points, there are also seven private refuelling points located on the premises of companies that have fleets with natural gas vehicles. With the exception of the refuelling point belonging to Sonorgás, S.A., located in the district of Vila Real, which is able to supply CNG and LNG, the remaining private refuelling points are exclusively for CNG. It should be noted that some of these private points provide access for private individuals to refuel their vehicles.

In addition to the existing NVG refuelling infrastructure in 2015, two new CNG+LNG combined refuelling points are expected to enter into operation, one of which is already under construction and the other of which is awaiting the issuance of an operating licence.

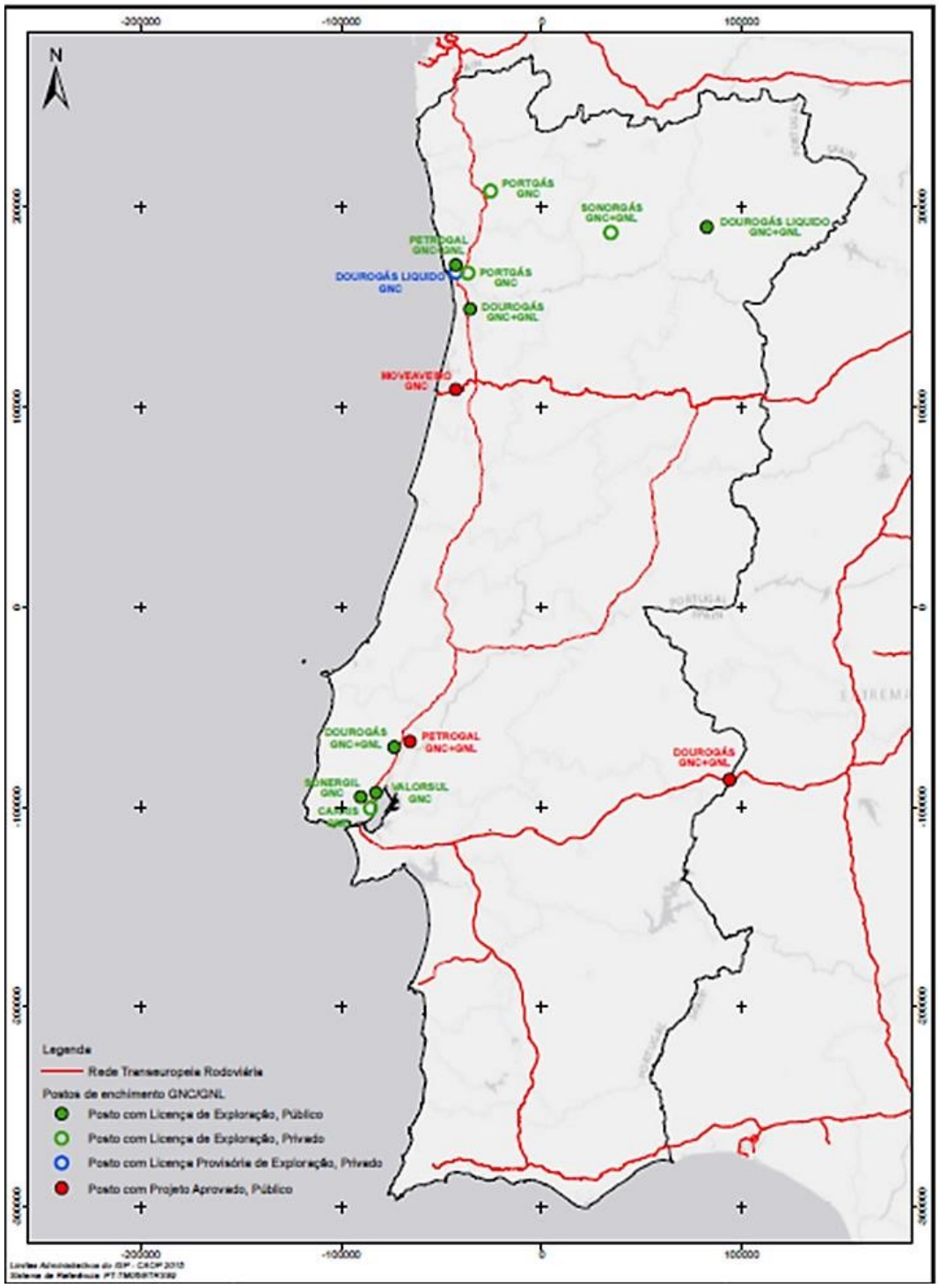


Figure 26 - Map with the location of LNG and CNG refuelling points. Source: DGEG.

PT	EN
GNL	LNG
GNC	CNG
Legenda	Key
Rede Transeuropeia rodoviária	Trans-European road network
Postos de enchimento GNC/GNL	CNG/LNG refuelling points
Posto com Liçenca de Exploração, Público	Point with Operating Licence, Public
Posto com Liçenca de Exploração, Privado	Point with Operating Licence, Private
Posto com Liçenca Provisória de Exploração, Privado	Point with Temporary Operating Licence, Private
Posto com Projeto Aprovado	Point with Approved Design

Current CNG refuelling points are supplied through the Concessionaire's Natural Gas Network or through UAGs. In the case of LNG refuelling points, these are supplied directly by tanker trucks, as there are still no solutions available that allow the on-site liquefaction of natural gas, given the considerable costs involved.

2.1.3 - Natural Gas Vehicles

It is estimated that at the end of 2015, there were around 618 vehicles with CNG engines in circulation, most of which were urban passenger transport buses. In addition to this, there were around 138 motorbikes (including mopeds, motorcycles, tricycles and quadricycles).

TABLE 7 - Number of natural gas vehicles in circulation at the end of 2015.
Source: IMT/Own production

Alternative fuel vehicles	Number of Vehicles	Comments
	2015	
CNG cars	17	Light passenger vehicles
Hybrid CNG cars	97	Light passenger vehicles
CNG light commercial vehicles	8	
Hybrid CNG light commercial vehicles	29	
CNG heavy-duty vehicles	106	Heavy goods vehicles
Hybrid CNG heavy-duty vehicles	3	Heavy goods vehicles
CNG buses	357	Heavy passenger vehicles
Hybrid CNG buses	1	Heavy passenger vehicles
CNG motorcycles	5	Includes Moped, motorcycle, tricycle and quadricycle
Hybrid CNG motorcycles	133	Includes Moped, motorcycle, tricycle and quadricycle
LNG light commercial vehicles	0	
LNG heavy-duty vehicles	0	Heavy goods vehicles
LNG buses	0	Heavy passenger vehicles

The consumption of natural gas by the transport sector is mainly due to urban passenger transport companies, especially in the metropolitan areas of Lisbon and Porto.

To date, nine freight transport companies have received incentives to purchase LNG-fuelled vehicles for their heavy-duty fleets under the European LNG Blue Corridors Project.

2.1.4 - Incentives and Funding

Natural gas appears to be a short- and medium-term solution to assist in reducing emissions of GHG and other air pollutants associated with the transport sector, as well as minimising costs and dependence on oil imports by diversifying energy resources and source markets. That is why several measures to encourage the use of this alternative fuel have been envisaged.

The 'Green Tax' reform act provides for several tax incentives for the purchase and use of natural gas vehicles, in particular:

- Granting of tax incentives for the purchase of compressed natural gas (CNG) vehicles, through new amounts eligible for tax expenditure and autonomous taxation of Personal Income Tax and Corporate Income Tax;
- Possibility to deduct 50% of the VAT incurred on expenditure related to the purchasing, manufacturing or importing, leasing and conversion of CNG or LNG-fuelled vehicles, when considered as passenger vehicles, the purchase cost of which does not exceed that defined in the Ministerial Implementing Order referred to in Article 34(1)(e) of the Corporate Income Tax Code;
- Possibility to deduct costs incurred for the purchase, in Portuguese territory, of natural gas for refuelling road passenger and freight transport vehicles;
- Setting of new amounts above which the depreciation of light passenger or mixed-use vehicles is accepted as expenses for natural gas-fuelled vehicles.

2.1.5 - Research and development

In addition to the tax benefits under the 'Green Tax Act', programmes have been identified to fund the implementation of measures in the field of natural gas mobility. The Community support framework 2014-2020/Portugal 2020 provides for the allocation of funds to promote the use of natural gas in transport.

At European level, the European LNG Blue Corridors Project aims to establish LNG as a viable alternative for medium and long-distance transport by defining a roadmap of LNG refuelling points along four corridors. Twenty-seven companies from 11 countries, including Portugal, are involved in this project, with a fund of almost EUR 8 million. The project aims to build 14 new LNG or CNG-LNG refuelling points and 100 LNG-fuelled heavy-duty vehicles.

Figure 27 - Main routes of the 'LNG Blue Corridor' Project.

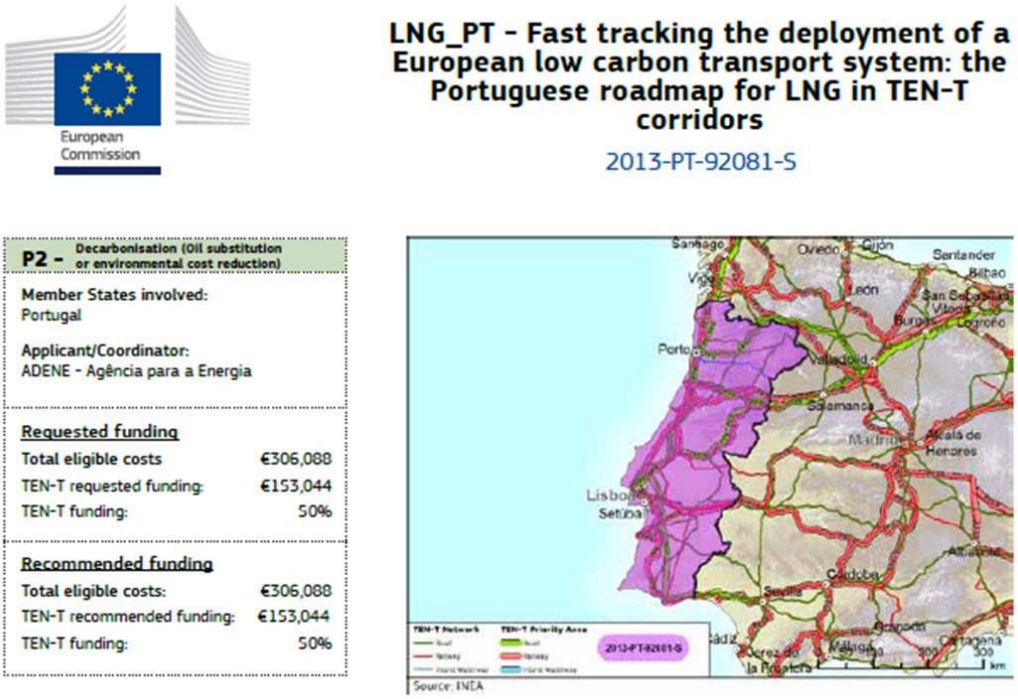
PT	EN
Potenciais Rotas	Potential Routes
Portugal – Espanha para França, Holanda, Reino Unido e Irlanda	Portugal – Spain to France, Netherlands, United Kingdom and Ireland
Portugal – Espanha para França, Alemanha, Dinamarca e Suécia	Portugal – Spain to France, Germany, Denmark and Sweden
Arco Mediterrâneo para Itália, com um ramo para Croácia – Eslovénia	Mediterranean Arc to Italy with a branch to Croatia – Slovenia
Irlanda – Reino Unido para a Áustria	Ireland – United Kingdom to Austria

The Portuguese partners involved in this project are Dourogás, S.A. and Galp Energia, S.A., which obtained funding for the construction of the Carregado (Goldenergy/Dourogás), Elvas (Goldenergy/Dourogás), Matosinhos (Galp Energia) and Sines (Galp Energia - in licensing) refuelling points. As already mentioned, this project also co-financed the purchase of LNG-fuelled vehicles by some national road haulage operators.

Market Study for LNG in Portugal

The 'LNG_PT- Fast Tracking the Deployment of a European Low Carbon Transport System: Portuguese roadmap for LNG in TEN-T corridors' project was set up to help define a national policy framework in the road transport sector to accelerate the uptake of LNG as an alternative fuel for freight transport .

The market study for LNG in Portugal was coordinated by the ADENE (Portuguese Energy Agency) in partnership with the Higher Technical Institute of the University of Lisbon, with the support of the European Commission's Innovation and Network Executive Agency (INEA) and funding from the Trans-European Transport Networks (TEN-T).



This project arises from the need to promote a more sustainable national energy consumption matrix, particularly in long-haul freight transport, with six possible barriers to successfully implementing LNG having been identified in this study:

1) High cost of vehicle purchase: High initial costs of purchasing vehicles when compared to diesel vehicles - on average, 7% higher. As regards the cost associated with retrofitting, costs of between EUR 8,000 and EUR 18,000 were estimated for the application of CNG, while costs of at least EUR 8,500 were estimated for LNG modifications, including costs for approving the system.
2) Reduction in the fuel storage capacity of the vehicle: Limited range of around 730-750 km.
3) Concerns about vehicle safety and reliability: Limitations on the weight of the cargo transported and the lack of power and torque of these vehicles (compared to diesel vehicles), preventing them from operating on steeper inclines. Limited number of qualified technicians to maintain and repair vehicles.
4) Uncertain refuelling cost: For long distance freight transport, a 7% reduction in the EUR/km price was estimated compared to diesel.
5) Limited number of refuelling points: The current number of LNG refuelling points is less than intended and their locations are not fully aligned with the routes operated, limiting the functionality of vehicles.
6) Reduced competitiveness of vehicles: Limited offer of vehicles.

Despite the barriers identified, this study concluded that, as a fuel for long-haul heavy goods vehicles, LNG is a viable solution in the short and medium-term and is considered to be an environmentally advantageous option that enables an improvement in GHG emissions and a reduction in local pollutant emissions (NOx, PM and CO), despite a significant increase in hydrocarbon (HC) emissions.

With regard to costs associated with LNG, a decrease of around 24% was expected between 2010 and 2030, in particular due to a 67% decrease in transportation costs and a 14% decrease in liquefaction costs.

However, the adoption of LNG technology may lead to an increase of up to 54% in monthly vehicle costs (purchase/leasing costs), despite a 36% decrease in monthly fuel costs. The operators interviewed as part of this project reported an average increase of around 20% in the cost of purchasing LNG vehicles.

It should be noted, however, that some of the barriers identified in the aforementioned market study for LNG in Portugal, coordinated by the ADENE, are already starting to be overcome. For example, with regard to the range of heavy-duty vehicles, there are now solutions for 40-tonne trucks that enable them to achieve ranges in excess of 1,000/1,200 km, in particular vehicles equipped with one LNG tank and an additional CNG tank or with two cryogenic LNG tanks.

2.2 - MARITIME TRANSPORT

LNG is one of the most viable alternatives, from an economic, environmental and technical point of view, as a substitute for traditional fossil fuels used in the maritime sector or as a complementary alternative, from a perspective of diversifying fuel supply sources. It is considered an economically competitive, highly efficient and cleaner option as far as the emission of certain pollutants is concerned.

The use of LNG is compatible with the EU's and the International Maritime Organisation's (IMO) environmental provisions and rules on the reduction of air pollution from maritime transport, enabling a reduction in sulphur oxide emissions to practically zero and a significant

decrease in other pollutant gases such as nitrogen oxides and particulates when compared to traditional fuels used in this sector.

This alternative fuel is therefore a viable solution in order to comply with European environmental provisions established in 2014, which do not permit the use of marine fuels with a sulphur content of more than 0.5% in European territorial seas and exclusive economic zones (outside SO_X Control Zones or European ports) beyond 2020. It may also address the decision recently adopted by the IMO at the most recent meeting of the Marine Environment Protection Committee (MEPC 70), within the scope of Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL). This decision, taken in October 2016, aligned this cap with the cap established at European level in 2014, and was ahead of schedule, given that the IMO had only planned to examine this issue in 2018.

Furthermore, the use of LNG as an alternative fuel needs to be studied in order to investigate a number of issues related to the ships themselves, their design or conversion (changes in engines, conversion to LNG fuel or dual-fuel), the onboard and onshore storage of LNG, as well as logistical aspects (security of supply, reception terminals and distribution network), funding possibilities and associated regulatory requirements, as Portugal does not yet have any port equipped with the necessary infrastructure to bunker ships with this alternative fuel.

COSTA project

As far as the use of LNG in maritime transport is concerned, Portugal participated in the 'COSTA- CO2 & Ship Transport Emissions Abatement by LNG' project Commission Decision (2012)7017 final of 08.10.2012 - supported by the Trans-European Transport Network, TEN-T, as part of the European Commission's Motorways of the Sea (MoS) initiative.

This project, funded by the CEF and with the partnership of Portugal, Spain, Italy and Greece, aimed to develop a strategic plan for LNG as a fuel for short sea shipping between the Mediterranean Sea, the North Atlantic and the Black Sea, as well as for deep sea navigation in the North Atlantic towards the Autonomous Region of the Azores and the Autonomous Region of Madeira, in order to implement the Motorways of the Sea. To this end, it would be essential to ensure the creation of a strategic infrastructure for bunkering ships with LNG, and this fuel could also be used in some of the activities carried out in ports along the network of maritime corridors - Core Network Corridors (CORE Mediterranean, Atlantic and Black Sea).

This project also aimed to promote short sea shipping and, above all, to reduce emissions of carbon dioxide, sulphur oxides and nitrogen oxides, in compliance with EU provisions and in line with the provisions of the IMO's MARPOL Convention, in particular as regards capping the sulphur content of marine fuels with a view to improving air quality in the Mediterranean, Atlantic and Black Sea corridors.

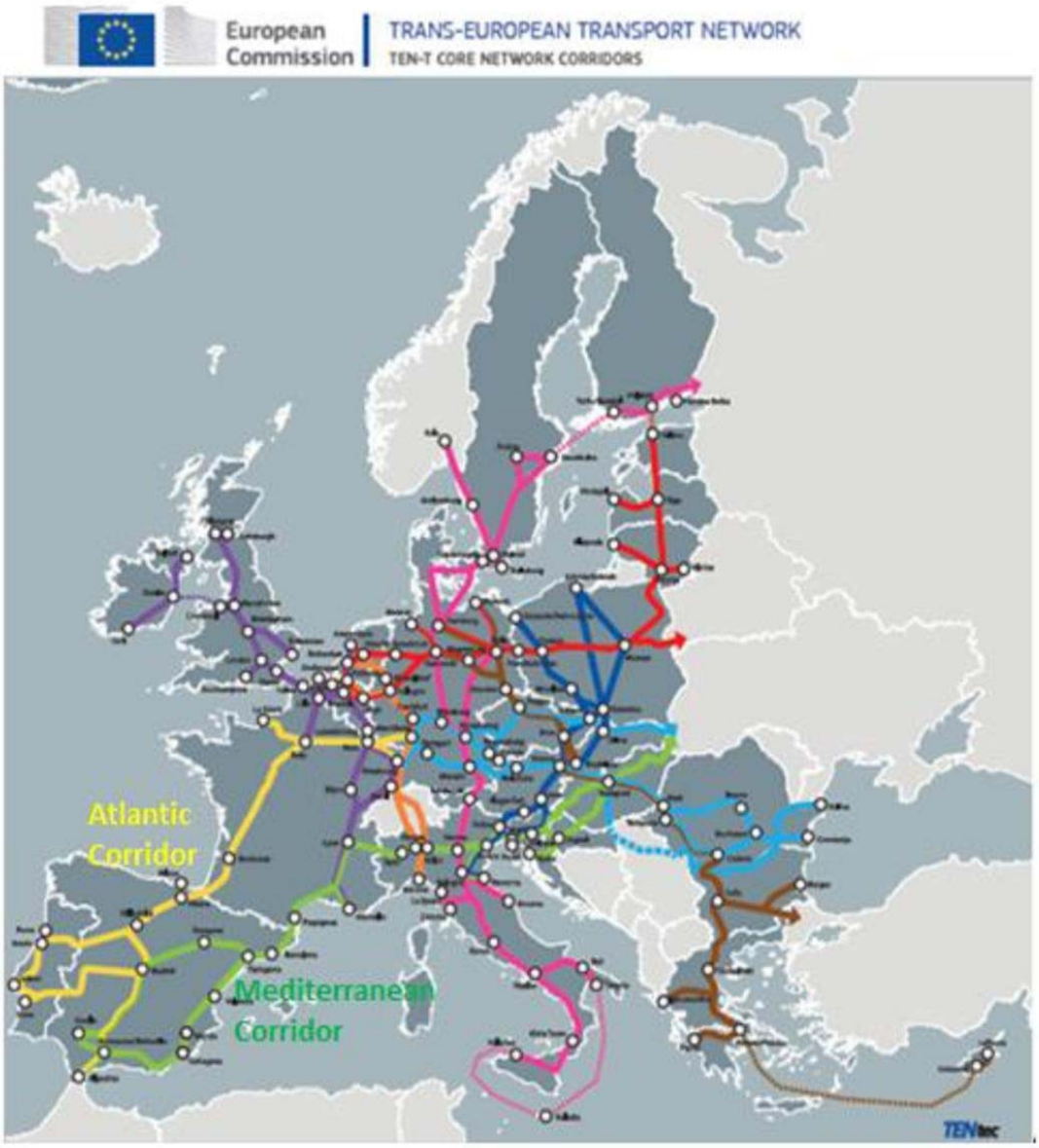


Figure 28 - Maritime corridors of the Trans-European Transport Network: TEN - T Core Network Corridors.

To this end, by describing the current situation and establishing benchmark scenarios for the years 2020 and 2030, LNG bunkering needs and methods in national ports were studied and defined, taking into account a variety of technical, economic and social feasibility criteria for bunkering ships with LNG in the Mediterranean, Atlantic and Black Sea corridors. Supply needs were also assessed, taking into account their logistics and specific features. Action plans were identified and details for their implementation were defined, as well as the investments required to enable the use of LNG as a shipping fuel from 2020.

Portugal would have the Ports of Madeira and the Ports of the Azores as implementing bodies and very significant cooperation with the three ports that are part of the CORE network, namely Leixões, Lisbon and Sines.

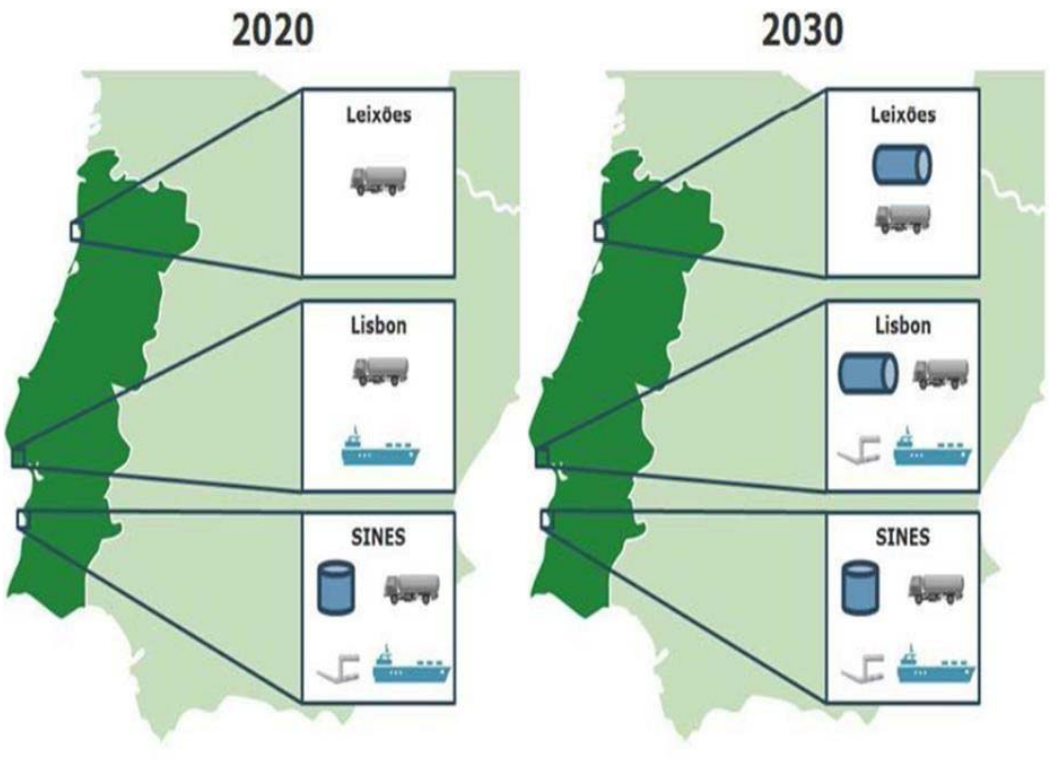


Figure 29 - Proposed infrastructure in relation to estimated LNG demand. Source: COSTA project.

Despite not being within the current Emission Control Area (ECA), Portugal forms part of the TEN-T network and, by 2020, will undoubtedly be influenced by the global sulphur cap of 0.5%. It is therefore essential to create infrastructure that enables the bunkering of LNG in the main national ports. Moreover, considering the location of the three Portuguese ports in the CORE network (Leixões, Lisbon and Sines), the Azores and Madeira, these ports could benefit from close collaboration to create a complete LNG infrastructure network.

GAIN4MOS Project

Within the scope of the European Commission's Motorways of the Sea (MoS) initiative, the COSTA project evolved into the GAIN4MOS ('Sustainable LNG Operations for Ports and Shipping - Innovative Pilot Actions') project. This project, which Portugal is participating in along with France, Italy, Spain, Slovenia and Croatia, is also co-funded by the CEF Programme.

With a total planned budget of more than EUR 40 million, up to EUR 20 million of which is to be funded by European funds, this project aims to contribute to the roll-out of LNG bunkering infrastructure in the Atlantic and the Mediterranean, within the scope of compliance with Directive 2014/94/EU, the installation of pilot infrastructure for LNG bunkering at the CORE ports of Koper, La Spezia and Venice and fully operational LNG bunkering stations in the ports of Fos-Marseille and Nantes-Saint Nazaire. The project also aims to prove that ships can be retrofitted, providing tested technologies that can be used to retrofit and help build a short-sea fleet deployed in the Atlantic and Mediterranean.

This project is coordinated by the Valenciaport Foundation, and the Port of Setúbal, representing the Portuguese Ports Association (*Associação dos Portos de Portugal* - APP), is the national coordinator of this European project.

Within the scope of this project, Portugal initially applied for three pilot projects for retrofitting ships:

1) 'LNG in the Port of Leixões Fleet': APDL - Administração dos Portos do Douro e Leixões, S.A., with a budget of EUR 2.72 million;
2) 'PLIM - Madeira Action SHIPS&LOG Intermodal Logistical Project': APRAM - Administração dos Portos da Região Autónoma da Madeira, S.A., with Grupo Sousa as partner and a budget of EUR 1.57 million;
3) 'Deep Blue Atlantic Retrofitting': Portos dos Açores, S.A., with Mutualista Açoriana, S.A., as partner and a budget of EUR 4.5 million.

However, these projects are being redrafted and are awaiting the decision of the INEA - Innovation and Networks Executive Agency.

Core LNGas hive Project

Core LNGas hive is a project co-funded by the EU within the scope of the CEF Programme - Transport Calls for Proposals 2014 programme, and is part of the development of infrastructure in the Atlantic and Mediterranean Priority Corridors under the Trans-European Transport Network. The project - Commission Decision C (2015) 7358 final of 30.10.2015 - aims, in particular, to promote the use of LNG in the Iberian Peninsula, mainly in the maritime sector, by supporting the development, by 2025, of an LNG logistics chain and bunkering infrastructure for maritime transport and operations in ports in the Portuguese and Spanish sections of the respective corridors (CNC-7 Atlantic and CNC-3 Mediterranean), thereby enhancing the use and geographical projection of LNG.

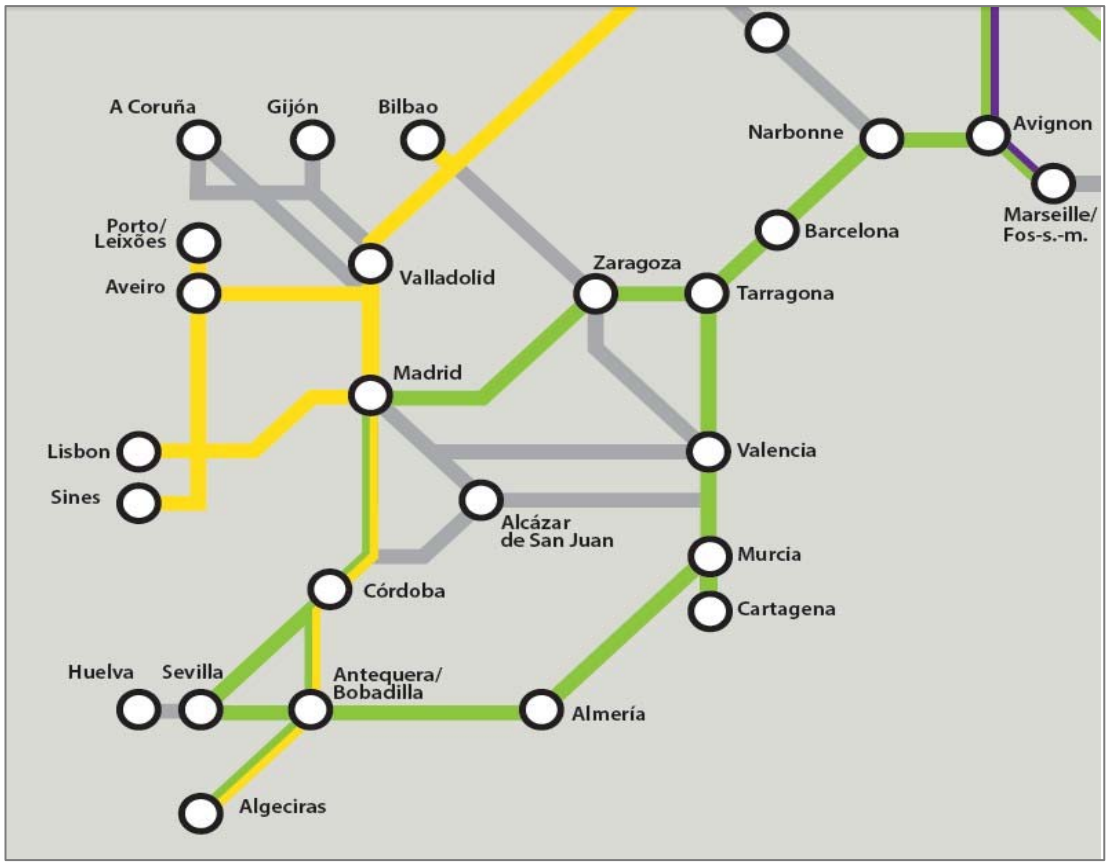


Figure 30 - Ports covered by the 'Core LNGas hive' project. Source: 'CORE LNGas hive'.

The project, which is focused on the energy and transport sectors, is based on four essential activities (Management, Studies, Pilot Studies and Impacts/Results) and involves administrative, training, technical and financial aspects and constraints analysis (technical, logistical, social, environmental, financial and regulatory).

REN Gasodutos is the only Portuguese partner of the 42 partners in the consortium, and the remaining partners are various Spanish public and private bodies. The 'CORE LNGas hive' project, led by *Puertos del Estado* (Spanish State Ports) and coordinated by Enagás, is expected to run until 2020, with total investment expected to amount to EUR 33 million and a contribution of EUR 16.4 million.

REN is coordinating the technical study for the Atlantic Corridor (ET3 - Study on LNG demand and supply chain analysis for the Roll out - ATL corridor), which will assess the use and evolution of demand for LNG infrastructure and logistics chain in this corridor, in Spain and Portugal, and the IMT, I.P. is the national institutional body that will monitor its Spanish counterpart, *Puertos del Estado*. The costs of the study are estimated at EUR 600,000 and are considered to be eligible for community funding.

The main objectives of this study coordinated by REN include:

- Evolution of LNG demand for use in maritime transport and in various port operations, contributing to the depollution of the Mediterranean and Atlantic corridors;
- Requirements for the development of LNG bunkering hubs;
- Development of a logistics chain for LNG supply;
- Necessary adaptations to be made to existing LNG Terminals in the Iberian Peninsula;
- Industrial models for implementing infrastructure that enables the supply of LNG taking into account the different existing port conditions.

3 - LIQUEFIED PETROLEUM GAS (LPG)

'Liquefied petroleum gas' (LPG) is a mixture of light hydrocarbons resulting from the oil refining process, with the best known being propane (C3H8), butane (C4H10) or a mixture of the two. These hydrocarbons can also be extracted in oil and natural gas fields and, although LPG is in a gaseous state at room temperature and pressure, it is easily converted to its liquid phase when subjected to a moderate increase in pressure at room temperature or to a decrease in temperature at atmospheric pressure. This liquefaction significantly reduces its volume and makes it a versatile fuel that is easy to store, transport and distribute.

This fuel may be stored in pressure tanks, cryogenic tanks or underground caverns and is distributed in bottles, tanker vehicles (bulk) and through a gas distribution network (piped).

LPG can therefore be used in several sectors of activity, including the household sector, and is one of the main sources of heat energy used in homes (with almost 25,000 sale and distribution points nationwide), the industrial sector (e.g. agro-industry, manufacturing, metallurgy, glass, ceramics, textile industry) or as vehicle fuel.

3.1 - ROAD TRANSPORT

3.1.1 - LPG Mobility in Portugal

LPG can be vaporised and burned in an ignition engine, such as that of a petrol car, and is supplied in its liquefied form to the engine, using an electronic power system that instantly adjusts the flow according to the needs of the engine.

Autogas is therefore a fuel for internal combustion engines, consisting of a mixture of propane and butane gas. Compared to diesel and petrol, its combustion enables a reduction of around 10% in GHG emissions, as far as CO_2 emissions are concerned. However, as with natural gas, the main environmental advantage associated with this alternative fuel, is the low emissions of particulates and nitrogen oxides (NOx).

The possibility of using LPG as a fuel for light and heavy-duty vehicles dates back to the start of the 1990s, with the publication of Decree-Law No 195/91 of 25 May 1991, which defined the approval framework for vehicles adapted for the use of LPG and the publication of Ministerial Implementing Orders No 982/91 and 983/91 of 26 September 1991, which respectively approved the articles of association of the bodies responsible for adapting motor vehicles for the use of LPG and the rules on the technical specifications for these vehicles.

Ministerial Implementing Order No 350/96 of 9 August 1996 approved a new regulation on the technical characteristics of LPG-fuelled motor vehicles, repealing Ministerial Implementing Order No 983/91, and Order No 8197/97 of 14 September 1997 established the specifications of the LPG to be used in these vehicles.

Later, Decree-Law No 136/2006 of 26 July 2006 established the principles for the use of LPG in motor vehicles, including the creation of an identification sticker, to be regulated by Ministerial Implementing Order, as well as the possibility of parking in enclosed spaces, provided there is natural ventilation through openings at ceiling and ground level, thereby repealing Decree-Law No 195/91.

More recently, Law No 13/2013 of 31 January 2013 repealed this law, establishing the new legal framework for the use of LPG and natural gas as a vehicular fuel (NVG).

The publication of Ministerial Implementing Order No 207-A/2013 of 25 June 2013 represented an important step in promoting a wider use of this fuel, as it implemented the objectives of Law No 13/2013 by defining the technical and identification specifications that LPG vehicles must comply with in order that they may be parked in enclosed and underground parking areas, as well as the new identification sticker templates for LPG vehicles. The set of Ministerial Implementing Orders published in 2015, already mentioned in the chapter on NVG, are also relevant to the framework applicable to LPG vehicles.

3.1.2 - Refuelling Infrastructure and LPG vehicles

There are currently more than 50,000 LPG vehicles operating in Portugal, almost of all of which are passenger cars. These vehicles have a network of 347 refuelling points spread throughout the mainland, of which 69 are located on major motorways.

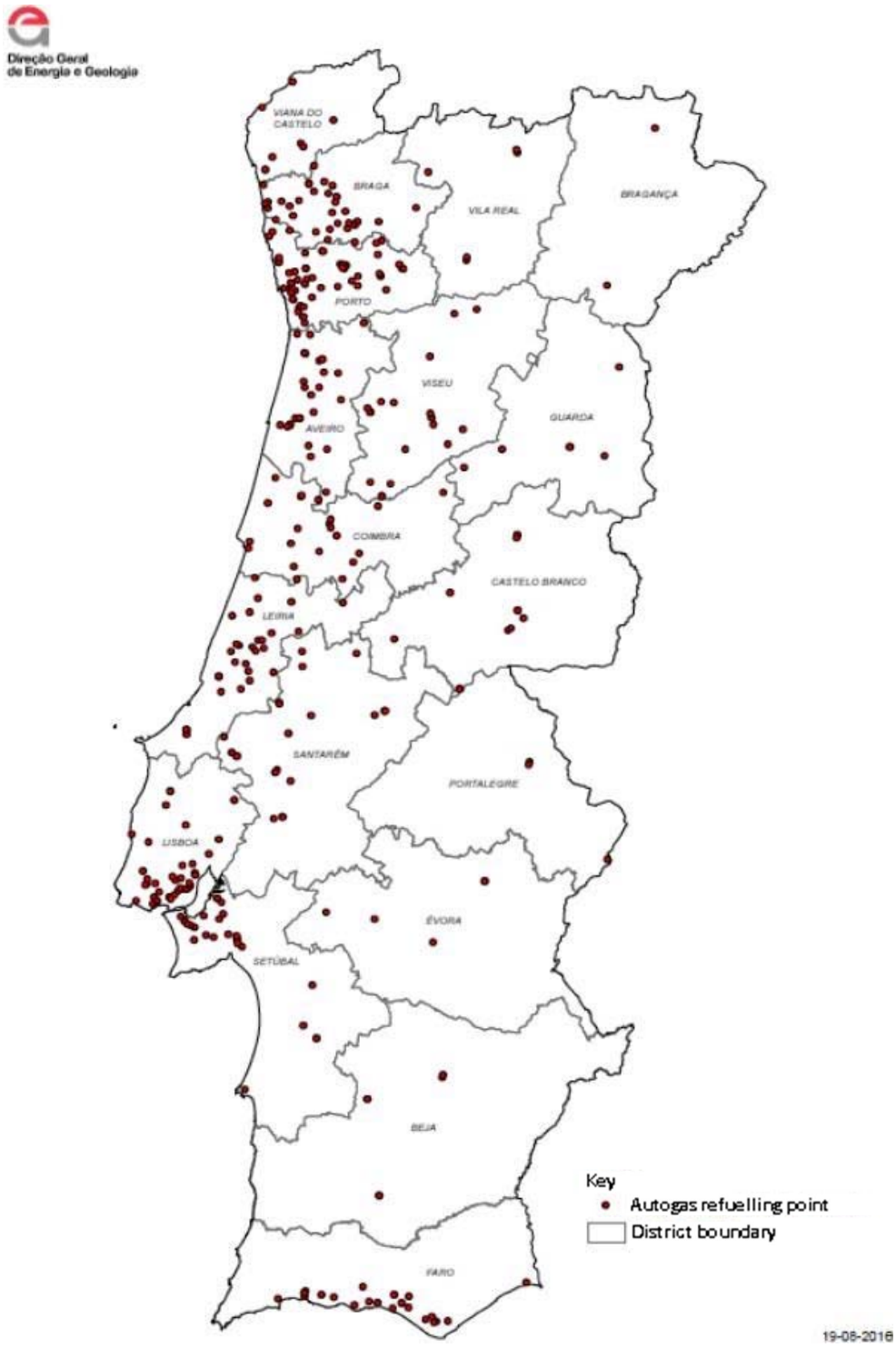


Figure 31 - Map with the location of LPG points. Source: DGEG.

Although the consumption of autogas only accounted for 0.7% of total energy consumption in the transport sector in 2015, there has generally been a gradual increase in the consumption of this fuel.

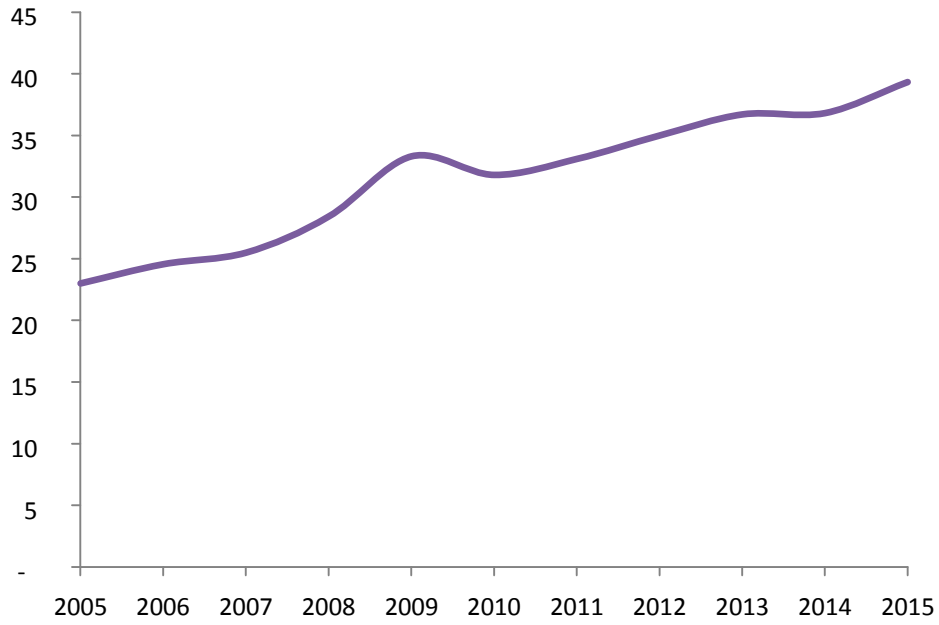


Figure 32 - Evolution of LPG consumption in transport (ktoe). Source: DGEG.

3.1.3 - Incentives and Funding

The 'Green Tax' reform act also provides for several tax incentives for the purchase and use of LPG vehicles, in particular:

- Granting of tax incentives for the purchase of LPG vehicles, through new amounts eligible for tax expenditure and autonomous taxation of Personal Income Tax and Corporate Income Tax;
- Possibility to deduct 50% of the VAT incurred on expenditure related to the purchase, manufacture or import, lease and conversion of LPG-fuelled vehicles, when considered as passenger vehicles, the purchase cost of which does not exceed that defined in the Ministerial Implementing Order referred to in Article 34(1)(e) of the Corporate Income Tax Code;
- Possibility to deduct costs incurred for the purchase, in Portuguese territory, of LPG for refuelling road passenger and freight transport vehicles;
- Setting of new amounts above which the depreciation of light passenger or mixed-use vehicles is accepted as expenses for LPG-fuelled vehicles.

3.1.4 - Research and development

Although the current autogas refuelling infrastructure is already well developed and tailored to the needs of the market, there are plans to carry out a project to integrate new LPG refuelling points in metropolitan areas of Portugal and Spain.

This project, co-financed by the EU under the CEF Programme and coordinated in Portugal by Repsol Gás Portugal, S.A., is expected to run from February 2016 to December 2018. The main objective of this action is to reinforce the alternative road fuel infrastructure along the Atlantic and Mediterranean Corridors through the installation of 69 new LPG refuelling points at existing refuelling stations in the Iberian Peninsula.

Considering that this strengthening of the LPG infrastructure will be sufficient to meet market needs in the short and medium-term and given the existence of other alternative

technologies that have similar or greater environmental advantages and potential and make a more significant contribution to security of supply and reducing oil dependence, Portugal will be more committed to developing these alternatives, such as electricity, rather than expanding the LPG refuelling infrastructure.

Nevertheless, the abovementioned Assembly of the Republic Resolution No 240/2016 also recommends measures to the Government that will contribute to strengthening the LPG network and adapting current legislation on LPG-fuelled vehicles to facilitate their licensing, circulation and parking, within the framework of the necessary safety standards.

4 – BIOFUELS

Under current legislation, biofuels are considered to be liquid or gaseous fuels used in transport and produced from biomass.

Biofuels are currently the most accessible and implementable solution for the introduction of renewable energy sources in transport. In view of the current technological situation and the fact that they can be used immediately in vehicles already in circulation, biofuels are expected to play a major role in meeting Portugal's objectives in terms of renewable energy and reducing GHG emissions for the transport sector.

Considering the national fuel consumption profile of this sector, which shows the clear predominance of diesel, and bearing in mind that national refineries produced an excess of petrol for the market, Portugal based its commitment to biofuels on the production of diesel substitutes, namely biodiesel (Fatty Acid Methyl Esters - FAME).

The emergence of the first large industrial unit for the production of biofuels in Portugal dates back to 2006, and was associated with the animal feed industry. The national biofuel industry has therefore been characterised by its synergy with the animal feed industry and has used surplus animal feed as raw material for the production of biodiesel.

Decree-Law No 62/2006 of 21 March 2006 transposed into national law Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport, which set indicative targets, on the basis of energy content, for the placement of these alternative fuels in place of petrol and diesel used in transport: 5.75 % by 31 December 2010.

To this end, this Decree-Law included a set of measures to promote the use of these alternative fuels, namely:

i. The possibility of imposing minimum quotas for the incorporation of biofuels in fossil fuels;
ii. The conclusion of agreements for the use of biodiesel in public passenger transport and freight transport fleets, with a percentage rate of biodiesel incorporation in fossil fuels of more than 10%;
iii. The creation of the title of ‘dedicated small producer’ for companies with a maximum annual production of 3,000 tonnes from waste materials or using technological development projects based on products that are more environmentally friendly.

Companies that comply with all the requirements set out in Article 7 of Decree-Law No 62/2006, as amended, may therefore be recognised as Dedicated Small Producers (*Pequenos Produtores Dedicados* - PPD):

- Maximum annual production of 3,000 tonnes of biofuel or other renewable fuels;
- Use of waste materials (currently with a minimum of 60%, Decree-Law No 117/2020) or using technological development projects based on products that are more environmentally friendly, using innovative processes, or at a demonstration phase; and
- Placing all of their production with duly identified captive fleets and consumers.

The promotion of biofuels through tax measures was covered in Decree-Law No 66/2006 of 22 March 2006, which provided for total exemption (for small dedicated producers) or partial exemption from the Tax on Oil and Energy Products (*Imposto sobre Produtos Petrolíferos e Energéticos* - ISP) for these fuels, up to a maximum quantity set annually and regulated by Ministerial Implementing Order of the members of government responsible for the areas of finance, environment, economy, agriculture and transport.

The publication of Ministerial Implementing Order No 1391-A/2006 of 12 December 2006 set the maximum annual amounts of biofuels exempt from the ISP, in accordance with Article 71-A of the Excise Duty Code (*Código dos Impostos Especiais de Consumo* - CIEC), for 2007, and through Ministerial Implementing Order No 1554-A/2007 of 7 December 2007, for 2008, 2009 and 2010.

However, these measures that were implemented to ensure the competitiveness of biofuels and encourage their introduction into the market have proved to be insufficient. Decree-Law No 49/2009 of 26 February 2009 was subsequently published, setting quotas for the compulsory incorporation of biofuels in diesel fuel and established monitoring and control procedures. Nevertheless, compliance with the incorporation targets established in this Decree-Law (6% (v/v) for 2009 and 10% (v/v) for 2010) remained subject to amendments to the European standard EN 590 on diesel fuel.

This measure, in addition to the obligation to incorporate biodiesel in dyed and marked diesel and the regulation on the sale of fuels with a higher biofuel content than that laid down in current standards, up to 20% in volume (provisions contained in Decree-Law No 89/2008 of 30 May 2008 and later repealed by Decree-Law No 142/2010 of 31 December 2010, first amendment to that Decree-Law), was aimed at boosting the development of the biofuels sector in Portugal and meeting national targets for introducing these types of alternative fuels into the market.

It should be noted that, even with the partial ISP exemptions granted to biofuels, the market for rich mixtures failed to emerge and has, so far, been virtually non-existent.

Decree-Law No 117/2010 of 25 October 2010, as amended by Decree-Law No 6/2012 of 17 January 2012 and Decree-Law No 224/2012 of 16 October 2012, transposes into national law Articles 17 to 19 of and Annexes III and V to Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009, as well as Article 1(6) of and Annex IV to Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009.

This Decree-Law establishes the biofuels support mechanism which will remain in place until 2020, establishing sustainability criteria for the production and use of biofuels and bioliquids and mandatory biofuel incorporation targets for the years 2011 to 2020. Bodies that introduce road fuels for the transport sector into the market, known as 'incorporators', are therefore required to meet mandatory biofuel incorporation targets, on the basis of energy content, for the fuel they introduce into the market:

- 2011 and 2012 - 5.0%;
- 2013 and 2014 - 5.5%;
- 2015 and 2016 - 7.5%;
- 2017 and 2018 - 9.0%;
- 2019 and 2020 - 10.0%;

This Decree-Law also establishes an obligation to incorporate 2.5%, on the basis of energy content, of petrol-substitute biofuels, in relation to the amounts of petrol placed on the market, for the years 2015 to 2020.

However, Article 176 of the State Budget Law for 2017 (Law No 42/2016 of 28 December 2016) waived the entry into force of the incorporation target planned for 2017, and instead maintained the target of 7.5% for 2017.

The fulfilment of these obligations is proven by the submission of biofuel entitlements (*títulos de biocombustíveis* - TdB), where each TdB represents the incorporation of 1 tonne of oil equivalent (toe) of sustainable biofuels to be incorporated into the national market, which can take the following forms:

- 'TdB -G' (TdB issued for a biofuel substitute for petrol);
- 'TdB-D' (TdB for a biofuel substitute for diesel);
- 'TdB -O' (TdB for a biofuel replacing another fuel other than petrol and diesel).

However, a bonus is granted for biofuels produced from raw materials classified as waste or debris, non-food cellulosic material or lignocellulosic material, and 2 TdBs are issued for each toe of biofuel introduced to the market.

In this sense, the Coordinating Body for Compliance with the Sustainability Criteria (*Entidade Coordenadora do Cumprimento dos Critérios de Sustentabilidade* - ECS) is responsible for checking compliance with the sustainability requirements defined for biofuels, as well as for issuing the respective TdBs.

The same Decree-Law also provides that dedicated small producers, which generally use waste material to produce biofuels, continue to benefit from exemption from the ISP in accordance with the CIEC.

However, with the publication of Directive (EU) 2015/1513 of the European Parliament and of the Council of 9 September 2015 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and Directive 2009/28/EC on the promotion of the use of energy from renewable sources, Decree-Law No 117/2010 will have to be revised to take account of the new directives introduced by this Directive (ILUC - Indirect Land Use Change Directive).

This directive seeks to limit the use of conventional biofuels produced from agricultural raw materials and to promote the development and production of advanced biofuels produced from waste and algae which enable a large reduction in greenhouse has emissions, with a low risk of indirect land use change and which are not in direct competition with the food and feed markets with regard to the use of agricultural land.

Biofuels not only aim to reduce the dependence of transport on oil, but also to decarbonise the sector, while also offering opportunities to diversify primary energy consumption and enhance security of energy supply. The development of this sector may even contribute to creating jobs in rural areas and opening up prospects for technological development.

There are currently eight large biodiesel production facilities (biofuel production units with an installed capacity of more than 20,000 tonnes/year), with a total installed capacity of around 748,581 tonnes/year (according to information reported by the operators), and one unit for manufacturing biofuel substitutes for petrol, with an installed Bio-ETBE capacity of around 53,000 tonnes/year.

It should be noted that other small companies produce biofuel substitutes for diesel, with installed capacities of no more than 3,000 tonnes/year, and almost all of these companies are classed as Dedicated Small Producers. It is estimated that, at the beginning of 2016, only 14 companies would be operating.

In general, there has been a growing trend in biofuel production in Portugal. However, due to the turbulent economic situation that the country has experienced, particularly between 2011 and 2012, and which it is still recovering from, there has been a decline in the consumption of diesel fuel, which has also been reflected in a decrease in the national consumption of biofuels.

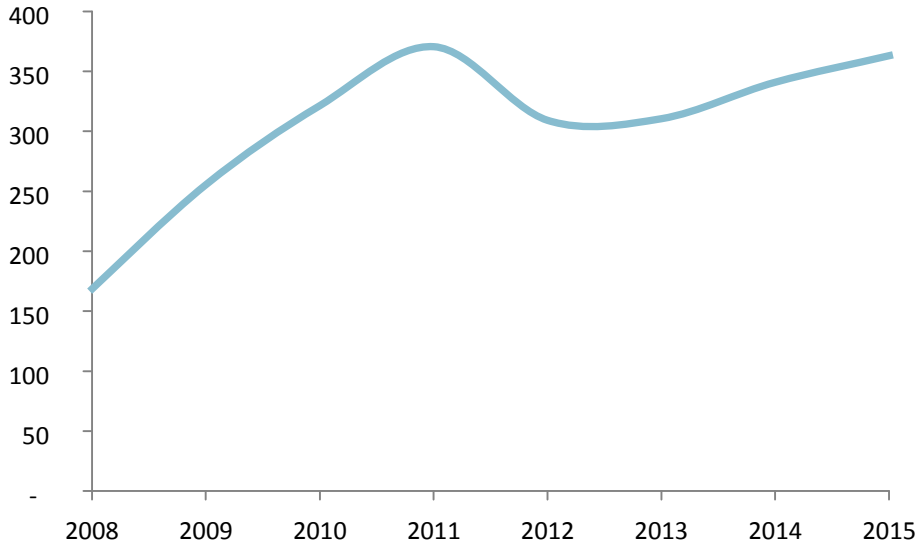


Figure 33 - Biodiesel production (ktonne). Source: DGEG.

By the end of 2014, biofuel production in Portugal was focused on the production of biofuel substitutes for diesel and, in particular, of biodiesel (FAME - fatty acid methyl ester).

In recent years, however, other types of biofuels have been incorporated into diesel and petrol, such as hydrogenated vegetable oils (HVO) or Bio-ETBE (ethyl tert-butyl ether produced from bioethanol).

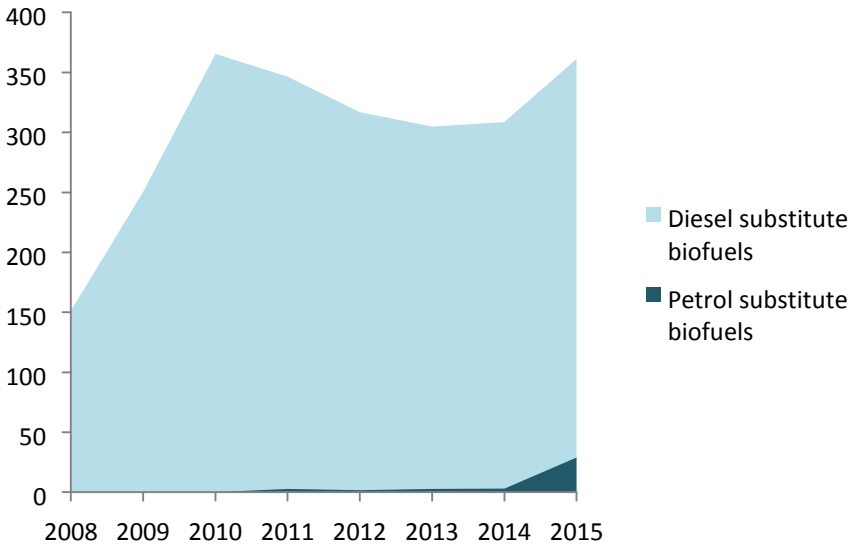


Figure 34 - Biofuels incorporated in diesel and petrol consumed in road transport (Ktonne) Source: DGEG.

On the other hand, dedicated small producers of biofuels introduce their biofuel directly into the market by selling it to captive fleets and consumers. These operators mainly produce biofuel from waste material such as used cooking oils and animal fats.

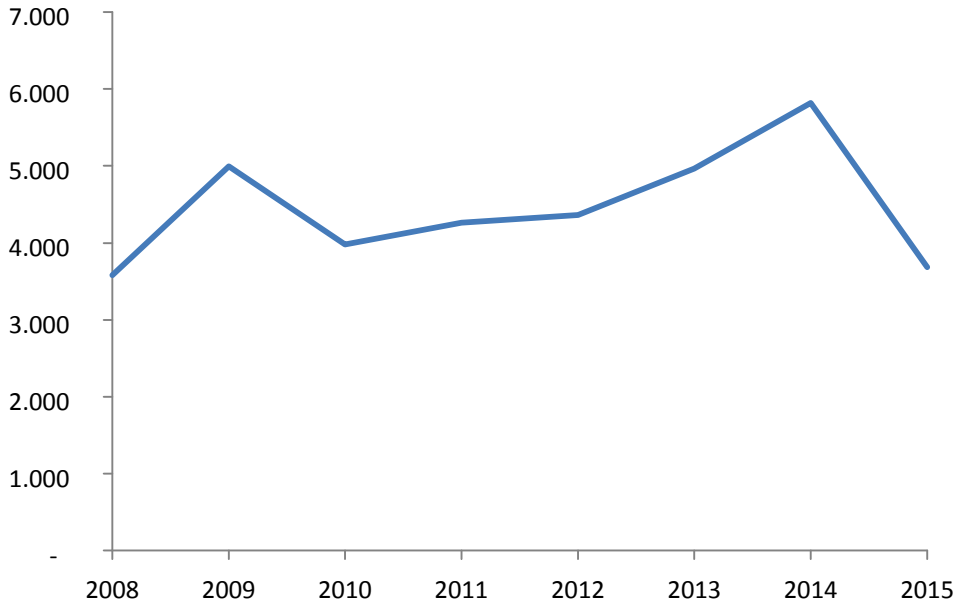


Figure 35 - Introduction of biofuels to the market by PPDs (tonne). Source: DGEG.

As a result, the strategy for introducing biofuels into the market in Portugal mainly involves incorporating them into road fuels by using the existing infrastructure for these conventional fuels.

BIOMETHANE

Biomethane is a gas that consists mainly of methane (about 85-95%) and can be obtained by the biochemical (biogas) or thermochemical (synthesis gas) conversion of biomass. The

most commonly used method to produce biomethane consists of a process of purifying and upgrading the chemical composition of biogas for enrichment in methane in order to ensure that its properties are similar to those of natural gas. Biogas (or synthesis gas obtained by gasification) can be produced from several types of biomass of different origins, usually organic waste, although in Portugal it is mainly from organic material deposited in landfills.

Biogas produced in Portugal, when upgraded, has almost exclusively been used to produce electricity in plants located alongside wastewater treatment plants, landfill sites, organic waste recovery centres, agricultural holdings and agro-food industries.

However, Portugal has the potential to be able to benefit even more from this renewable resource, in particular by purifying it in biomethane before injecting it into the natural gas network, which would enable its use in other areas and extension to other sectors. That is why one of the strategic areas to be promoted, included in the PNAER 2020, relates to Biomethane. Among the measures included in this plan are the assessment of the potential of biomethane in Portugal and its alternative applications to support rules being drawn up on the necessary specifications for it to be injected into the natural gas network, so that it can be used for purposes other than electricity production.

In this context, the National Energy and Geology Laboratory (*Laboratório Nacional de Energia e Geologia* - LNEG), with the support of the FAI, carried out a study entitled 'Evaluation of the Potential and Impact of Biomethane in Portugal'.

Technically, the production of biomethane from biogas and its use in several sectors is well developed and demonstrated, but there is no European-wide market for biomethane, i.e. a well-developed uniform common policy.

According to this study, in 2015, there were more than 60 biogas production plants in Portugal, with 51 plants connected to the grid and some of them (six plants) in cogeneration. There were a further six additional plants which were not connected to the electricity grid, two of which operate in cogeneration.

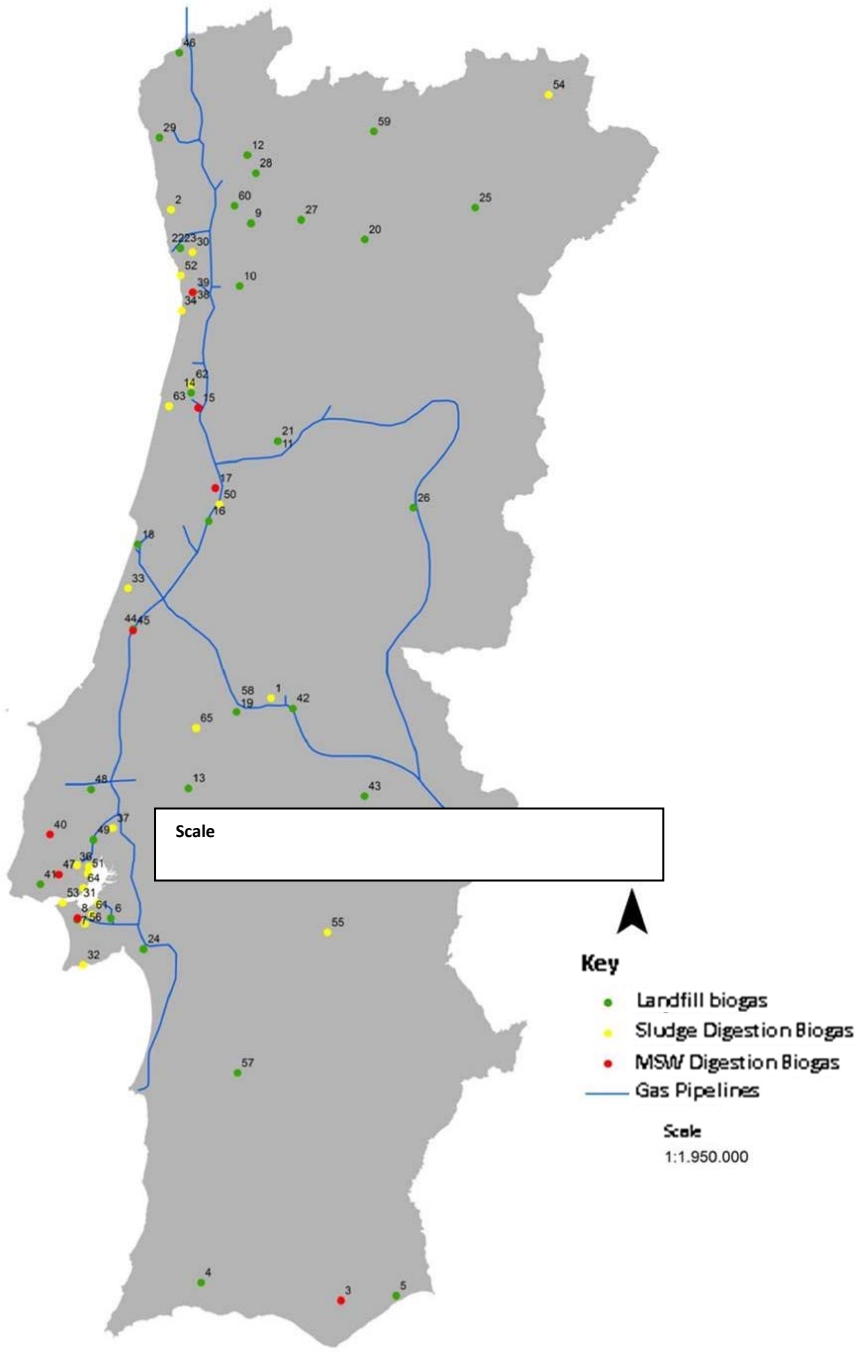


Figure 36 - Existing licensed plants for biogas production. Source: Map taken from the study 'Evaluation of the Potential and Impact of Biomethane in Portugal'.

As a result of the study, an overall biomethane production potential of around 1.7 G Nm^3/year, equivalent to 1 738 ktoe/year, was identified from different types of biomass. In addition to the use of waste, this study also identified the option of using energy catch crops with a low ILUC (indirect land use change) impact to produce this biofuel.

TABLE 8

Estimated Biomethane Potential in Portugal.
Source: 'Evaluation of the Potential and Impact of Biomethane in Portugal' study

Biomethane						
Organic matter	Production		Energy Potential			
	M Nm^3/year		GWh/year		Ktoe/year	
	Biogas	Bio-SNG	Biogas	Bio-SNG	Biogas	Bio-SNG
Municipal Solid Waste	412		4 482		385	
Domestic Sewage	43		465		40	
Agricultural	258		2,807		241	
Food Industry	93		1,013		87	
Wood		866		9,425		810
Paper and Cardboard		14		148		46
Plant Tissues		38		412		127
TOTAL	805	917	8,767	9,985	754	984

Having identified the resources and potential for biomethane production in Portugal, the study sought to analyse several options for the production and provision of this alternative fuel. Taking into account the state of the art, economic aspects and possible constraints, mainly of a logistical nature, three alternatives were considered:

i. Decentralised biomethane production associated with each biogas production unit, which in the short-term can be applied in landfills with excess biogas or without generators, MSW, agricultural or sludge digesters that can be adapted to receive a larger quantity of waste, and even in industrial digesters.
   In this alternative, the minimum size to be considered could be small (> 50 m^3/h of biogas), and this solution seems to be the easiest to implement in the short term through its use as vehicle fuel, either for self-consumption or supplied directly at public refuelling points;
ii. Establishment of clusters of biogas production operators by implementing a biomethane conversion unit to serve a certain number of operators. This was considered as an option to be observed in the medium-term, considering the distance between units and being dependent on the future development of the biogas production sector;
iii. Channelling of raw materials from a group of bodies (farmers, WWTPs, etc.) to a central plant for centralised biogas production and conversion into biomethane. This alternative requires the implementation of a national process for collecting and channelling to a central biomethane production facility, so it is only expected to be implemented in the medium- or long-term.

Replacing natural gas consumption with biomethane not only brings environmental benefits, but also benefits in terms of security of supply. It may even contribute to the reduction of external energy dependence. In view of the development of the natural gas transmission and distribution network and the increasing consumption of this fuel in recent

years, the injection of biomethane into the NG network is now an interesting alternative to the direct use of biomethane/biogas for producing electricity.

Furthermore, Portugal has committed to the target of incorporating 10% of renewable energy sources in the transport sector, which can only be achieved using biofuels. The use of biomethane in the transport sector could contribute to achieving this commitment, in particular when produced from waste material eligible for the issue of 2 TdBs for each toe of biofuel introduced into the market.

The development of a biomethane market in Portugal does not necessarily require the implementation of a specific infrastructure for the refuelling of this alternative fuel. It is possible to put in place one of the alternatives identified in the study carried out by the LNEG, including the option of using biomethane as vehicle fuel, using existing and planned natural gas distribution and supply infrastructure.

Incentives and Funding

Support and incentives such as tax exemptions have also been granted in the field of biofuels, particularly in terms of the ISP, with small producers continuing to benefit from total exemption from this tax.

Furthermore, projects in the field of biofuels have also been supported by the FAI, namely:

i. 'Development of 2nd Generation Biofuels' project - aimed at developing a technological roadmap for the production of biofuels from non-food crops, namely Jatropha. The project aimed to develop several stages of the roadmap in order to establish and consolidate pre-industrial processes: I. Plant breeding and production techniques; II. Mechanical harvesting; III. Oil extraction; IV. Recovery of by-products; and V. Biodiesel. The FAI supported stages II, III and V, with a contracted incentive of EUR 1,008,497. However, in February 2014, the sponsor stated that they were unavailable to continue with the project.
ii. BIOCH4 project - aimed to carry out a study with the objective of evaluating biomethane potential in Portugal and its alternative applications. This study sought to identify opportunities and constraints in Portugal for the use of methane in the transport sector, comparing it with the experience of other EU Member States. The project envisaged a total investment of EUR 50,150, 100% co-financed by the FAI, and the technical implementation of the project was completed by the end of March 2015.

5 – HYDROGEN

Hydrogen is recognised as an energy vector that allows the temporary storage of energy and offers a high flexibility of use as it can be used in electricity generation and thermal energy production in stationary systems and also as fuel in the transport sector. Portugal has participated in several studies on the potential for hydrogen usage, with projects to produce hydrogen from renewable energy sources currently ongoing in research centres and universities. As an example, in 2005, Portugal participated in an international study and reflection on the role of hydrogen and fuel cells, carried out under the aegis of the International Energy Agency, which not only took a technological approach but also adopted a prospective approach in terms of barriers, benefits and challenges, in order to identify short- and medium-term measures that can be implemented. Hydrogen can play an important role in the future energy scenario, in particular due to its significant potential in the transport sector where penetration of renewables has been a major challenge, by contributing to a cleaner and

more sustainable system and meeting national energy and climate objectives in the medium and long term. Given the possibility of using renewable energy sources, its introduction into the energy mix will also contribute towards reducing national energy dependence.

Hydrogen can also play an important role in stabilising electricity generation systems with a high contribution from variable sources, as is the case with the national system. Electricity from renewable sources reflects the temporal variability of its sources - sun, wind and even waves have patterns that are not always in line with consumption patterns, resulting in periods of excess electricity and periods of electricity shortage that present a challenge for the management of a grid that requires stability and permanent balance. As an example, hydrogen produced via water electrolysis, obtained through the use of electricity generated during periods of excess, can be stored for long periods. Hydrogen can be converted back into electricity, converted to methane for integration into the natural gas network, or used directly as a fuel, for example in vehicles with fuel cells. Hydrogen can open up new prospects for integrating renewables into the energy system and compensate for the loss of flexibility resulting from intermittent sources.

However, there are concerns about its handling and infrastructure needs which need to be thoroughly analysed in order to identify specific measures enabling sound and proper medium to long-term planning in order to ensure the successful introduction of hydrogen in Portugal. The PNAER provides for the assessment of the potential of hydrogen in Portugal and the definition of a strategy for its development. This work was initiated in 2016, and a two-pronged action plan was designed - one of a strategic and regulatory nature, under the responsibility of the Directorate-General for Energy and Geology and another of a more technological nature, under the responsibility of the National Energy and Geology Laboratory, with both institutions under the authority of the Secretary of State for Energy of the Ministry of Economy. Analytical work was therefore carried out at the end of 2016 to evaluate the potential of hydrogen and define a roadmap for its development in Portugal. The studies that formed part of this work were approved for co-financing by the Sustainability and Resource Use Efficiency Operational Programme (*Programa Operacional de Sustentabilidade e Eficiência no Uso dos Recursos* - POSEUR), and are scheduled to be completed in April 2018. These studies will identify the state of the art and technological and non-technological barriers to the promotion of hydrogen, identify priorities and strategy for technological innovation, identify and model key hydrogen introduction sectors, create a formal support network and define the medium and long-term national roadmap for this energy vector in Portugal.

In these circumstances, which still reflect a lack of maturity in the study and in the application of this technology in Portugal, it would be premature to define objectives and targets for the creation of a hydrogen refuelling infrastructure for the transport sector.

PART B - NATIONAL OBJECTIVES AND TARGETS

1 – ELECTRICITY

1.1 - ROAD TRANSPORT

The national electrical system is characterised by an increasing penetration of renewable energy sources in its production mix, but the opportunity to fully harness their potential is limited by a number of factors. These include the intermittent and unpredictable nature of some of these sources (in particular wind and solar energy), the lack of interconnections that would enable Portugal to export surplus energy to central Europe and economically viable solutions that enable the storage of energy from renewable sources.

To a certain extent, electric vehicles may become one of these solutions in the medium to long-term, as they can simultaneously serve as a means of transportation and as a device for storing and using electricity, playing a very important role in improving the balance of the electrical system.

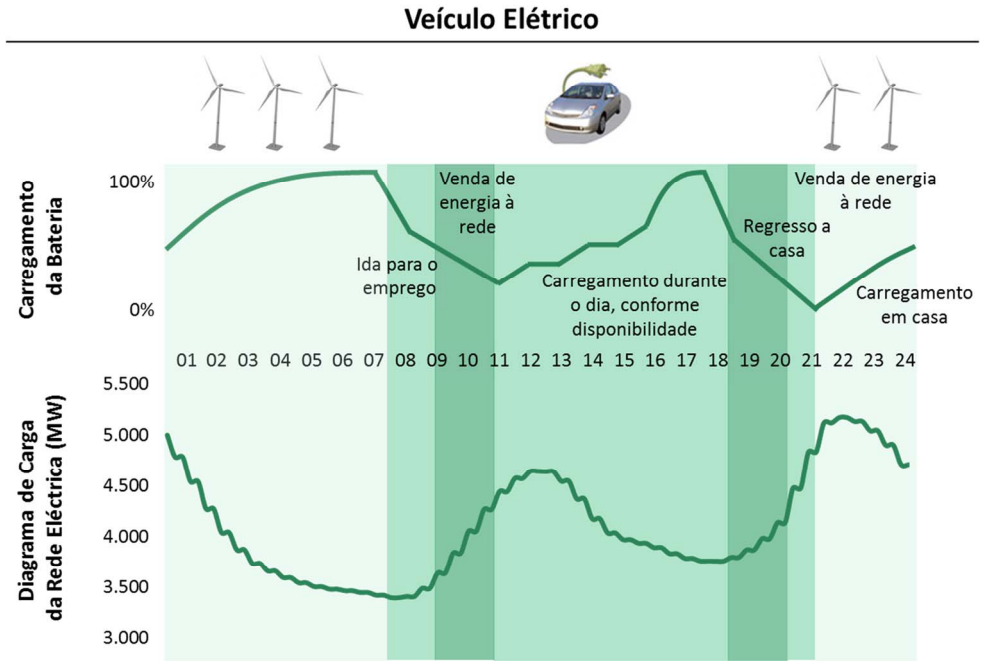


Figure 37 - Diagram of the potential of electric vehicles to improve the management of the national electrical system.

PT	EN
Veículo Elétrico	Electric Vehicle
Carregamento da Bateria	Battery Recharging
Diagrama de Carga da Rede Elétrica (MW)	Electrical Grid Recharging Diagram (MW)
Ida para o emprego	Commute to work
Venda de energia à rede	Sale of energy to the grid
Carregamento durante o dia, conforme disponibilidade	Charging during the day, subject to availability
Regresso a casa	Commute home
Venda de energia à rede	Sale of energy to the grid
Carregamento em casa	Recharging at home

Given the strong renewable component in electricity generation in Portugal, the use of this fuel in the transport sector, particularly in road transport, offers a number of opportunities and benefits to be explored. The diversification of energy sources consumed in the transport sector, which is currently heavily dependent on oil, as well as the introduction of renewable energy in this sector, where alternatives are still scarce, represent some of the benefits of electric mobility in Portugal.

Benefits	Barriers
Decrease in external energy dependence and diversification of the energy mix	Cost of purchasing electric vehicles
Reduced emissions of GHG and pollutants such as particulates as well as reduced noise emissions	Cost and time to charge the battery
Introduction of energy from renewable sources into transport	Range of the vehicle with a single charge
Enable an improvement in the management of the electrical system	Battery life
Use as a device to store electricity	Value chain surrounding battery reuse
Interoperability: access by any user to any recharging point belonging to any operator (roaming) and compatibility with all makes of vehicle	Management of the availability of recharging points
Ability to monitor, in real time, the energy profile and impacts (eg: emissions) associated with mobility	Lack of a second-hand market for electric vehicles
Existence of dedicated parking spaces both on public roads and in car parks and garages	Lack of business models involving battery leasing which help to reduce the initial cost of purchasing electric vehicles
	Lack of business models involving greater liberalisation of the current model which help to reduce the initial cost of the recharging infrastructure
	Uncertainty about the safety of lithium charging

The cost of purchasing an electric vehicle is still considerably higher than that of purchasing an internal combustion engine vehicle, mainly due to the cost and durability of the batteries. Nonetheless, the technological advances envisaged for electric motors, the effect of scale on their production as well as the emergence of new business models for purchasing vehicles (e.g. battery leasing) and for providing mobility services should contribute to making these vehicles more economically competitive.

Furthermore, the increasingly demanding technical specifications imposed on internal combustion engines have been increasing the price of these vehicles powered by traditional fuels, which has also helped to reduce the gap between the purchase prices of these two vehicle types.

Electric vehicles should therefore be encouraged to exceed their limits in terms of range and travel capability, extending their current role as urban or suburban vehicles to an intercity role and making it possible to connect cities and even countries.

With this prospect in mind, Portugal intends to roll out, by the end of 2018, a pilot network composed of 1,604 normal power recharging points distributed throughout the country, with at least two points per municipality and 50 high power recharging points to be installed in locations such as the country's main motorways.

Evolution of the Electric Vehicle Fleet

The electric vehicle fleet in Portugal is currently very small when compared to the total fleet of light and heavy-duty vehicles in circulation, accounting for less than 0.1%. In 2015, the number of electric vehicles totalled 4 083, including light passenger vehicles, freight vehicles, buses and motorcycles. In addition to this, there were 664 plug-in hybrid light vehicles and 15 plug-in hybrid motorcycles.

Despite the fact that these vehicles still make up a small part of the total number of vehicles in circulation, sales of electric vehicles have been increasing since 2010. In particular, the number of light electric vehicles in circulation has almost doubled from 2014 to 2015.

The National Renewable Energy Action Plan for the period 2013-2020 (PNAER 2020), approved by Resolution No 20/2013 of the Council of Ministers of 10 April 2013, defined a set of specific policies and measures for several sectors, including electric mobility. According to this strategic plan, it is estimated that, in 2020, the electric vehicle fleet in Portugal should number approximately 34,000 electric vehicles, which include light passenger vehicles, freight vehicles, buses and motorcycles.

By extrapolating the PNAER 2020 forecasts to 2030, it is expected that, with the implementation of measures to stimulate electric mobility defined in this policy framework and the expected technological improvements in electric vehicles during the next decade, particularly in terms of batteries, the number of electric vehicles in circulation will reach 179, 000 by 2030. The electric vehicle fleet in Portugal is therefore expected to grow at an estimated AAGR of 29% between 2011 and 2020.

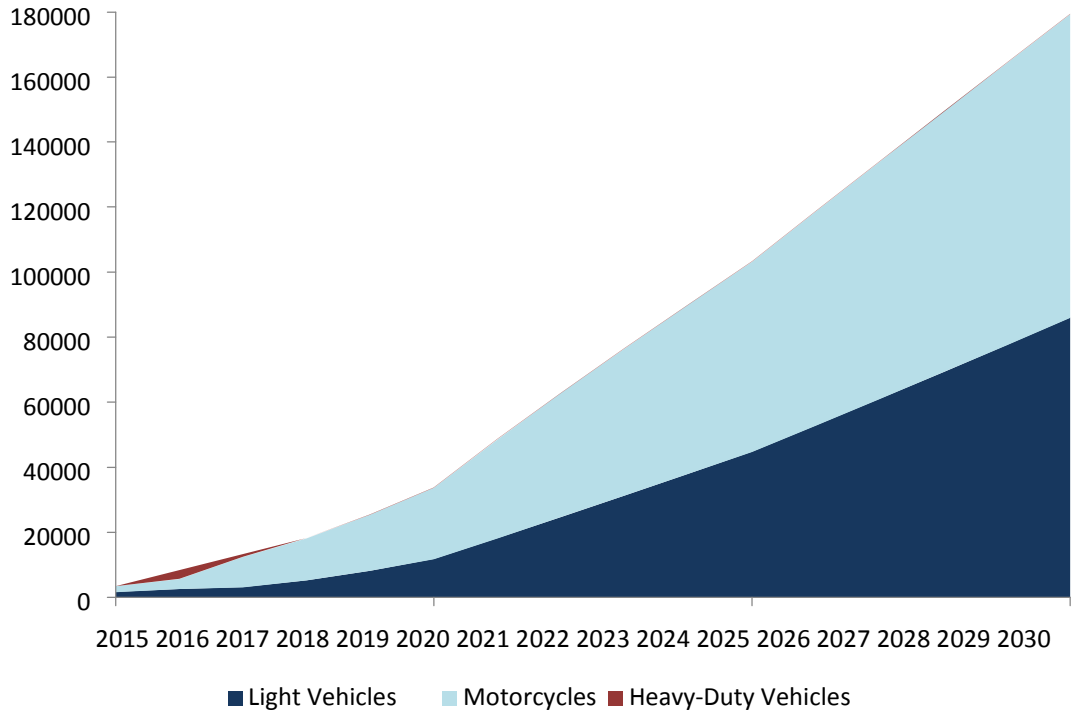


Figure 38 - Forecast of the evolution of the number of electric vehicles in Portugal.

Evolution of the Recharging Point Infrastructure

The roll-out of the pilot network will ensure that all municipalities will have access to a minimum recharging infrastructure, the intention being to have, by the end of 2018, a pilot network made up of 1,604 normal power recharging points and 50 high power recharging points. Recharging points should also be installed outside of the pilot network initiative, with a public network of at least 2,394 recharging points for electric vehicles, including pilot network points, expected by 2020.

At the same time, efforts have been made, particularly in terms of defining an appropriate regulatory framework, to encourage recharging points in private spaces, including points in private premises with private access, to connect to the public network.

A set of private recharging points should thereby complement the public network, thus ensuring a network of publicly accessible recharging points capable of meeting the expected demand for 2020.

The development of the public network of recharging points in the period post-2020 will be largely dependent on whether the forecast evolution of the electric vehicle fleet actually materialises. The development of this infrastructure should be adjusted to the trends in demand and the need for connection with Spain as part of projects on the European interconnection of the electric mobility network. The arrival of the expected technological developments during the next decade, with an impact on vehicle purchase costs, is sure to strongly influence the evolution of the electric vehicle fleet and, consequently, the demand for this alternative fuel.

2 - NATURAL GAS

2.1 - ROAD TRANSPORT

The use of natural vehicle gas in its compressed or liquefied form can play an important role in the diversification of energy sources used in road transport and, in conjunction with an electric mobility policy, can help reduce emissions of GHG and other pollutants such as nitrogen oxides and particulates associated with this sector.

The cost associated with natural gas is significantly lower than the cost of conventional fuels (diesel and petrol). Natural gas appears to be a potentially interesting alternative for long-distance transport, particularly LNG as an alternative fuel for heavy goods vehicles. Furthermore, CNG could be an option for heavy passenger vehicles, particularly those with pre-defined and routine urban routes.

Benefits	Barriers
Diversification of energy sources	Relatively high investment costs, both in terms of refuelling infrastructure and vehicles
Cost associated with NVG is significantly lower than the cost of diesel and petrol	Environmental risk associated with a potential methane leakage (GHG impact). Natural gas is essentially composed of methane (CH_4), whose comparative impact on climate change is more than 25 times greater than CO_2 over a period of 100 years

Provides a cleaner burn	Reduced cargo capacity due to fuel storage taking up more space, resulting in reduced competitiveness of vehicles
Reduced emissions of pollutants such as particulates, NOx and SOx	Safety concerns associated with the low flash point and cryogenic nature of LNG
Possible reduction of GHG emissions	
Reduced noise emissions	
NG-fuelled vehicles are as safe or safer than those operating with traditional fossil fuels	

To date, the use of natural gas in the transport sector has mainly focused on heavy passenger transport, in particular on urban routes, and it is expected to increase slightly with the purchase of 500 new vehicles by the end of 2020. For this purpose, a call for tender was opened by POSEUR to replace heavy-duty vehicles for collective passenger transport with other vehicles powered by cleaner technologies with better environmental performance.

With regard to long-distance heavy goods transport, LNG is currently an alternative to diesel. However, due to the higher cost of purchasing vehicles and limitations in terms of freight transported and range, hauliers are still somewhat cautious when it comes to adopting this technology. However, once the possible technological limitations of these vehicles have been overcome and the cost reduction associated with the increase in their production scale has materialised, and once the infrastructure for the supply of LNG to the TEN-T network is in place, a fleet of heavy goods vehicles with around 200 LNG vehicles is planned for 2025.

It should be noted, however, that the introduction of NVG as a professional fuel, including LNG for heavy passenger and freight transport, could be positively influenced by extending the tax benefits granted to commercial diesel to this technology, particularly in terms of the ISP.

Natural gas has not been widely introduced in light passenger transport. At this level, an autogas network has already been developed and implemented as an economically more attractive alternative to diesel fuel, with a current network of around 350 refuelling points. As a result, the expected changes in the fleet of CNG light passenger vehicles should mainly relate to taxi fleets.

Given its size, Portugal does not have the capacity (lack of market scale) to simultaneously develop and support the different types of vehicles powered by alternative fuels. When it comes to alternative fuels in light passenger transport, Portugal is focused on electric and LPG vehicles (with the latter technology having already been implemented several years ago in Portugal).

With regard to the refuelling point infrastructure, compared to the existing network in 2015, it is expected that a further five combined LNG and CNG refuelling points and four CNG refuelling points will be operational by 2025, distributed along the TEN-T, and that the minimum distances between refuelling points recommended by Directive 2014/94/EU should generally be met. Meanwhile, two LNG+CNG refuelling points were already installed during 2016. The remainder are expected by 2025 based on possible applications to the CEF or other similar mechanisms.

2.2 - MARITIME TRANSPORT

Notwithstanding the potential of this alternative fuel in road transport, liquefied natural gas is one of the most economically, environmentally and technically viable alternatives in maritime transport, and its use is compatible with the environmental requirements imposed on this sector. In particular, LNG is a viable solution for meeting the environmental protection limits imposed in so-called ECA zones, as well as the need to comply with the approved provision for maritime transport to cap the use of fuels with a sulphur content exceeding 0.5% by 2020.

However, some barriers to the use of LNG as an alternative fuel for maritime transport still need to be overcome.

Benefits	Barriers
Diversification of energy sources	Relatively high investment costs, both in terms of bunkering infrastructure and ships
Reduced emissions of GHG and pollutants such as particulates, NOx and SOx	Environmental risk associated with a potential methane leakage (GHG impact). Natural gas is essentially composed of methane (CH_4), whose comparative impact on climate change is more than 25 times greater than CO_2 over a period of 100 years
Compatible with environmental provisions and rules applicable to maritime transport, particularly with regard to the sulphur cap for marine fuels	Reduced capacity for storing fuel or the cargo carried by the ship
Cost associated with LNG is competitive compared to other fuels	The infrastructure for bunkering LNG to ships is still in development
Provides a cleaner burn, reducing the need for maintenance	Safety concerns associated with the low flash point and cryogenic nature of LNG

Different standards and guidelines on the bunkering of LNG to ships already exist or are being drawn up. The ISO issued guidelines for systems and installations for supply of LNG as fuel to ships (ISO/TS 18683: 2015) in early 2015 and is currently working to finalise ISO/DIS 20519 on the specification for bunkering of gas-fuelled vessels, which is expected to include a substantial set of functional requirements for LNG bunkering equipment and operations.

The SGMF (Society for Gas as a Marine Fuel) also launched its 'SGMF LNG Bunkering Safety Guidelines' in early 2015 in an aim to provide the industry with best practices for the bunkering of ships with LNG with high levels of safety, integrity and reliability. This document is currently being reviewed/updated, as a result of the contribution of different industry players.

The IACS (International Association of Classification Societies) recently published the 'IACS Recommendation on LNG Bunkering' to define and cover the additional risks associated with LNG bunkering and to propose a methodology for dealing with these risks, in order to provide a level of safety similar to that achieved for traditional liquid fuel refuelling operations.

Furthermore, the IAPH (International Association of Ports and Harbours) has developed specific LNG bunkering checklists, 'IAPH LNG Bunker Check-Lists', for the various known LNG bunkering scenarios, from tanks, barges or tanker trucks.

The European Maritime Safety Agency (EMSA) is currently developing a best practices document/guide that will seek to harmonise procedures for involving competent authorities in making LNG available and operational as a fuel for ships.

Notwithstanding all these international guidelines and recommendations, a national regulatory framework should also be developed to enable LNG bunkering operations for ships, including the licensing of bunkering operations, in particular those carried out from barges or tanker trucks.

Evolution of LNG bunkering infrastructure for ships

It is estimated that, by the end of 2015, there were around 75 LNG-fuelled ships around the world, and a further 97 ships are expected to be built/enter into service in 2016. There are currently no ships carrying the national flag in operation, but there are pilot projects to convert two vessels to LNG.

The majority of existing LNG-fuelled vessels are ferries and PSVs (Platform supply vessels).

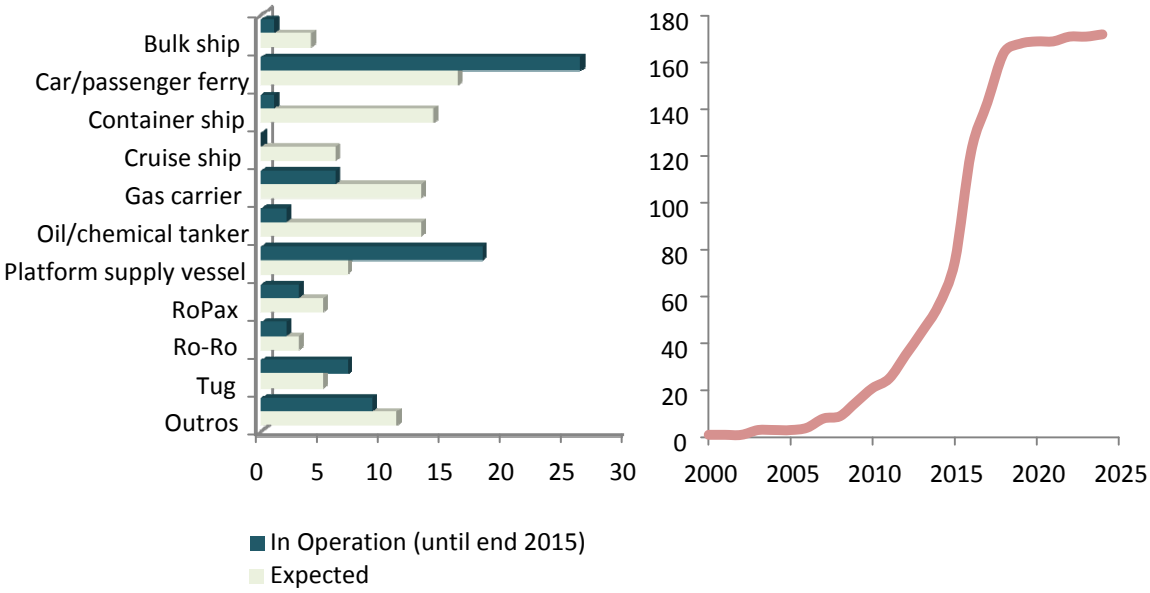


Figure 39 - Overall estimate of LNG-fuelled vessels in operation and on order.
Source: DNV.GL/Own production.

In view of the increasingly demanding environmental requirements imposed on maritime transport, particularly in terms of the emission of pollutants, it is essential to create an infrastructure for the bunkering of LNG to ships in the main Portuguese ports.

Although Portugal is not currently included in an ECA zone, some ships that operate in these controlled emissions areas sail routes where Portuguese ports would be an alternative for docking and bunkering. However, as mentioned above, from 2020, Portugal will be covered by the global sulphur cap of 0.5%. With the legislation published in 2014 (Decree-Law No 170-B/2014 of 7 November 2014), passenger and cargo ships in national ports, including the ports that make up the CORE Network (Leixões, Lisbon and Sines), cannot use marine fuels with a sulphur content exceeding 0.10% by mass in a wide range of circumstances.

In addition, in view of their location, the ports of the Azores and Madeira are in a strategic position, particularly with regard to the Transatlantic and North African routes, respectively.

Moreover, LNG can contribute to the decarbonisation of electricity in Madeira and the Azores. The use of LNG as an alternative fuel for maritime mobility between the mainland and the islands could make it economically viable to substitute fuel for natural gas in the production of electricity in the markets of these Autonomous Regions.

In the Autonomous Region of the Azores, the availability of LNG in ports could promote inter-island maritime traffic with less environmental impact.

Portugal therefore intends to focus on creating an infrastructure that enables the bunkering of this alternative fuel to ships, seeking to position its main ports as a viable option where LNG ships can bunker.

To this end, in 2025, Portugal will have five ports with the capability to carry out LNG bunkering operations for ships: Three ports in the Core network (Leixões, Lisbon and Sines) and two ports in the Autonomous Regions (Azores and Madeira). The type of bunkering infrastructure may vary in the various ports, and should be tailored to the specific features of each port.

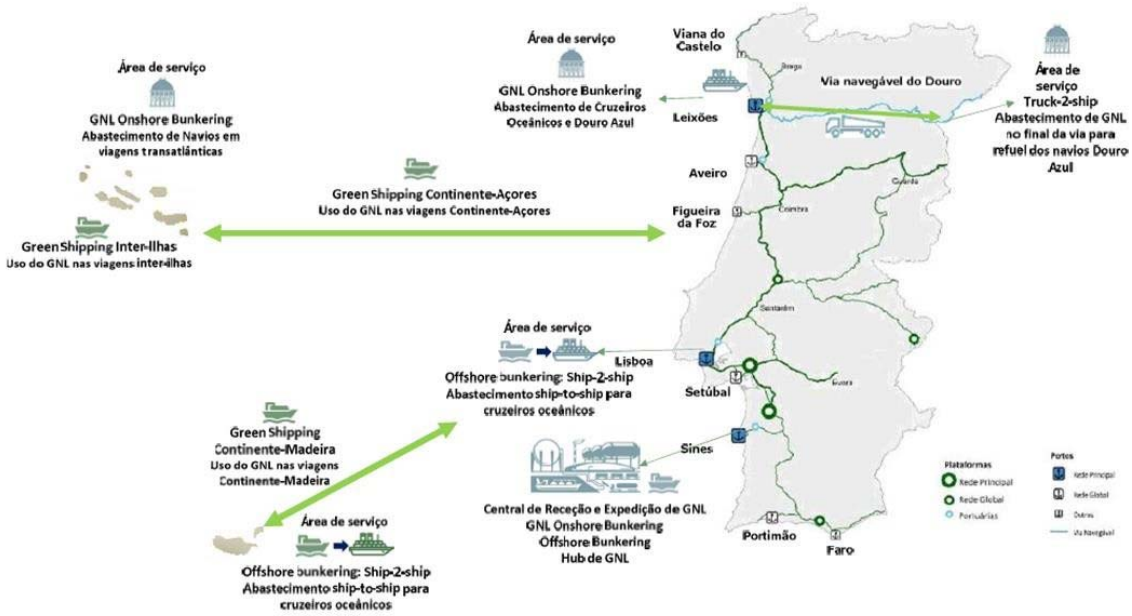


Figure 40 - Potential locations and capacities for maritime-port infrastructure.
Source: The Ministry of the Sea's 'Strategy to Increase Port Competitiveness - Horizon 2016-2026'.

PT	EN
Área de serviço	Service area
GNL Onshore Bunkering	Onshore LNG Bunkering
Abastecimento de Navios em viagens transatlânticas	Bunkering of ships on transatlantic routes
Green Shipping Inter-Ilhas	Green Shipping Inter-Island
Uso do GNL nas viagens inter-ilhas	Use of LNG in inter-island travel
Abastecimento de Cruzeiros Oceânicos e Douro Azul	Bunkering of Oceanic and Douro Azul Cruises
Green Shipping Continente-Açores	Green Shipping Mainland-Azores
Uso do GNL nas viagens Continente-Açores	Use of LNG in Mainland-Azores travel
Abastecimento ship-to-ship para cruzeiros oceânicos	Ship-to-ship bunkering for oceanic cruises
Green Shipping Continente-Madeira	Green Shipping Mainland-Madeira

Uso do GNL nas viagens Continente-Madeira	Use of LNG in Mainland-Madeira travel
Central de Receção e Expedição de GNL	LNG Reception and Unloading Centre
Hub de GNL	LNG Hub
Via navegável do Douro	Douro waterway
Lisboa	Lisbon
Área de serviço Truck-2-ship	Truck-2-ship service area
Abastecimento de GNL no final da via para refuel dos navios Douro Azul	LNG bunkering at the end of the route for refuelling Douro Azul vessels
Rede Principal	Main Network
Rede Global	Global Network
Portuárias	Ports
Outros	Other
Via navegável	Waterway

PART C - MEASURES

1. MEASURES TO PROMOTE THE DEVELOPMENT OF ALTERNATIVE FUELS INFRASTRUCTURE

Meeting the objectives and targets set out in this national policy framework will depend on the successful implementation of a set of measures aimed at promoting the use of these alternative fuels. Some of these measures are intended to stimulate demand for these cleaner alternatives, while others seek ensure the existence of a minimum refuelling/recharging infrastructure.

TABLE 9 - Overview of NPF measures

Sector	Objective	Measure	Background documents	Type of measure(s)	Ministry responsible for the measure	Deadline for launching the measure	Indicator
ALTERNATIVE FUELS (general)	Replacement of 500 public transport operators' vehicles with alternative fuel vehicles	Promote the economic and energy efficiency of public passenger transport by ensuring the replacement of 500 public transport operators' vehicles	National Reform Programme	Financial incentive	Ministry of Planning and Infrastructure/Ministry of the Environment	2017	Number of vehicles replaced/replacement technology
	To increase the use of alternative fuel vehicles by private individuals and companies, in particular hybrid and electric vehicles	Promote the purchase of high environmental performance vehicles, particularly low carbon vehicles, by individuals and companies	National Climate Change Programme, Green Growth Commitment, National Energy Efficiency Action Plan, National Renewable Energy Action Plan	Regulatory Tax incentive Driving benefits	Ministry of Finance/Ministry of Internal Administration/ Local Authorities	2018	Number of vehicles purchased/type and technology
		Revision of the Energy Consumption Management in the Transport Sector Regulations, including benefits to fleets that have alternative fuel vehicles	-	Regulatory	Ministry of the Economy	2017	Publication of new Energy Consumption Management in the Transport Sector Regulations
	To increase the % of alternative fuels in fuel consumed in road transport	Create a tax framework that favours less polluting alternative fuels, significantly	-	Regulatory Tax incentive	Ministry of Finance	2017	% consumption of alternative fuels by type, compared to total road fuels

		encouraging their use as a professional fuel					
ELECTRICITY	To increase the use of less polluting vehicles in segments with the greatest energy and environmental impact	Direct incentives for purchasing electric vehicles to segments with the greatest energy and environmental impact, such as public transport buses, taxis, school transport, freight transport and urban logistics	XXI Government Programme	Regulatory Tax incentive Benefits	Ministry of the Environment/Ministry of Finance	2018	Number of vehicles purchased/service, type and technology
	Integration of around 1 200 electric vehicles into the State Vehicle Fleet by 2020.	Continue the ECO.mob Programme by promoting the replacement of combustion vehicles with electric vehicles, with an estimated total of around 1 200 vehicles.	ECO.mob Programme (Resolution 54/2015 of the Council of Ministers)	Budgetary	Ministry of Finance/Local Authorities	2017	Number of vehicles replaced/Public Administration body
	25% of electric vehicles when renewing the State fleet intended for urban circulation	Commit the State and local authorities to purchase 25% electric vehicles when renewing their fleet intended for urban circulation (for example, by drawing up mobility plans at the level of the Public Administration and companies which set objectives for renewing their fleets with electric vehicles).	XXI Government Programme and Green Growth Commitment	Budgetary	Ministry of Finance/Ministry of the Economy	2017	% of electric vehicles in fleets of Central and Local Administration bodies
	To increase the	Create incentives that	XXI	Regulatory	Ministry of the	2018	Number of operators

	use of electric vehicles in urban environments	lead logistics operators to adopt emission-free electric vehicles, particularly to operate in urban environments and last mile transport.	Government Programme		Environment/Local Authorities		Number of electric vehicles
	Replacement of 1,000 taxis with electric vehicles	Promote the economic and energy efficiency of public passenger transport by ensuring the replacement of 1 000 taxis with electric vehicles	National Reform Programme	Financial incentive	Ministry of Planning and Infrastructure/Ministry of the Environment	2018	Number of taxis replaced
	To increase the use of electric vehicles	Extend the granting of tax incentives for purchasing electric and plug-in hybrid cars through amounts eligible for tax deduction and autonomous taxation of Personal Income Tax and Corporate Income Tax	Green Growth Commitment	Tax incentive	Ministry of Finance	2018	Number of incentives granted/vehicle technology
		Incentive for the introduction of low emission vehicles into the market	Law No 42/2016 Order No 1612-B/2017	Tax incentive	Ministry of the Environment	2017	Number of vehicles replaced/replacement technology
	Emergence of car sharing and electric bike sharing operators	Create incentives for the emergence of car sharing and electric bike sharing operators.	XXI Government Programme	Regulatory	Ministry of the Economy Ministry of the Environment	2017	Number of operators and electric vehicles in shared systems
	To promote electric vehicles as a simultaneous solution for electricity storage and use,	Define a regulatory framework and a tariff for selling energy stored in a decentralised manner in electric vehicle	XXI Government Programme	Regulatory	Ministry of the Economy Ministry of the Environment	2018	Amount of energy supplied to the electrical grid by vehicles

	optimising the management of the electrical system	batteries to the electrical grid, enhancing their capacity to stabilise the electrical grid by storing energy in off-peak hours and injecting it into the electrical grid during peak hours.					
	Installation of 2, 394 electric vehicle recharging points by 2020	Encourage electric mobility by installing 2 394 electric vehicle recharging points by 2020	National Reform Programme	Investment	Ministry of the Environment	2017	Number of recharging points installed in the public network
	To improve the public recharging point network	Rehabilitate and resize the Mobi.E public recharging network	XXI Government Programme	Investment	Ministry of the Environment	2017	Number of recharging points upgraded
	To increase the number of recharging points in privately accessible private spaces connected to the MOBI.E public network	Promote recharging in the garages of homes and companies, where electric vehicle users park most of the time	XXI Government Programme	Regulatory Procedural	Ministry of the Economy	2017	Number of garages equipped with recharging points
	To increase the number of recharging points in privately accessible private spaces connected to the MOBI.E public network	Create the necessary regulatory conditions for recharging points in privately accessible private spaces, such as in the garages of homes and companies, to connect to the public network.	-	Regulatory	Ministry of the Economy	2017	Number of recharging points in private garages
	To increase the number of recharging points	Implement Ministerial Implementing Order 220/2016 to deploy an	-	Regulatory	Ministry of Planning and Infrastructure	2017	Number of new buildings with infrastructure

	in private spaces	infrastructure to install recharging points in new buildings					
	To increase system reliability and security	Dissemination and application of the Technical Guide for electrical installations for powering electric vehicles	Decree-Law 90/2014 Ministerial Implementing Order 220/2016	Regulatory	Ministry of the Economy	2017	Number of private installations implemented
	To develop the technological cluster linked to electric mobility	Within the framework of Portugal 2020, design programmes and support lines for the component industry for electric vehicles, electric motors and batteries, as well as the recharging infrastructure.	XXI Government Programme	Incentives	Ministry of the Economy /Ministry of Planning and Infrastructure	2017	Number of programmes and support lines created
		Support projects aimed at upgrading the production and assembly industry of two-wheeled vehicles - motorcycles, scooters and bicycles - for the electric segment.	XXI Government Programme	Incentives	Ministry of Planning and Infrastructure	2017	Number of projects supported
		Support the training of technicians for the manufacturing and repair industries of electric vehicles and their components.	XXI Government Programme	Incentives	Ministry of Planning and Infrastructure	2017	Number of training actions Number of trainees
	To develop the technological cluster linked to electric mobility	Create live demonstration laboratories for new electric mobility	XXI Government Programme	Incentives	Ministry of Planning and Infrastructure	2017	Number of demonstration actions

		solutions: in terms of vehicles, with an emphasis on new electric mobility applications, such as public transport, freight transport or urban logistics; and in terms of smart charging, integrated with smart grids and decentralised renewable energy generation, with an emphasis on V2G (vehicle to grid) and V2H (vehicle to home).					
	To promote the supply of shore side electricity to maritime transport	Support the development of the necessary infrastructure for supplying electricity to ships in port, rather than using diesel to generate energy for internal use.	-	Incentives/Regulatory	Ministry of the Sea	2020	Number of installations for supplying electricity to ships
NATURAL GAS	To enable the bunkering of LNG to ships	Establish a regulatory framework that enables LNG bunkering operations to ships to be carried out	-	Regulatory	Ministry of the Economy	2018	Publication of regulations for the bunkering of LNG to ships
	To define the maritime-port infrastructure for LNG bunkering	Approve the strategic plan for creating a maritime-port infrastructure for LNG bunkering	-	Planning instrument	Ministry of the Sea	2018	Approval of the LNG Strategic Plan
	To create the supply of LNG as a	Build a network of ship bunkering stations in	-	Financial incentives	Ministry of the Sea	2018	Number of ports with LNG bunkering stations

	fuel for ships and vessels	national ports					
	To increase the use of alternative fuels in maritime transport	Encourage the use of maritime transport (ships and vessels) powered by less polluting fuels	Green Growth Commitment (SEA)	Financial incentives	Ministry of the Sea	2017	Amount of NG bunkered in ports on the mainland and in the Azores
	To improve the supply of Natural Vehicle Gas by extending the network of refuelling points	Encourage the development of the network of CNG and LNG refuelling points for road transport	Green Growth Commitment Assembly of the Republic Resolution No 240/2016	Incentives	Ministry of the Economy Ministry of Planning and Infrastructure	2017	Number of Natural Vehicle Gas refuelling points installed per district
	To encourage the conversion of vehicle engines to CNG or LNG	Ensure the implementation of training and certification of professionals for changing the fuel of motor vehicles	-	Regulatory	Ministry of the Environment	2017	Number of certified professionals Number of vehicles with converted engines
	To increase the use of LNG in heavy road transport	Creation of conditions for the use of LNG in heavy road and passenger transport	Assembly of the Republic Resolution No 240/2016	Incentive/Regulatory	Ministry of the Economy/Ministry of the Environment	2018	Number of LNG-fuelled heavy passenger vehicles in circulation Number of LNG-fuelled heavy goods vehicles in circulation