GOVERNMENT GAZETTE
OF THE HELLENIC REPUBLIC

31 October 2017 | Series II | No 3824

DECISIONS

No. 77226/1

Laying down and specifying the detailed implementing measures and technical specifications required for the National Policy Framework for the development of the market as regards alternative fuels in the transport sector and the deployment of the relevant infrastructure.

THE MINISTERS FOR
THE INTERIOR - ECONOMY
AND DEVELOPMENT - EDUCATION, RESEARCH AND RELIGIOUS AFFAIRS - FOREIGN AFFAIRS – FINANCE - ENVIRONMENT AND ENERGY - INFRASTRUCTURE
AND TRANSPORT - SHIPPING
AND ISLAND POLICY - RURAL DEVELOPMENT AND FOOD - TOURISM

1. Having regard to:

a. Articles 3 and 8 of Law 4439/2016 'Transposing Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure, simplifying the licensing process and setting out other provisions on fuel and energy supply stations, and other provisions into Greek legislation' (Government Gazette, Series I, No 222).

b. Article 90 of the Legislative Code on Government and Government Bodies ratified by Article 1 of Presidential Decree 63/2005 on the codification of legislation on government and governmental bodies (Government Gazette, Series I, No 98), as in force.

c. Presidential Decree 73/2015 on the appointment of a deputy Prime Minister, Ministers, Alternate Ministers and Deputy Ministers (Government Gazette, Series I, No 116).

d. Presidential Decree 123/2016 on the re-establishment and renaming of the Ministry of Administrative Reform and e-Government, re-establishment of the Ministry of Tourism, establishment of the Ministry of Migration Policy and the Ministry of Digital Policy, Telecommunications and Media, renaming of the Ministries of the Interior and Administrative Reconstruction, Economy, Development and Tourism and Infrastructure, Transport and Networks (Government Gazette, Series I, No 208).

e. Presidential Decree 125/2016 on the appointment of ministers, alternate ministers and deputy ministers (Government Gazette, Series I, No 210).

f. Presidential Decree 105/2014 on the organisational structure of the Ministry of the Interior (Government Gazette, Series I, No 172).

g. Presidential Decree 116/2014 on the organisational structure of the Ministry of Economy, Development and Competitiveness (Government Gazette, Series I, No 185).

h. Presidential Decree 114/2014 on the organisational structure of the Ministry of Education, Research and Religious Affairs (Government Gazette, Series I, No 181).

i. Law 3566/2007 ratifying the organisational structure of the Ministry of Foreign Affairs as a Code (Government Gazette, Series I, No 117), as in force.

j. Presidential Decree 111/2014 on the organisational structure of the Ministry of Finance (Government Gazette, Series I, No 178).

k. Presidential Decree 100/2014 on the organisational structure of the Ministry of the Environment, Energy and Climate Change (Government Gazette, Series I, No 167).

l. Presidential Decree 123/2017 on the organisational structure of the Ministry of Infrastructure and Transport (Government Gazette, Series I, No 151).

m. Presidential Decree 103/2014 on the organisational structure of the Ministry of Shipping and Island Policy (Government Gazette, Series I, No 170).

n. Presidential Decree 107/2014 on the organisational structure of the Ministry of Rural Development and Food (Government Gazette, Series I, No 174).

o. Presidential Decree 112/2014 on the organisational structure of the Ministry of Tourism (Government Gazette, Series I, No 179).

p. Decision No 20871/21.3.2017 of the Prime Minister and Minister for Infrastructure and Transport appointing the Secretary General of the Ministry of Infrastructure and Transport (Government Gazette, YODD Series [for Employees Occupying Special Positions and for Administrative Bodies of Public Sector Agencies or Agencies of the Wider Public Sector] No 153).

2. The fact that this Decision entails no expenditure under the national budget; we hereby decide:

Article 1
Subject matter - Scope

This decision lays down and specifies the detailed implementing measures and technical specifications required for the National Policy Framework for the development of the market as regards alternative fuels in the transport sector and the deployment of the relevant infrastructure, in accordance with Article 3(1) of Law 4439/2016 (Government Gazette, Series I, No 222).

Article 2

Annex

An annex is attached hereto and constitutes an integral part hereof. This Annex lays down and specifies the detailed implementing measures and technical specifications required for the National Policy Framework for the development of the market as regards alternative fuels in the transport sector and the deployment of the relevant infrastructure, in accordance with Article 3(1) of Law 4439/2016 (Government Gazette, Series I, No 222).

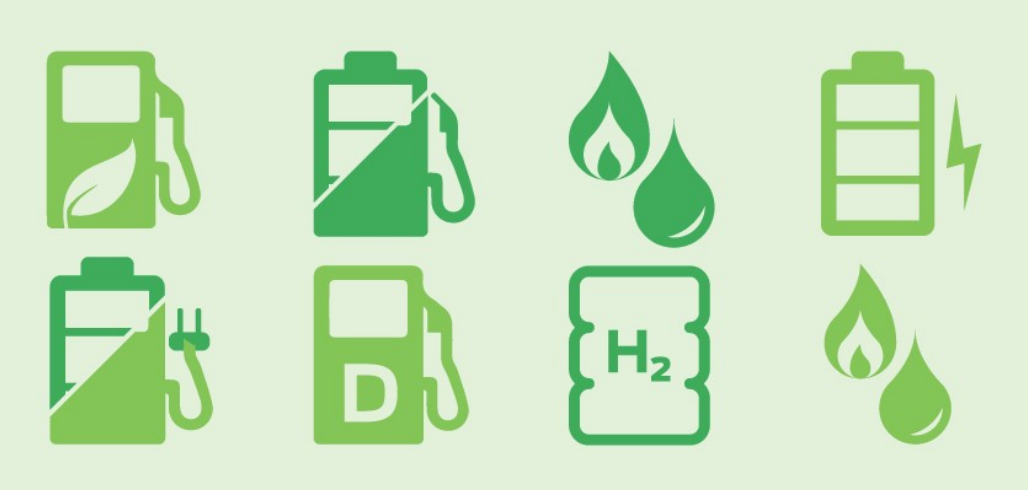
ANNEX

The National Policy Framework
for the development of the market as regards
alternative fuels in the transport sector and the
deployment of the relevant infrastructure

ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
ΥΠΟΥΡΓΕΙΟ
ΥΠΟΔΟΜΩΝ & ΜΕΤΑΦΟΡΩΝ

European Commission

National Policy Framework for the development of the market as regards alternative fuels in the transport sector and the deployment of the relevant infrastructure



September 2017

National Policy Framework for the development of the market as regards alternative fuels in the transport sector and the deployment of the relevant infrastructure

Athens, September 2017

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Frequently used abbreviations

DEPA	Public Gas Corporation of Greece S.A.
DESFA	Hellenic Gas Transmission System Operator S.A.
DEDDIE	Hellenic Electricity Distribution Network Operator S.A.
ADMIE	Independent Power Transmission Operator S.A.
HELIEV	Hellenic Institute of Electric Vehicles
NTUA	National Technical University of Athens
EV	Electric vehicles
CRES	Centre for Renewable Energy Sources
AFV	Alternative Fuel Vehicles
YPA	Hellenic Civil Aviation Authority
YEN	Ministry of Shipping and Island Policy
YPEKA	Ministry of the Environment and Energy
YME	Ministry of Infrastructure and Transport
MINTOUR	Ministry of Tourism
MINDEV	Ministry of Economy and Development
ESFA	Hellenic Natural Gas System
NG	Natural gas
RAE	Regulatory Authority for Energy

0 INTRODUCTION:

To bolster the competitiveness and safety of energy supplies by using resources and energy in transport more effectively, and to reduce transport dependence on oil and achieve a 10% market share target of renewable sources in transport fuels by 2020, Directive 2014/94/EU[1] on the deployment of infrastructure for alternative fuels, of the European Parliament and of the Council of 22 October 2014 was issued.

Among other things, the Directive provides guidelines on setting minimum standards for developing alternative fuel infrastructure, including recharging points for electric vehicles, natural gas (CNG and LNG) refuelling points for both vehicles and floating craft. It also lays down specifications on how users should be informed about the alternative fuels available.

Directive 2014/94/EU was transposed into Greek law by virtue of Law 4439/2016[2] (Government Gazette Series I, No 222) drafted by the Ministry of Infrastructure and Transport. Among other things, Article 8 of that law requires the adoption of a National Framework on development of the alternative fuel infrastructure market in the transport sector and on deployment of the relevant infrastructure, which is outlined in detail in the sections below. The necessary implementing details and technical specifications for the National Policy Framework, pursuant to Article 8, are to be set out and detailed in a Joint Ministerial Decision issued by the Ministers for

- the Interior
- Economy and Development
- Education, Research and Religious Affairs
- Foreign Affairs
- Finance
- Environment and Energy
- Infrastructure and Transport
- Shipping and Island Policy
- Rural Development and Food;
- Tourism

Article 3 of Law 4439/2016 sets out the general guidelines for the contents of the National Policy Framework, which must include at least the following:

- an assessment of the current state and future development of the market with regard to alternative fuels in the transport sector, including their potential simultaneous and combined use, and the development of infrastructure for alternative fuels, taking cross-border continuity into consideration, where applicable;
- national targets and objectives, pursuant to Article 4(1), (3) and (5), Article 6(1), (2), (3) and (4)(a) to (d), and Article 5(1), for the deployment of infrastructure for alternative fuels. These national targets and objectives are established and revised on the basis of an assessment of national, regional and European demand, while ensuring compliance with the minimum infrastructure requirements laid down in the Directive, the above law and any other relevant applicable legislation;
- measures necessary to ensure that the national targets and the objectives set out in the National Policy Framework are achieved (by issuing relevant provisions etc.);

- measures that can promote the deployment of alternative fuels infrastructure in public transport services;
- designation of urban/suburban and other densely populated areas, and of networks which, subject to market needs, are to be equipped with recharging points accessible to the public in accordance with Article 4(1) of the Law;
- designation of urban/suburban and other densely populated areas and of networks which, subject to market needs, are to be equipped with CNG refuelling points in accordance with Article 6 (4)(c) of the Law;
- an assessment of the need to install refuelling points for LNG in ports outside the core network of the Trans-European Transport Network (TEN–T);
- investigation/examination of the need to install electricity supply points at airports for use by stationary airplanes.

The development of infrastructure for alternative fuels and the promotion of alternative fuels in the market depends on numerous factors such as: the domestically available technology, especially for vehicles that use alternative fuels, the availability of domestic forms of alternative fuels, the adequacy of the distribution network and infrastructure, the cost of production and the environmental footprint of their use in the transport sector.

1. ASSESSMENT OF THE CURRENT SITUATION IN THE TRANSPORT SECTOR

In recent years, energy consumption in the transport sector has accounted on average for approximately 40% of total energy consumption in Greece [3,4] (Figure 1.1) and relates primarily to road transport. Average annual energy consumption in the transport sector for the period 2000-2015, based on the statistical data available [3,4], is estimated at around 7 700 ktoe/year, while maximum energy consumption, which was recorded in 2009, was approximately 8 810 ktoe.

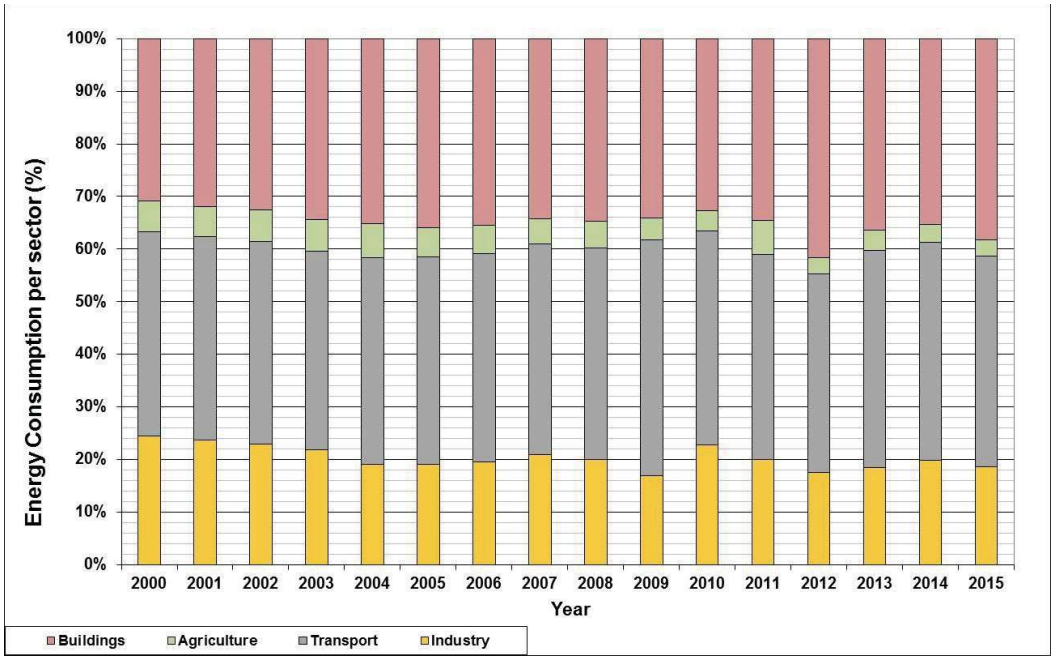


Figure 1.1: Energy consumption rate per sector of use in Greece [3,4]

Production and availability of fuels in the transport sector in Greece includes both conventional and alternative fuels based on the definitions contained in the Directive. Conventional fuels primarily include:

- gasoline;
- diesel;
- heavy oil;
- kerosene or paraffin, lamp oil, coal oil.

Alternative fuels include:

- LPG, which is used by a significant number of mainly private vehicles;
- biofuels, which as defined in Article 2(i) of Directive 2009/28/EC that was transposed into national law by Article 15(1) of Law 4062/2012 (Government Gazette Series I, No 70), are liquid or gaseous fuels for transport made from biomass. Biomass is defined as: the biodegradable fraction of products, waste and residues;

- of biological origin from agriculture (including vegetal and animal substances), forestry and related industries, including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste;
- natural gas which is primarily compressed natural gas (CNG). There is an ever expanding network of natural gas stations (FISIKON) owned by DEPA which is expected to meet market needs;
- hydrogen: Greece only has experimental hydrogen production plants at the Centre for Research and Technology Hellas (CERTH) and the Centre for Renewable Energy Sources (CRES). The use of hydrogen in the transport sector is not expected in the near future;
- electricity: The use of electricity in the transport sector is still at an embryonic stage in Greece. However, there are prospects for growth in electric vehicle use in the years to come.

In Greece, at present, vehicles that use alternative fuels or a combination thereof are primarily vehicles fuelled by:

- LPG;
- petrol and LPG;
- natural gas;
- hybrid vehicles using unleaded petrol and natural gas or LPG;
- hybrid vehicles using electricity and unleaded petrol and/or LPG;
- hybrid vehicles using electricity and catalytic/unleaded diesel;
- electric vehicles.

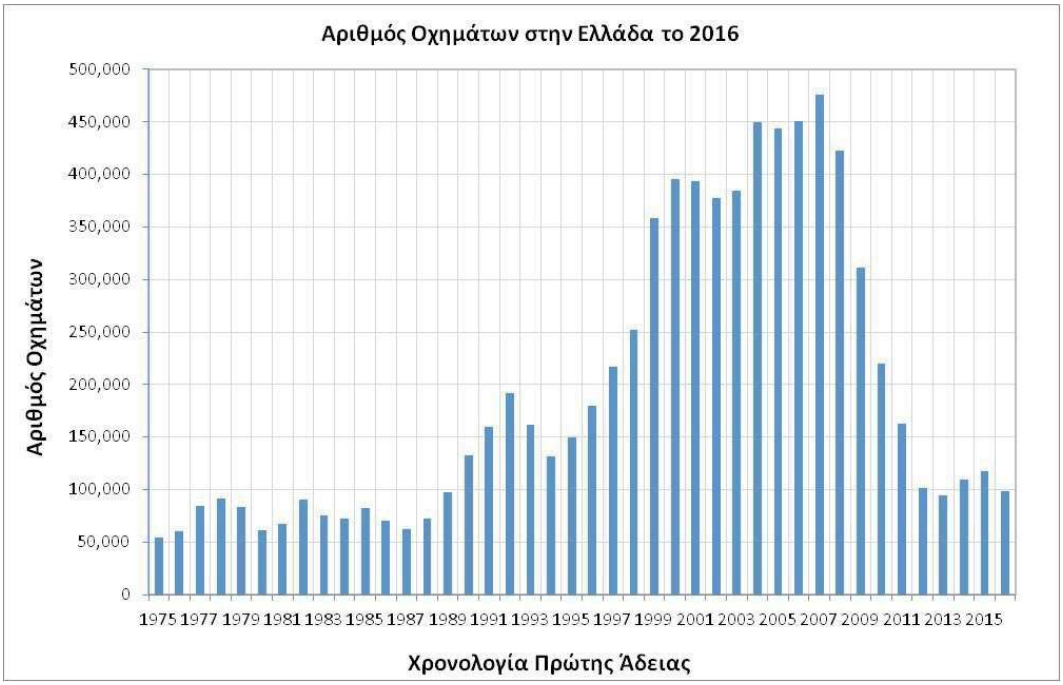
Through Directive 2014/94/EU [1], which was transposed into Greek law by virtue of Law 4439/2016, the European Commission is also promoting the development of alternative fuel infrastructure in shipping, and above all at the ports of the TEN-T core network. More specifically, all European countries are expected to use:

- LNG on ships, in order to limit the pollutants emitted in the context of international environmental regulations;
- electricity, especially for berthed ships, in order to reduce pollutants emitted at ports.

The shipping sector's interest in using LNG has increased globally. However, the use of LNG in old-tech ships requires the ships to be retrofitted and that is quite an expensive investment.

1.1. CONVENTIONAL AND ALTERNATIVE FUEL VEHICLES (AFV)

Based on data from the Ministry of Infrastructure and Transport (YME) [5], there are around 8 070 000 vehicles in circulation in Greece. Over 60% of the vehicles in circulation were first registered in the period 1997-2010 (Figure 1.2) while 40% of vehicles were first registered more than 17 years ago, which is to say before 2000.



No of vehicles in Greece in 2016

Number of vehicles

Date of first registration

Figure 1.2: Number of vehicles in circulation per year of first registration in Greece [5]

UNREGISTERED - 0.47%

UNLEADED (Conventional, Catalytic, Hybrid with Natural Gas or LPG) -61.4%

GASOLINE – LPG - 0.23%

GASOLINE – 24.64%

ELECTRIC – 0%

DIESEL (Conventional or Catalytic with natural gas etc.) – 13.27%

HYBRID (Electric with gasoline or diesel or LPG) – 0.01%

LPG – 0.01%

NATURAL GAS – 0.02%

Figure 1.3: Percentage of vehicles in circulation per type of fuel in Greece in 2016 [5]

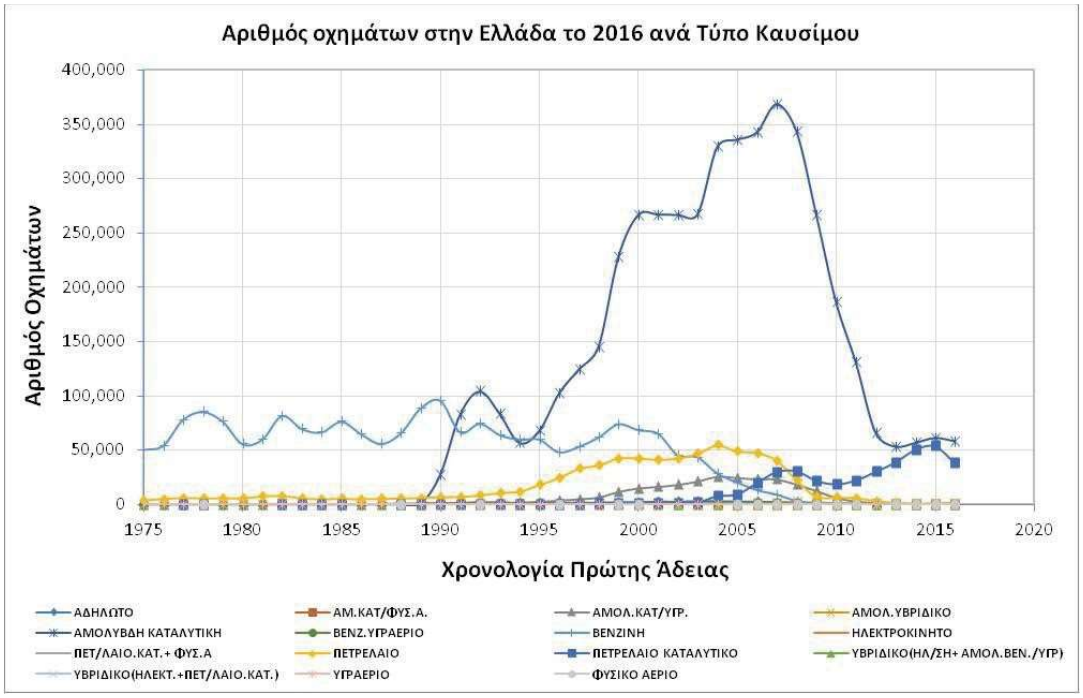
The vehicles in circulation (Figure 1.3) using some form of gasoline (ordinary or unleaded/catalytic) account for around 86% of all vehicles in circulation in Greece (24.7% use ordinary gasoline and 61.4% use unleaded/catalytic gasoline). Likewise, the vehicles that use conventional and catalytic diesel account for 13.3% of all vehicles in circulation (8.64% conventional diesel and 4.63% catalytic diesel).

Table 1.1 gives a detailed breakdown of the number of vehicles in use per type of fuel in Greece in 2016[5].

Table 1.1: Fleet of vehicles per type of fuel (2016) [5]

Vehicles – All types of gasoline-powered vehicles	**6,957,895**
Light-duty motor vehicles	6,954,037
Heavy-duty motor vehicles	3,858
Buses	1,352
Vehicles – All types of diesel-powered vehicles	**1,070,520**
Light-duty motor vehicles	845,579
Heavy-duty motor vehicles	224,941
Buses	26,633
Vehicles – Gasoline + natural gas-powered vehicles	**507**
Light-duty motor vehicles	507
Heavy-duty motor vehicles	0
Buses	0
Hybrid vehicles	**645**
Light-duty motor vehicles - Hybrid	644
Heavy-duty motor vehicles - Hybrid	1
Hybrid buses	0
Hybrid vehicles (electric and diesel)	**403**
Light-duty motor vehicles - Hybrid	402
Heavy-duty motor vehicles - Hybrid	1
Hybrid buses	0
Hybrid vehicles - Hybrid (LPG - Gasoline)	**245,384**
Light-duty motor vehicles	245,382
Heavy-duty motor vehicles	2
Buses	1

Figure 1.4 shows the vehicles in circulation per type of fuel and per year of first registration in Greece in 2016. Most vehicles fuelled by ordinary gasoline were first registered before 2000, while those which were first registered after 1995 primarily use unleaded gasoline (catalytic or hybrid with natural gas, LPG, etc.) [5]. The majority of vehicles using conventional diesel were registered in the period 1995–2007, whereas vehicles in circulation using catalytic diesel were first registered from 2003 onwards. Vehicles in circulation using another type of fuel still account for a very small percentage, primarily due to the high initial purchase cost.



No of vehicles in Greece per type of fuel in 2016

No of vehicles

Date of first registration

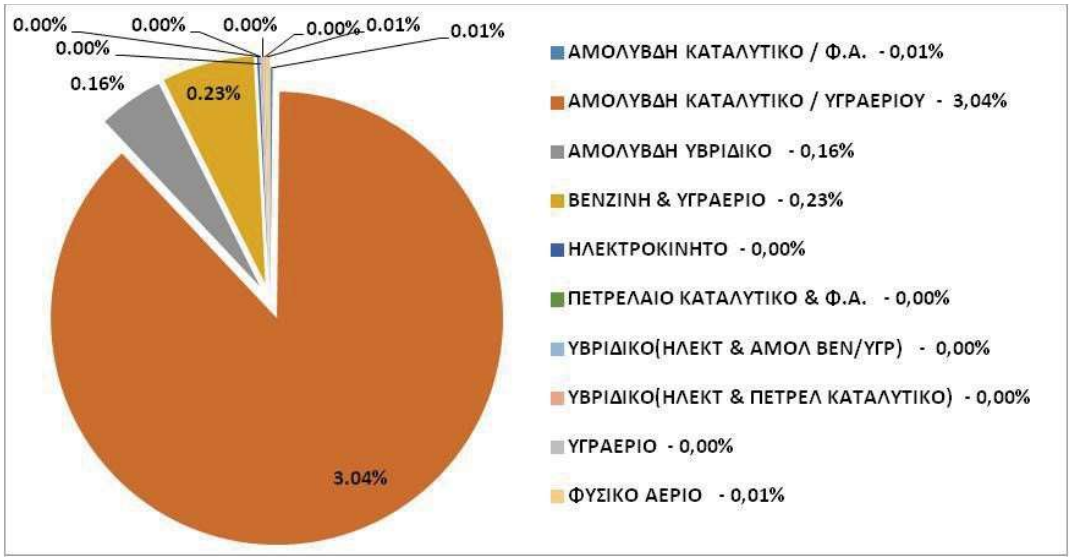
-UNREGISTERED
-UNLEADED CATALYTIC
-CATALYTIC DIESEL + NATURAL GAS
-HYBRID (ELECTRIC + CATALYTIC DIESEL)

-UNLEADED CATALYTIC/NATURAL GAS
-GASOLINE/LPG
-DIESEL
-LPG

-UNLEADED CATALYTIC/LPG
-GASOLINE
-CATALYTIC DIESEL
-NATURAL GAS

-UNLEADED HYBRID
-ELECTRIC
-HYBRID (ELECTRIC + UNLEADED GASOLINE/LPG)

Figure 1.4: Number of vehicles in circulation per type of fuel and per first year of registration in Greece in 2016 [5]



-UNLEADED CATALYTIC/ NATURAL GAS – 0.01%
-UNLEADED CATALYTIC/LPG – 3.04%
-UNLEADED HYBRID – 0.16%
-GASOLINE & LPG – 0.23%
-ELECTRIC -0%
-DIESEL CATALYTIC & NATURAL GAS - 0%
-HYBRID (ELECTRIC & UNLEADED -0%
-HYBRID (ELECTRIC & CATALYTIC DIESEL) - 0%
-LPG – 0%
-NATURAL GAS – 0.01%

Figure 1.5: Percentage of vehicles in circulation per type of alternative fuel out of all vehicles in Greece in 2016[5]

Likewise, Ministry of Infrastructure and Transport data show that the vehicles in circulation in Greece using alternative fuels account for just 3.5% of all vehicles in circulation (Figure 1.4). That percentage also includes vehicles that use a combination of conventional and alternative fuels, such as unleaded gasoline and LPG.

Table 1.2 shows the number of vehicles per type of alternative fuel in circulation in Greece. The majority of vehicles using alternative fuels are catalytic vehicles using unleaded gasoline and LPG.

Table 1.2: Number of vehicles using alternative fuels in Greece in 2016 [5]

Type of vehicles per fuel or fuel mix	Number of vehicles
LPG	388
Electric	397
Natural gas	900
Unleaded gasoline – Hybrid	12,998
Gasoline – LPG	18,280
Unleaded gasoline (catalytic) and natural gas	507
Unleaded gasoline (catalytic) and LPG	245,384
Electric and unleaded gasoline/LPG	242
Electric and diesel (catalytic)	403

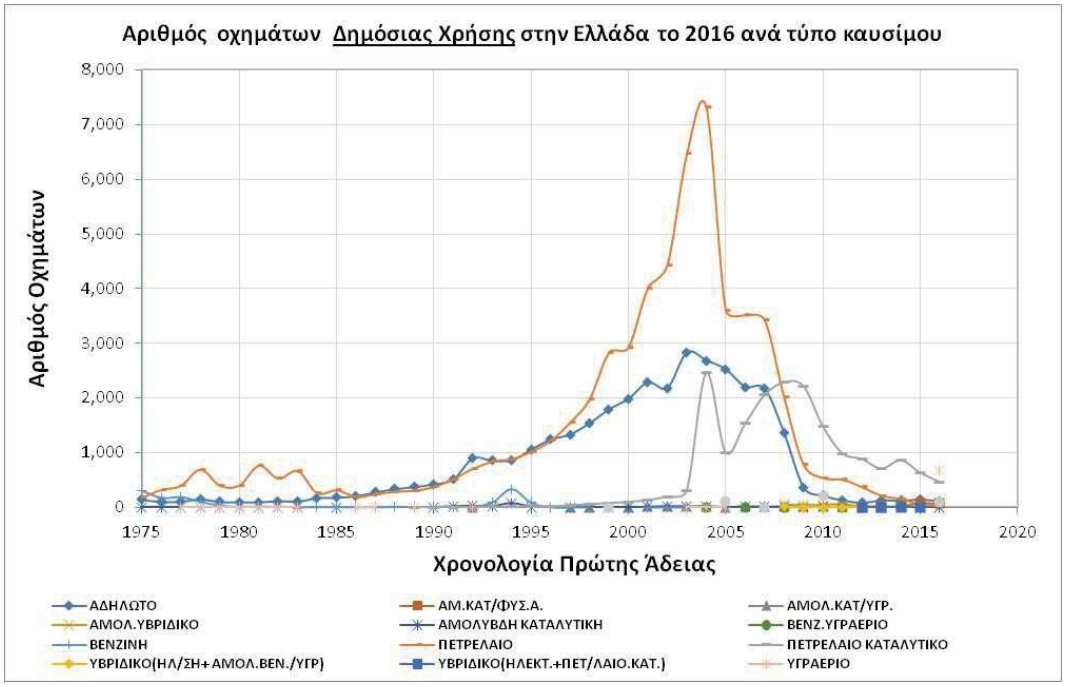


Figure 1.6: Number of public use vehicles per type of fuel and per first year of registration (2016)[5]

Number of public use vehicles in Greece per type of fuel (2016)

No of vehicles

Date of first registration

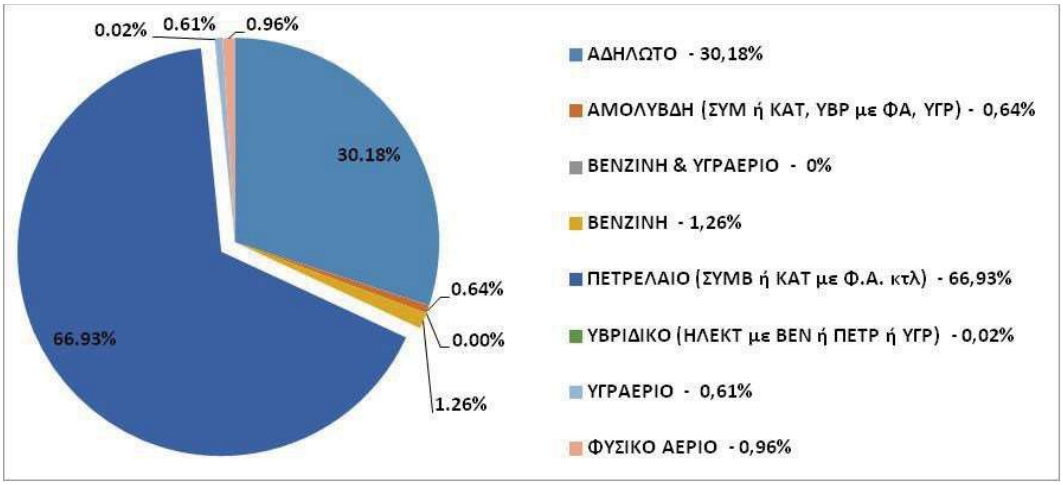
-UNREGISTERED
-UNLEADED HYBRID -GASOLINE -HYBRID (ELECTRIC + UNLEADED GASOLINE/LPG)

-UNLEADED CATALYTIC/NATURAL GAS - UNLEADED CATALYTIC -GASOLINE --HYBRID (ELECTRIC + CATALYTIC DIESEL)

-UNLEADED CATALYTIC/LPG -GASOLINE/LPG -CATALYTIC DIESEL -LPG

The first year of registration of public use vehicles (public transport vehicles and trucks), in circulation in 2016, indicates the age of the fleet and varies significantly depending on the type of fuel used (Figure 1.6). Specifically, the majority of public vehicles in circulation that are powered by diesel, were first registered between 1995 and 2010, with the majority (%) registered between 2000 and 2005. Vehicles powered by catalytic diesel (Figure 1.4) began to appear in circulation in the early 1990s, however there was a significant rise after 2003. Around 70% of public use vehicles were registered for circulation after 2000, which is to say that around 30% of public use vehicles have been registered for more than 17 years (Figure 1.6).

Moreover, the majority of public use vehicles use diesel (67%), out of which 50.8% use conventional diesel (Figure 1.7) and around 16.2% catalytic diesel[5].



UNREGISTERED – 30.18%

UNLEADED (Conventional or Catalytic, Hybrid with Natural Gas or LPG) – 0.64%

GASOLINE – LPG -0%

GASOLINE-1.26%

DIESEL (Conventional or Catalytic with Natural Gas etc.) -66.93%

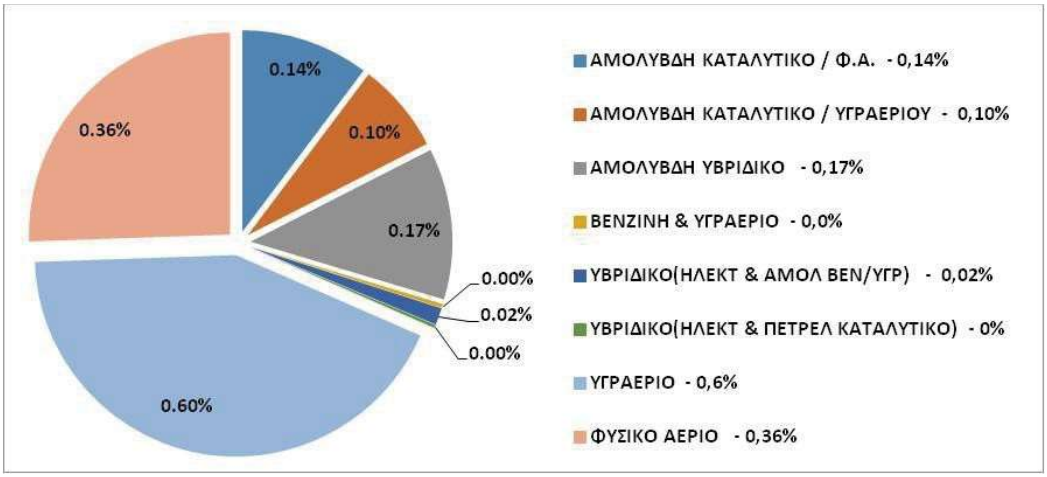
HYBRID (electric with gasoline or diesel or LPG)-0.02%

LPG -0.61%

NATURAL GAS-0.96%

Figure 1.7: Percentage of public use vehicles in circulation per type of fuel (2016)[5]

Public use vehicles using alternative fuels in Greece in 2016 accounted for just 1.4% of all public use vehicles in circulation. Figure 1.8 shows the proportion (%) of public use vehicles per category of alternative fuel.



UNLEADED CATALYTIC/NATURAL GAS-0.14%

UNLEADED CATALYTIC/LPG-0.10%

UNLEADED HYBRID-0.17%

GASOLINE & LPG-0%

HYBRID (ELECTRIC + UNLEADED GASOLINE/LPG)-0.02%

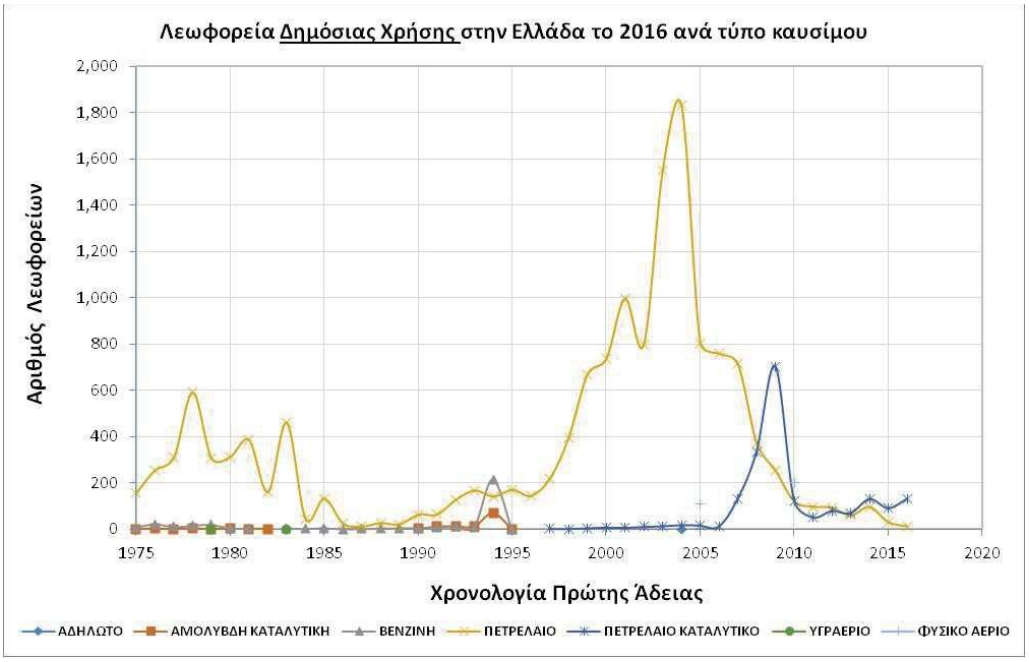
HYBRID (ELECTRIC + CATALYTIC DIESEL)-0%

LPG -0.6%

NATURAL GAS-0.36%

Figure 1.8: Percentage of public use vehicles in circulation per type of alternative fuel out of all vehicles in Greece in 2016[5]

Likewise, Figure 1.9 shows the public buses in circulation per type of fuel and per first year of registration in Greece in 2016. Diesel (conventional or catalytic) is the main fuel used by public buses. Vehicles powered by catalytic diesel first began to appear after 2006. Likewise, buses fuelled by natural gas were first registered after 2005, and there are 310 in total[5]. 34% of buses were registered for circulation before 2000.



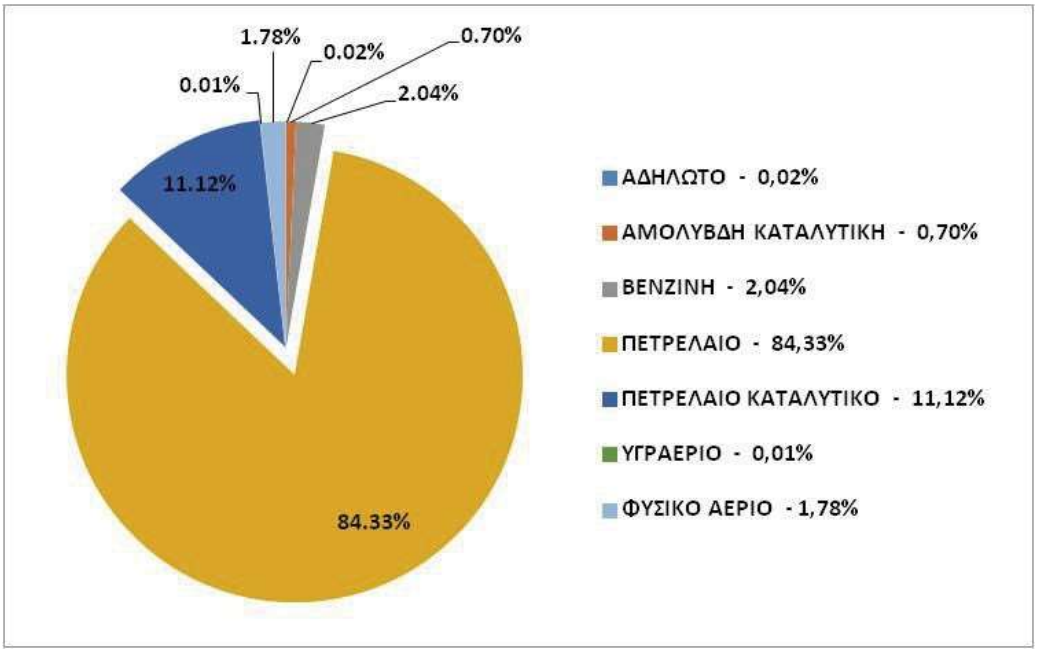
Number of public buses in Greece per type of fuel (2016)

No of buses

Date of first registration

-UNREGISTERED
-UNLEADED CATALYTIC
-GASOLINE
-DIESEL
-DIESEL CATALYTIC
-LPG
-NATURAL GAS

Figure 1.9: Number of public buses per type of fuel (2016)[5]



UNREGISTERED-0.02%

UNLEADED CATALYTIC-0.70%

GASOLINE-2.04%

DIESEL-84.33%

DIESEL CATALYTIC-11.12%

LPG-0.01%

NATURAL GAS-1.78%

Figure 1.10: Percentage of public buses in circulation per type of fuel (2016)[5]

The majority of public buses (Figure 1.10) use diesel (95%) (84% conventional fuel and 11% catalytic fuel respectively). Buses using alternative fuels (mainly LPG and natural gas) account for just 1.8% of the entire active fleet. Note that natural gas is only currently used by state-owned buses that are in circulation in the Prefecture of Attica (Figure 1.10).

1.1.1 Vehicles using alternative fuels (Directive 2014/94/EU)

Table 1.3 provides detailed information about the number of vehicles in circulation in Greece using exclusively alternative fuels in 2016, per type of fuel, based on the definition of alternative fuels in Directive 2014/94/EU. The information is based on statistical data from the Ministry of Infrastructure and Transport.

Table 1.3: Number of alternative fuel vehicles in use[5]

Alternative Fuel Vehicles	No of vehicles in 2016
Electric vehicles	**397**
Light-duty electric vehicles	***397***
Heavy-duty electric vehicles	0
Electric buses	0
Electric trucks	14
Electric passenger vehicles	146
Electric 3-wheel passenger vehicles	113
Electric motorcycles (two-wheeled vehicles)	124
CNG vehicles	**900**
Light-duty CNG vehicles	484
Heavy-duty CNG vehicles	106
CNG buses	310
LNG vehicles	**0**
Light-duty LNG vehicles	0
Heavy-duty LNG vehicles	0
LNG buses	0
Hydrogen vehicles	**0**
Light-duty hydrogen vehicles	0
Heavy-duty hydrogen vehicles	0
Hydrogen buses	0
LPG vehicles	**388**
Light-duty LPG vehicles	376
Heavy-duty LPG vehicles	10
LPG buses	2
Biofuel vehicles*	0
Light-duty biofuel vehicles	0
Heavy-duty biofuel vehicles	0
Biofuel buses	0
Synthetic and paraffinic fuel vehicles	0
Light-duty synthetic and paraffinic fuel vehicles	0
Heavy-duty synthetic and paraffinic fuel vehicles	0
Synthetic and paraffinic fuel buses	0

*Vehicles that only use biofuels. Hybrid vehicles are excluded.

1.2. FUEL CONSUMPTION IN THE TRANSPORT SECTOR

Energy consumption in the transport sector in Greece rose gradually from the 1960s to 2008, when the first drop was recorded (Figure 1.11)[3,4]. The maximum annual energy consumption in the transport sector was recorded in 2009 when it reached 8 811 ktoe (Figure 1.11). The average annual energy consumption for the transport sector for the period 2012-2015 has dropped and is around 6 500 ktoe/year.

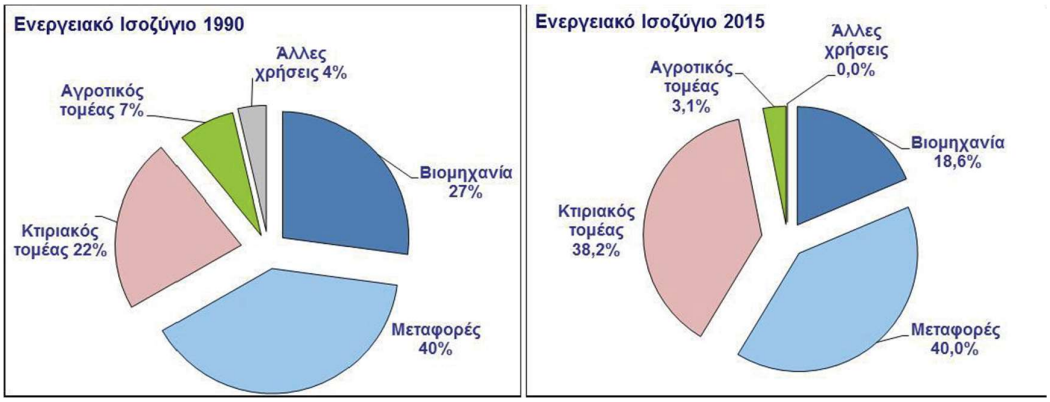
Annual energy consumption per sector in Greece

Energy in ktoe

Year

-Total
-Industry
-Transport
-Tertiary
-Household

Figure 1.11: Energy consumption rate (%) per sector in Greece.



Energy balance 1990
-Building sector-22%
-Agricultural sector-7%
-Other uses-4%
-Industry-27%
-Transport-40%

Energy balance 2015
-Building sector-38.2%
-Agricultural sector-3.1%
-Other uses 0%
-Industry-18.6%
-Transport-40%

Figure 1.12: Energy consumption rate (%) in transport in 1990 and 2013.

From 1960 to 2015, the transport sector accounted on average for 37(±7) % of overall annual energy consumption in Greece compared to the consumption rate for other energy end uses (buildings, industry, etc.). Figure 1.12 shows the percentage (%) stake of the transport sector in Greece's energy balance for the years 1990 to 2015[3,4].

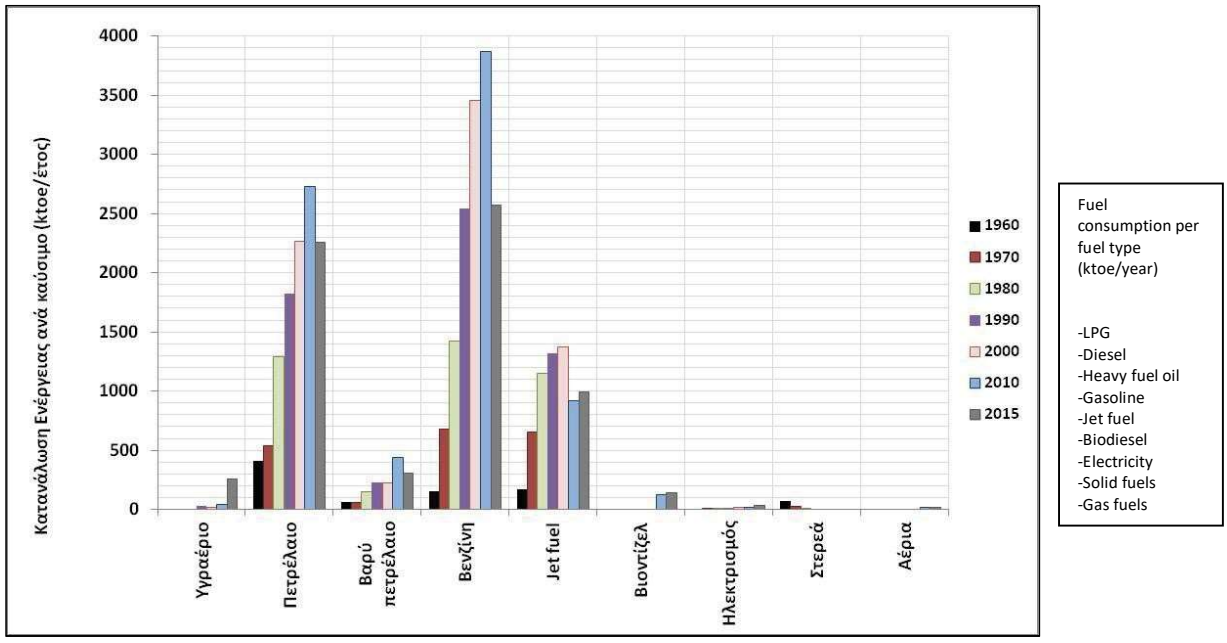


Figure 1.13: Energy consumption by type of fuel in the transport sector in the decades after 1960.

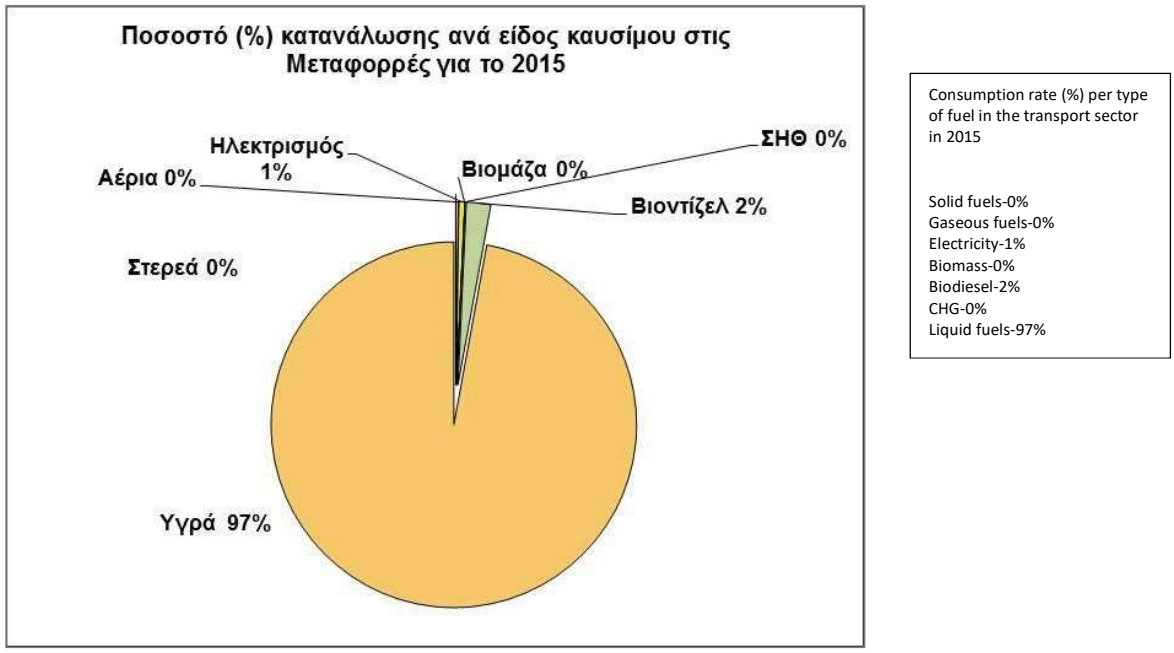


Figure 1.14: Consumption rate per type of fuel in the transport sector in 2015.

Liquid fuel consumption was the highest among all fuels in the transport sector in 2015, with a consumption rate of 97.5% in Greece (Figure 1.14). Meanwhile, biodiesel, which is considered an alternative fuel, accounted for just 2.2% of fuel used in the transport sector in 2015 (Figure 1.14).

Gasoline and diesel are the main liquid fuels used in the transport sector in Greece whereas jet fuel is placed third (Figures 1.15 and 1.16).

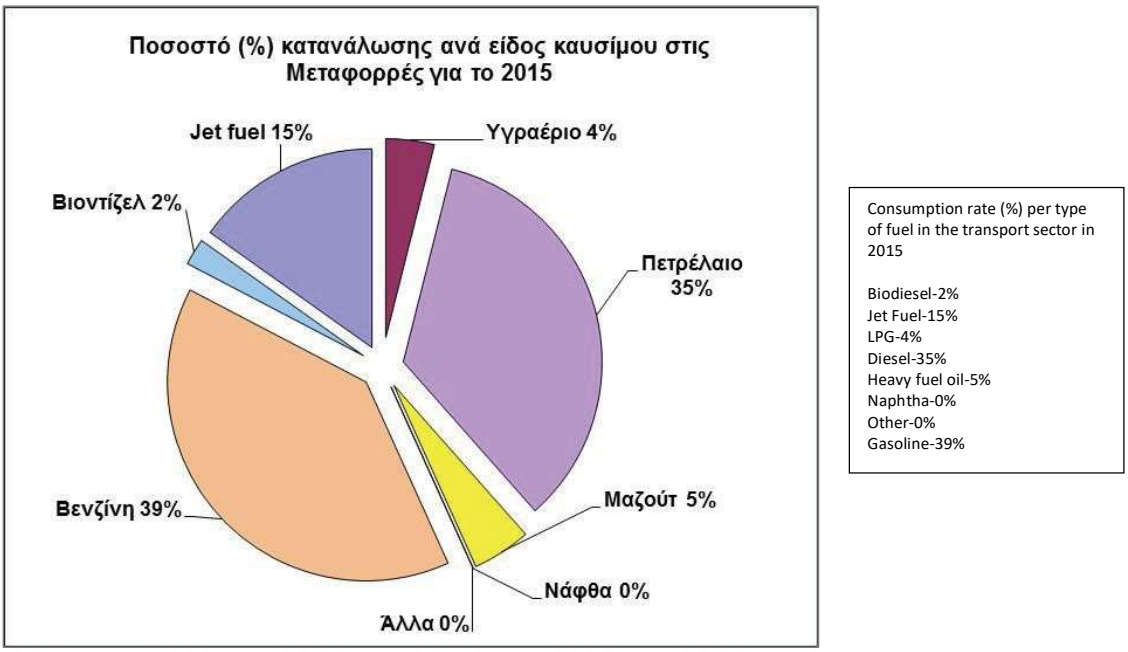


Figure 1.15: Consumption rate (%) per type of liquid fuel in the transport sector in 2015.

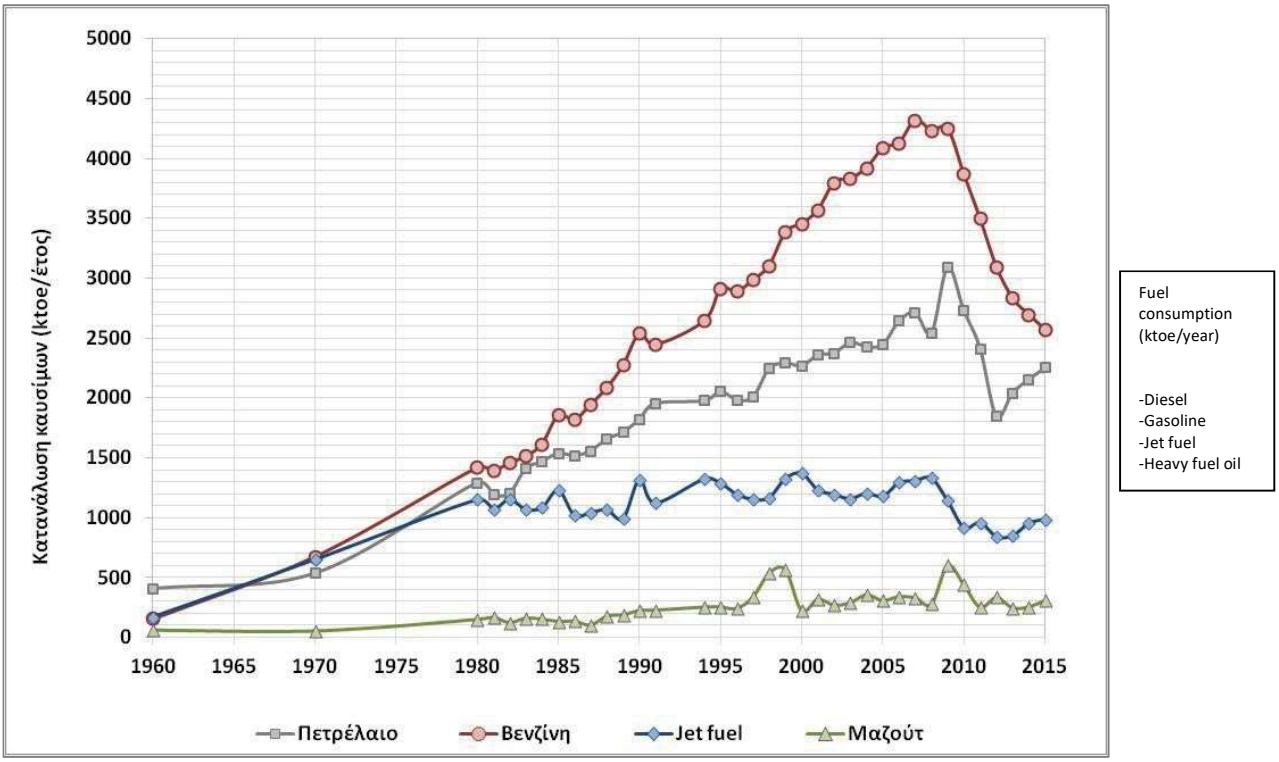


Figure 1.16: Fuel consumption in the transport sector from 1960 up to and including 2015.

Gasoline consumption in the transport sector (which primarily relates to road transport) in the period 2007–2015 in Greece gradually declined by an estimated 41% compared to 2007, which was the year in which the highest gasoline consumption rate was recorded, at around 4,317 ktoe (Figure 1.16)[3,4]. Similarly, diesel consumption gradually declined in the period 2009-2012 and then rose slightly up to 2015. However, the overall drop in diesel consumption for the period 2009-2015 is estimated overall at 27% compared to 2009, when the maximum diesel consumption rate recorded was 3,093 ktoe (Figure 1.16)[3,4].

Table 1.4 presents data about overall fuel production and fuel consumption in the transport sector in Greece, for both 2010 and 2014, and the variation rate (%) over that period. The rise in LPG consumption in the transport sector is significant, since from 2010 to 2014 there was a 374% rise (from 46 to 218 ktoe)[3,4]. At the same time there was also a gradual rise in biodiesel consumption, which was established as a fuel in the transport sector in Greece from 2009 onwards (mixed with conventional diesel).

Table 1.4: Change in annual production and consumption of fuels (ktoe) in Greece for 2010 and 2014[7,8]

Fuel type	2010, energy in ktoe		2014, energy in ktoe		Variation rate (%)	
	Production	Consumption	Production	Consumption	Production	Consumption
Gasoline	4,631	3,867	4,986	2,697	+7.7	- 30.3
Kerosene	-	919	-	955	-	+ 3.9
Diesel	4,437	2,434	9,685	2,155	+118.3	- 11.5
Heavy fuel oil	-	441	-	258	-	- 41.5
LPG	749	46	808	222	+7.9	+382.6
CNG	-	14.1	-	13.7	-	- 2.8
Biodiesel	112	128	142	134	+26.8	+4.7

Table 1.5 provides data on the total annual conventional and alternative fuel consumption from 2010 to 2015, based on Eurostat figures[3,8]. The alternative fuels in Table 1.5 do not include electricity.

Table 1.5: Consumption of conventional and alternative fuels in the transport sector in Greece from 2010 to 2015[8]

Fuel type	Total consumption (ktoe)					
	2010	2011	2012	2013	2014	2015
Total	8,161	7,470	6,480	6,337	6,467	6,577
Conventional	7,973	7,144	6,256	5,999	6,097	6,163
Alternative (CNG, LPG, Biofuels)	188	326	224	338	370	414
% of alternative fuels	2.3%	4.4%	3.5%	5.3%	5.7%	6.3%

The transport sector accounted for around 21%[8] of carbon dioxide emissions (CO_2) into the atmosphere in Greece in 2014 compared to 24%[8] for all Member States of the European Union combined. It is also the main source of other polluting emissions such as: carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOC), unburnt hydrocarbons, benzene and solid particulate matter (PM)[6].

In 2015, renewable energy sources (RES) accounted for around 2.2% of the transport sector in Greece (mainly biodiesel) whereas the average for EU Member States (EU28) was 4.0%[8]. Those figures only take account of biofuels that are considered to be sustainable. That percentage is expected to rise significantly due to implementation of the sustainable biofuels and bioliquids system under Ministerial Decision No 175700/2016 (Government Gazette, Series II, No 1212). The national target for 2020 of the share of renewables in energy end consumption in the transport sector has been set at 10%[9].That share, which is used to evaluate national targets under Directive 2009/28/EC, has been set in line with Eurostat methodology, which takes into account specific forms of renewables rather than all of them. For 2015 it was set at 1.43% for Greece and 6.71% for EU Member States overall (EU28).

Vehicles accounted for 76% of total fuel consumed in the transport sector (6,577 ktoe) in Greece in 2015[3]. The second highest category for fuel consumption in the transport sector (Table 1.6) was international air travel (12.5%) while inland waterway transport held third place (2.5%). Table 1.7 shows consumption rates overall per type of fuel and per transport sector in 2015[3].

Table 1.6: Consumption of fuels per transport sector in Greece for 2014 – 2015[3]

Transport Sector	2014		2015	
	(ktoe)	(%)	(ktoe)	(%)
Railway network	58	0.9%	59	0.9%
Road network	4,979	77.0%	4,976	75.7%
International air travel	777	12.0%	824	12.5%
Domestic air travel	180	2.8%	167	2.5%
Inland waterway transport	449	6.9%	534	8.1%
Unspecified sector	23	0.4%	17	0.3%
Total	6,467		6,577	

Table 1.7: Consumption per type of fuel and per transport sector in Greece for 2015[3]

Fuel consumption (ktoe)								
Transport Sector	**LPG**	**Gasoline**	**Jet Fuel**	**Diesel**	**Heavy fuel oil**	**Natural gas**	**Biofuel**	**Electricity**
Railway network				41			3	16
Road network	257	2,574		1,989		15	139	2
International air travel			824					
Domestic air travel			167					
Inland waterway transport				223	311			
Unspecified sector				1				16
Total	257	2,574	991	2,254	311	15	142	33

The fuels used in rail transport in Greece in the period 2014–2015 were primarily diesel (74.5%) and electricity (around 25.5%)[3].

The rate of electricity usage in Greece's railway network remains the lowest in Europe[9]. Energy consumption in the railway network includes the Athens metro and tram.

Shipping in Greece (short-sea shipping) currently uses diesel and heavy fuel oil whereas in European Union Member States shipping primarily uses diesel[3,9].

The penetration of alternative fuels into the transport sector is expected to rise significantly in the years to come, in the context of European Union goals to replace conventional fuels (diesel, gasoline). Factors such as climate change, the gradual depletion of energy resources as well as the extensive environmental impact from the use of conventional fuels will contribute to that rise and to the development of infrastructure for the use of alternative fuels. However, at present there is low interest in using alternative fuels, both among businesses and end consumers.

In 2010, Greece had 8,500 filling stations for vehicles, which dropped to 5,500 in 2016 (offering conventional and non-conventional fuels), primarily due to the economic situation. However, the number of filling stations is expected to rise as alternative fuels penetrate the Greek market.

1.2.1 Electricity

According to the recitals of Directive 2014/94/EU[1], electricity as a 'power source' is one of the alternative sources of energy, which are not necessarily released through combustion or non-combustion oxidation. Electricity can be considered an alternative source of energy and, consequently, an alternative fuel for the transport sector, provided primary energy production comes not just from the use of conventional fuels but also from the use of available renewable energy sources such as hydraulic, wind and solar power, etc.

The use of electricity in the transport sector has the potential to increase the energy efficiency of road vehicles and help reduce or control CO_2 emissions, depending on the sources of primary energy used to generate it. Note that the use of electric vehicles can contribute significantly to improving air quality (i.e. reduce air pollution) and reducing noise from vehicles in urban, semi-urban and other densely populated areas. However, there is a counter-argument to the benefits of limiting emissions in urban areas by using electric vehicles, since the emissions are transferred indirectly to the wider area around the power generation plants. The advantage of that indirect, concentrated transfer of emissions is that better control and containment is possible by using new anti-pollution technologies. Lastly, it increases the potential for making use of available renewable energy sources, via an online platform that informs electric vehicle users about the optimal vehicle charging time.

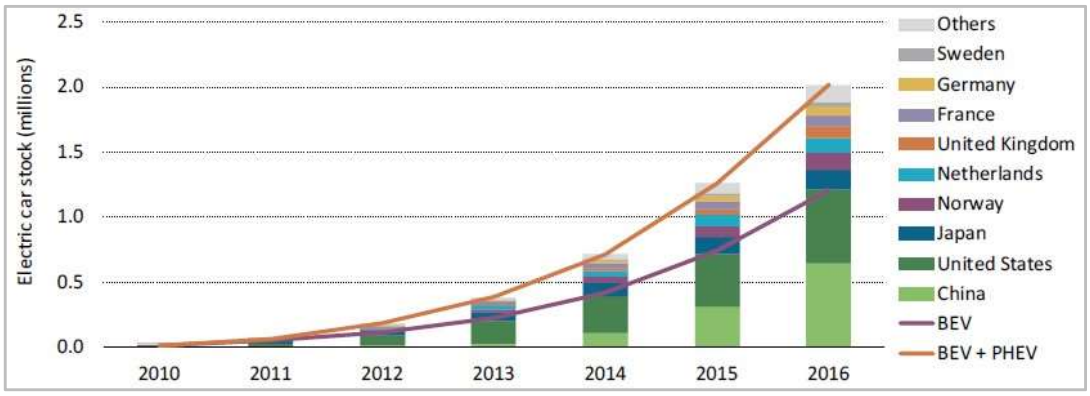


Figure 1.17: Change in electric vehicle stocks: IEA analysis based on EVI country submissions[12-18]

According to data from the OECD and the International Energy Agency (IEA), the use of electric vehicles worldwide is growing rapidly. Their recent joint publication 'Global EV Outlook 2016 – Beyond one million electric cars'[12], states that, in 2015, 1.26 million EVs were in circulation whereas, in 2014, the figure was half that (Figure 1.17).

The Hellenic Association of Motor Vehicle Importers and Dealers (SEAA) argues that the use of electricity to power vehicles in urban transport is vital to achieve future targets of eliminating emissions in cities and reducing noise. In addition, the pros of electric vehicles include the fact that the age of electric vehicles does not affect their environmental footprint when in use and maintenance is also expected to be more cost effective compared to vehicles that use conventional fuels[10]. However, the benefits of EVs aside, there are also challenges that must be addressed such as[9]:

1. The density, weight and improvement of the overall value chain for batteries from production of parts to recycling and re-use thereof.
2. The cost of purchasing and disposing of/recycling batteries as well as the environmental impact (environmental cost) that may arise.
3. The range of batteries and their charging time.
4. Connection to the power supply network and the method as well as the development of the necessary charging infrastructure.
5. The cost of purchasing and running electric vehicles.

These challenges are being addressed systematically at both European and global level, first and foremost by the automotive industry. In Greece, the use of electric vehicles is at an embryonic stage and is limited mainly to street cleaning or municipal police vehicles. Note that the first electric vehicle chargers were installed in Greece in 2011 and sales of electric vehicles started in 2013. However, the first sales of electric four-wheeled vehicles (L category vehicles) were recorded in the early 2000s. These vehicles were charged on private premises [11].

According to data from the Ministry of Infrastructure and Transport (Table 1.3), there were at least 395 electric vehicles in circulation in Greece in 2016. However, only three (3) approved and publicly accessible EV charging facilities have been recorded at vehicle service facilities (filling stations and car parks) in accordance with Joint Ministerial Decision No 71287/6443 (Government Gazette, Series II, 2015).

However, according to the Hellenic Institute of Electric Vehicles (HELIEV), there are at least 43 charging points installed, primarily for private use[11]. In addition, the technical characteristics of the charging points are not known, for instance the installed capacity, charging time and the charging method available to the users of electric vehicles[11]. These charging points are primarily located in privately operated car parks.

In the years to come, charging point infrastructure is expected to grow, since interest in purchasing and using electric vehicles is growing and potential users are becoming more familiar with the technology[11].

Existing shore-side infrastructure for supplying electricity to floating craft at maritime and inland ports in Greece primarily relates to tourist ports (marinas, harbours, anchorages, hotel docking facilities, etc.) whereas at Greece's major ports where sea-going ships berth, infrastructure is limited and primarily relates to pilot applications (such as the ELEMED programme par. 0), despite the major advantages offered by

this technology, such as reduced noise pollution, reduced environmental pollution and economic gains.

Table 1.8: Number of recharging points in operation[5,19-20]

ELECTRICITY	Recharging points
	2016
Normal power recharging points (public)	3
High power recharging points (public)	N/A
Normal power recharging points (private)	N/A
High power recharging points (private)	N/A
Recharging points of unspecified power and use	at least 43
Infrastructure for shore-side electricity supply at maritime and inland ports (terminals)	0
Infrastructure for electrical power supply for stationary airplanes	109

Tourist ports in Greece are equipped with electricity supply points (charging points) for berthed floating craft, primarily leisure craft. A total of 72 tourist ports with electricity supply points are estimated to be in operation[20], of which there are around:

- 35 marinas;
- 30 harbours/anchorages for tourist vessels;
- 7 hotel docking facilities.

The majority of tourist ports are usually supplied with medium voltage power and have suitable infrastructure, a medium voltage substation, distribution networks and electricity supply points, fuse boxes, etc. The capacity of charging points ranges from 16Amp/220V to 630Amp/380V per berth, depending on the size of each vessel and its power requirements, and the maximum available installed capacity at the tourist port. These charging points allow vessels to meet their energy needs and not use their engines (powered by conventional fuels) while they are berthed.

Total electric power (kVA) at tourist ports has not been recorded for all marinas in Greece. However, the total electric power mostly corresponds with berth capacity and the size of the vessels that call at those tourist ports. In any event, the minimum installed capacity in small anchorages is 250 kVA, 630 kVA in harbours and 800 kVA in large marinas.

For the power supply needs of stationary airplanes, only Athens central airport (Eleftherios Venizelos Airport) is equipped with fixed charging points. Stationary airplanes can recharge at 76 fixed charging points and there are also 33 portable power generators owned by private ground handlers. The other central and regional airports in Greece have no fixed charging points, just portable generators built into vehicles [21]. The power at fixed charging points is normally 90 kVA or 120 kVA, whereas, for portable generators, it is 90 kVA.

1.2.2 Natural gas

Natural gas is another alternative fuel for the transport sector according to Directive 2014/94/EU[1], since emissions from natural gas combustion are of better quality than oil burning emissions. The use of natural gas in the transport sector has so far been limited in Greece, with the majority of natural gas being currently used to generate electricity.

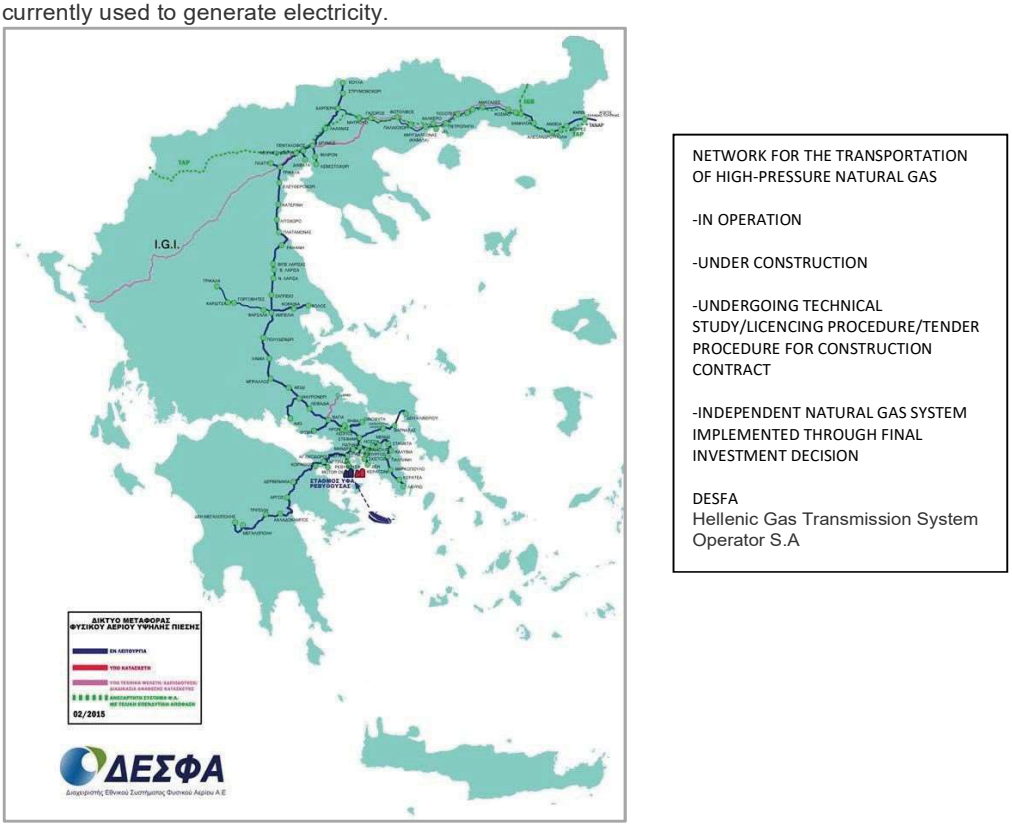


Figure 1.18: High-pressure natural gas transportation network based on DESFA data[22]

The National Natural Gas System (NNGS) consists of:

- the National Transportation Network, which carries natural gas from the Greek-Bulgarian border at Sidirokastro (managed by BULGARTRANSGAS) and the Greek-Turkish border at Kipoi, Evros (managed by BOTAS) to consumers, who are primarily located in eastern mainland Greece. The transportation system includes, amongst other things: (a) a 512 km long main high-pressure (70 bar) transportation pipeline that runs from the Greek-Bulgarian border to the Prefecture of Attica (Figure 1.18); (b) high-pressure branches towards Eastern Macedonia and Thrace as far as Kipoi in Evros, Thessaloniki, Volos and Attica, totalling 440 km in length, plus a new extension from Attica to Megalopolis; (c) high-pressure branches to Eastern Macedonia and Thrace as far as Kipoi in Evros; (d) the main high-pressure transportation pipeline from Revythousa to Megalopolis (PPC power plant) totalling 214 km in length, and (e) support infrastructure such as gas flow metering and pressure regulation stations, the remote control system and the operating and maintenance centres in Attica, Thessaloniki and Thessaly;

- the Revythousa storage station which includes, amongst other things: (a) LNG storage facilities, two storage tanks (with a capacity of 2 x 65,000 = 130,000 m^3), (b) tanker berthing facilities, (c) cryogenic facilities and d) gasifiers to turn LNG back into gas and to supply the transportation system via two pipelines which interconnect Revythousa with the transmission system, and
- the distribution network, which, amongst other things, includes: (a) the medium-pressure (19 bar) network in Attica, Thessaloniki and Thessaly and the industrial areas of Oinofyta, Platy in Imathia, Xanthi, Kavala and the Komotini Industrial Park, and (b) the low-pressure (4 bar) network in Attica, Thessaloniki and Thessaly.

In 2010, there were only two CNG filling stations in Greece, one in Anthousa and one in Ano Liosia, Attica. They are owned by the Public Gas Corporation of Greece (DEPA) and are still in use today to supply the refuse collection vehicles of local government authorities in the Prefecture of Attica and 400 buses operated by Road Transport S.A. (OSY). Note that, in 2010, there were 8,480 gasoline/diesel filling stations.

In 2017, there were 11 filling stations where both CNG and gasoline were available, and another 5 new ones are to open in Athens and Thessaloniki, which are currently in the licensing and construction stage. Note that, currently, the number of fuel and energy supply stations where conventional fuels (gasoline/diesel) are available has dropped to 5,500, of which 800 also sell LPG.

Table 1.9: Number of natural gas refuelling points in operation[5, 22, 42]

Natural gas refuelling points for the transport sector	**Number of refuelling points in 2016**
CNG refuelling points (public)	11 and 5 currently in the licensing stage
CNG refuelling points (private)	0 (the possibility of legislative regulation is being examined)
LNG refuelling points for heavy-duty motor vehicles (public)	0
LNG refuelling points for heavy-duty motor vehicles (private)	0
LNG refuelling points at maritime ports	0 (At the port of Piraeus there is potential for supplying LNG via ships from Revythousa)
LNG refuelling points at inland waterway ports	0

So far there are no facilities at Greek ports for supplying LNG to ships, since, currently, there is no demand for it from the short-sea shipping sector. However, it is possible to provide ships berthed at the Port of Piraeus with LNG by transporting it from Revythousa facilities on specially fitted ships.

1.2.3 Hydrogen

Hydrogen is considered to be one of the fuels of the future for the transport sector, since producing it using renewable energy sources (RES) can make it a particularly competitive source[7]. Hydrogen can be used:

- directly as a fuel (Power-to-Hydrogen – PtH2);
- following conversion into a gas or liquid synthetic fuel by means of chemical synthesis;
- in hydrogen fuel cells for electric vehicles.

So far, no regulatory framework has been put in place in Greece for the installation of hydrogen supply facilities for motor vehicles, at existing fuel and energy supply stations or at stations that are in the process of obtaining a licence[5,23]. Hydrogen production in Greece for commercial use (transport, etc.) does not appear to be achievable in the near future, since it requires the development of key hydrogen production and distribution infrastructure. However, Greece could become a source of innovative methods for hydrogen production, provided that the possibility of such investments by the state and the business sector is considered[7].

Table 1.10: Number of hydrogen refuelling points in operation[5]

HYDROGEN	Hydrogen refuelling points	
	2015 (350 bar)	2015 (700 bar)
Hydrogen refuelling points (public)	0	0
Hydrogen refuelling points (private)	0	0

1.2.4 Other Alternative Fuels: LPG, biofuels, synthetic and paraffinic fuels

Other than electric vehicle charging points and fuel and energy supply stations offering LPG and natural gas, Greece lacks the infrastructure to provide any other type of alternative fuel, such as biofuels or synthetic and paraffinic fuels.

From 1985 to 2010, there were around 15 LPG filling stations in operation in Greece. Under the provisions on LPG stations, which were amended at the end of 2010, those facilities were located exclusively in areas outside urban planning zones, and no activity was permitted in the vicinity those stations. Each of these stations was equipped with a garage for LPG vehicles. Following an amendment to the relevant provisions on establishing LPG stations, the number of public filling stations supplying LPG rose significantly, totalling 811 in 2017.

It should be noted that, in Greece, there are about 800 gaseous fuel technicians, whose work involves converting gasoline and diesel engines to LPG and CNG engines and maintaining and repairing these. There are around 450 garages dealing with gaseous fuels in operation[51].

Biofuels are liquid or gaseous transportation fuels that are sold on the Greek market mixed with diesel from existing refineries. Existing facilities can also provide the market with synthetic and paraffinic fuels. Greece currently has no fuel and energy supply stations with pumps supplying pure biofuel, or synthetic and paraffinic fuel pumps to power vehicles[51].

The only biofuel that is sold on the Greek market to power vehicles is biodiesel, which is mixed with ordinary diesel. The law requires a biodiesel blending ratio of 7% by volume according to the standards set by the Supreme Chemical Council (ACS). Blends containing a higher ratio, above the limit set in Supreme Chemical Council decisions, may be sold, provided all other specifications are within the thresholds for biofuels and products deriving from refined crude oil. Blending is only permitted at the facilities of refineries or holders of a class A petroleum products trading permit issued under Law 3054/2002 (Government Gazette, Series I, No 230).

Biodiesel was introduced to the Greek market in 2005 and the rate at which it is mixed with diesel has gradually risen to 7% by volume, which is the current figure[24,25]. The raw materials used to make biodiesel are mainly oil producing seeds, spent cooking oils and animal fats. The annual required quantities come primarily from Greek energy crops and raw materials, while additional quantities are either produced from imported raw materials at domestic processing plants or imported as finished products from other Member States.

The Supreme Chemical Council decision on gasoline specifications requires that the maximum rate at which bioethanol can be mixed with gasoline is 10% by volume. However, so far, pure bioethanol is not available on the Greek market.

Biogas is also not currently in use in Greece as a vehicle fuel. The use of biogas in the transport sector requires it to undergo scrubbing following anaerobic digestion, after which, it is upgraded to biomethane.

Table 1.11: Number of operating refuelling points for other alternative fuels[5,43]

Other alternative fuels	Refuelling points for other alternative fuels
LPG refuelling points (public)	811
LPG refuelling points (private)	0
Biofuel refuelling points (public)	0
Biofuel refuelling points (private)	0
Synthetic and paraffinic fuel refuelling points (public)	0
Synthetic and paraffinic fuel refuelling points (private)	0

2 NATIONAL OBJECTIVES AND TARGETS

2.1 THE OBJECTIVE OF USING DIFFERENT FUELS IN TRANSPORT

In Greece, the use of alternative fuels in the transport sector is extremely limited and in 2015 they accounted for just 6.7% of fuels used in this sector, excluding electricity, which represented 0.5% of total consumption. LPG is currently the most widely used alternative fuel in the transport sector, with consumption reaching 257 ktoe in Greece in 2015 (Figure 2.1). Other than LPG consumption, which has been reporting a steady rise over the last 7 years in Greece, the use of another alternative fuel, biodiesel, has been steadily rising in the transport sector since 2005, with consumption reaching 142 ktoe in 2015.

Likewise, the use of LPG in private vehicles is expected to rise rapidly as long as the cost of LPG remains low compared to other fuels on the market. LPG consumption rose considerably in the period 2010–2011, increasing almost 8-fold after the entry into force of Law 3710/2008 that allowed the construction of LPG filling stations in areas located within urban planning zones. After 2011, the rate of increase dropped, with an average annual rate of 7%.

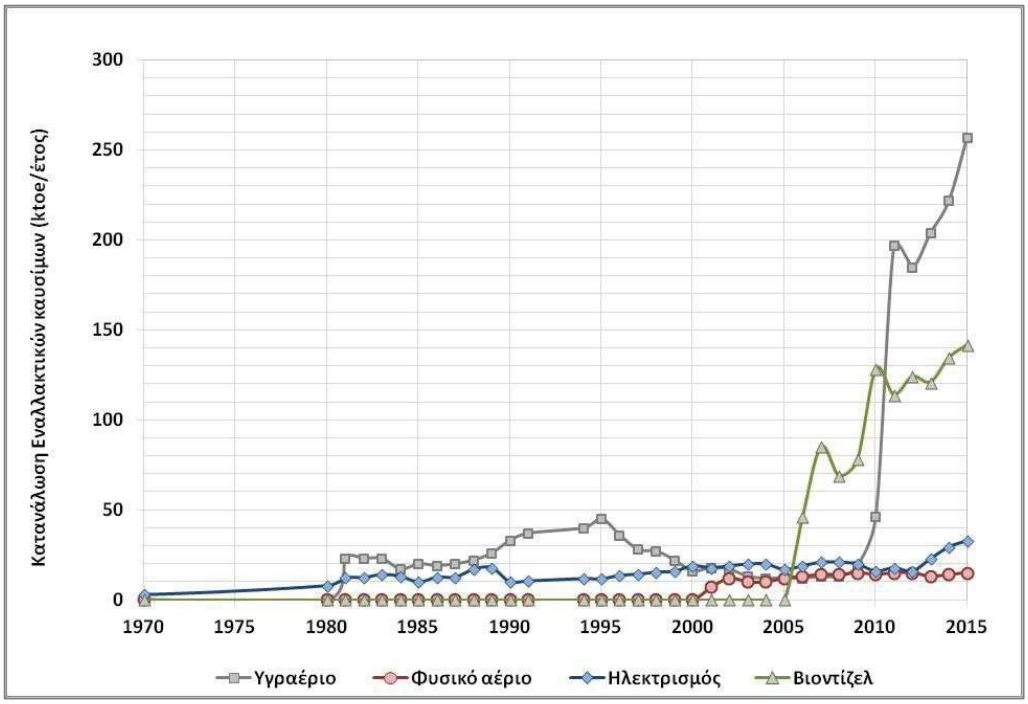


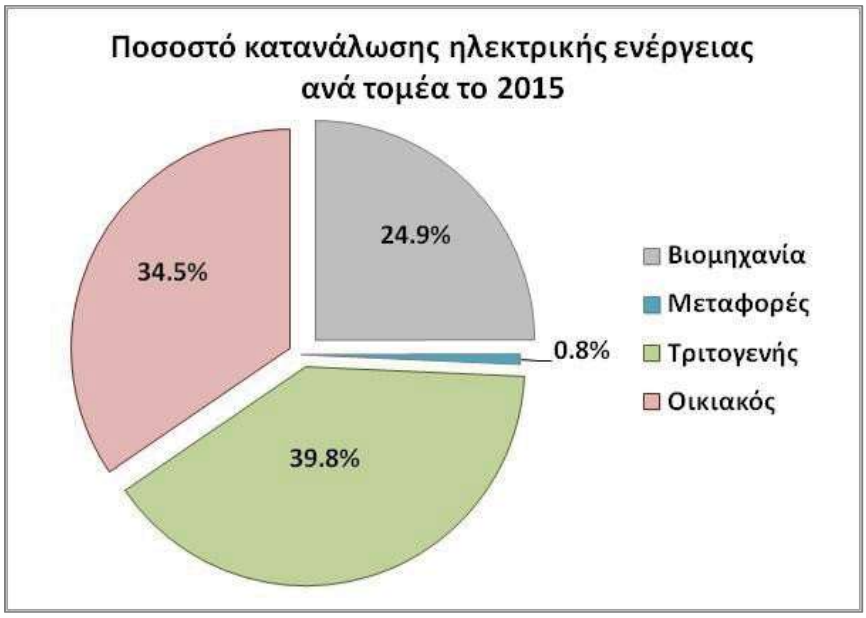
Figure 2.1: Evolution of alternative fuel consumption in the transport sector in Greece [3]

Gauging the evolution of alternative fuel consumption in the transport sector requires the use of detailed calculations, since there are many imponderable variables that have a universal impact on any approach taken. A potential economic crisis, for example, has a direct impact on citizens' commercial interests, energy costs, etc.

Specifically, in order to gauge the future usage of fuels in the transport sector, it is necessary to identify and have knowledge of a substantial amount of data concerning areas such as vehicle technology evolution, domestic vehicle production, the cost of purchasing, running and maintaining vehicles, energy and environmental benefits, and the network of fuel supply infrastructures available to meet market demand.

Greece is an energy dependent country, with net imported energy (imports minus exports) standing at approx.18,812 ktoe in 2015, of which 80% related to oil and 14% to natural gas[4]. Domestic energy production in Greece stood at 8,444 ktoe, of which 67% related to solid fuels (mainly lignite) and 31% to RES.

As far as electricity was concerned in 2015, around 18% of the electricity consumed in Greece was imported[4,22]. The transport sector consumes just 0.8% (Figure 2.2.) of the electricity consumed in Greece[3]. The expected rise in electricity consumption in the transport sector in the years to come, will be primarily due to the gradual electrification of existing fixed rail transport and new metro lines, and to a lesser extent due to the penetration of electric vehicles, which is expected to be limited in scale until 2020.



Electricity consumption rate (%) per sector in 2015

-Industry-24.9%
-Transport-0.8%
-Tertiary-39.8%
-Household-34.5%

Figure 2.2: Electricity consumption rate (%) per sector in Greece in 2015 [3]

2.2. NATIONAL TARGETS FOR THE PENETRATION OF VEHICLES USING ALTERNATIVE FUELS

Electric vehicles

In Greece, the first real attempt to study the potential for promoting electric mobility was made in 2011 when a Scientific Committee was set up and run by the Ministry of Environment, Energy and Climate Change, on 20 September 2011, to explore how electric vehicles could be developed and disseminated in Greece (Ministerial Decision No Δ6/21612/20.09.2011, Web Ref No 4A8K0-80B). The Committee's task was to analyse the policies and economic tools to support the initial phase of electric vehicle (EV) penetration into the Greek market, and to develop a proposal for the implementation of a comprehensive programme of incentives to promote such vehicles. The Committee's technical report[26] entitled 'Exploring methods for deployment and penetration of electric vehicles in Greece' was submitted in January 2012.

The report's main conclusion is that subsidising the initial purchase of an EV is necessary in the initial phase of penetration into the Greek market[26]. In addition, the study reported that operating electric vehicles will result in considerably lower CO_2 emission levels, which would be reduced even further since it was predicted that the power generation mix values in Greece would drop after 2013, taking into account:

- the suspension of operation of certain outdated power stations fuelled by lignite and
- the increase in the electricity generated annually using RES, especially wind farms and photovoltaic systems.

In Greece, electric vehicles:

- are exempt from the luxury tax under Article 17(3)(a) of Law 3833/2010 (Government Gazette Series I, No 40), as amended by Article 6 of Law 4211/2013;
- can be driven in the centre of Athens by way of exemption to the alternate day rules, under the terms of ministerial decision No 5592/Φ.911/16 (Government Gazette, Series II, No 3208/2016) on measures to limit vehicle traffic in the centre of Athens in the 2016–2017 period.

According to the Hellenic Institute of Electric Vehicles (HELIEV), which supports and promotes electric mobility in Greece, penetration of electric vehicles into Greece and other EU Member States requires that certain conditions are met and that certain steps are taken. These include[11]:

- investments in the development of essential infrastructure in the electricity production and distribution sector (electricity distribution network, charging points, etc.);
- policy actions and support measures: subsidies for new technologies, coordination among competent bodies and local government authorities for the development of infrastructure, etc.;
- development and advancement of available technology by the automotive industry: new, attractive models offering high levels of comfort and safety, reduced production and running costs, etc.;
- standardisation and certification of available technology through the creation of common quality and compatibility rules. The EU must play a coordinating role, laying down guidelines which can be followed by everyone involved;
- familiarisation of users with the features of these vehicles and how the vehicles can meet user needs;
- calculation of the cost of purchasing, running (energy cost) and maintaining these vehicles.

The various electric vehicle penetration scenarios for passenger and professional vehicles and buses/coaches, etc. for Greece are primarily based on estimates pertaining to:

- the development of vehicle and battery technology;
- the development of charging point technology in order to provide rapid service;
- car market trends under the pressure of environmental issues and public health concerns;
- the assessment of the electric vehicle market in developed European markets, and in other European states with lower growth rates;
- a levelling out of the economic situation.

The various estimates on the penetration of electric vehicles (Figure 2.3) globally, appear to show deviations depending on the scenarios and initial assumptions examined[12,13], with the prospects for electric mobility looking particularly promising.

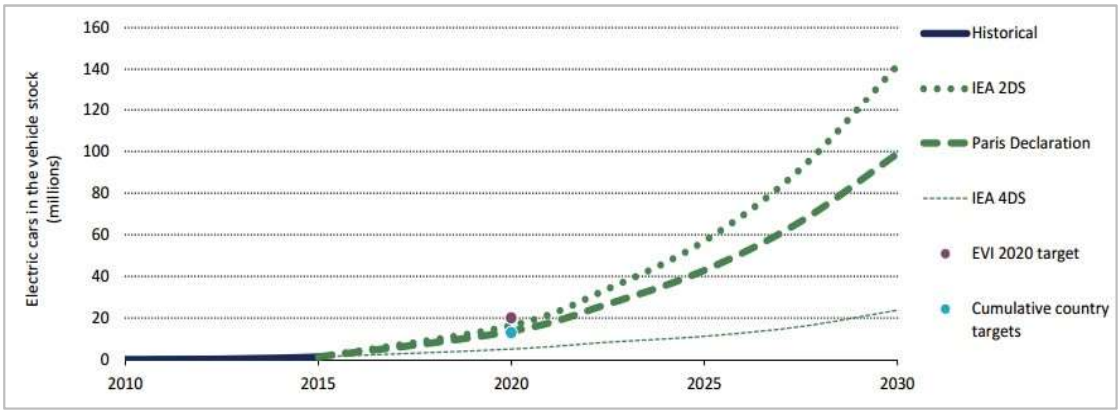


Figure 2.3: Electric vehicle penetration scenarios for 2030: IEA analysis [12-18, 27-30]

Having due regard to the conditions outlined above, in the best-case scenario for the growth of electric vehicle use in Greece, it is estimated that as a minimum:

- in 2020, there will be 3,500 electric vehicles of all types in circulation[11,23];
- in 2025, that figure will be 8 000 vehicles;
- in 2030, there will be 15 000 electric vehicles in circulation.

Natural gas vehicles

As for the further growth of natural gas as a fuel in Greece, the Public Gas Corporation of Greece (DEPA) is conducting studies based on current conditions in the Greek car market, with a view to assessing the penetration of natural gas vehicles into the Greek market. Those estimates are presented in the table below, which shows that the penetration of CNG-powered vehicles is expected to be significantly higher than that of LNG-powered vehicles. The forecasts are based on the following assumptions[23,41]:

- the actual number of vehicles in circulation in Greece today is around 8 million, of which only 1,400 are CNG-powered;

- the average rate of natural gas vehicle penetration in Europe over the last four years (2012–2016) has levelled off at 25%, meaning an increase of 75,000 vehicles a year (Figure 2.4). In Greece, while the growth rate in CNG-powered vehicles in the period 2014–2016 was estimated at 50%, in absolute terms, it is estimated that there were only 700 new vehicles in circulation over the three-year period;
- by 2020, the current number of CNG-powered vehicles will have increased approximately 10-fold;
- by 2025, the penetration rate of CNG vehicles as a share of all vehicles in circulation in Greece, is expected to be 0.5%, in keeping with other countries. Otherwise, by 2025, based on the European trend for the period 2012–2016, the annual growth rate of CNG-powered vehicles in Greece is estimated at 25%;
- by 2030, it is estimated that the annual rise in CNG-powered vehicles will level off at 15%.

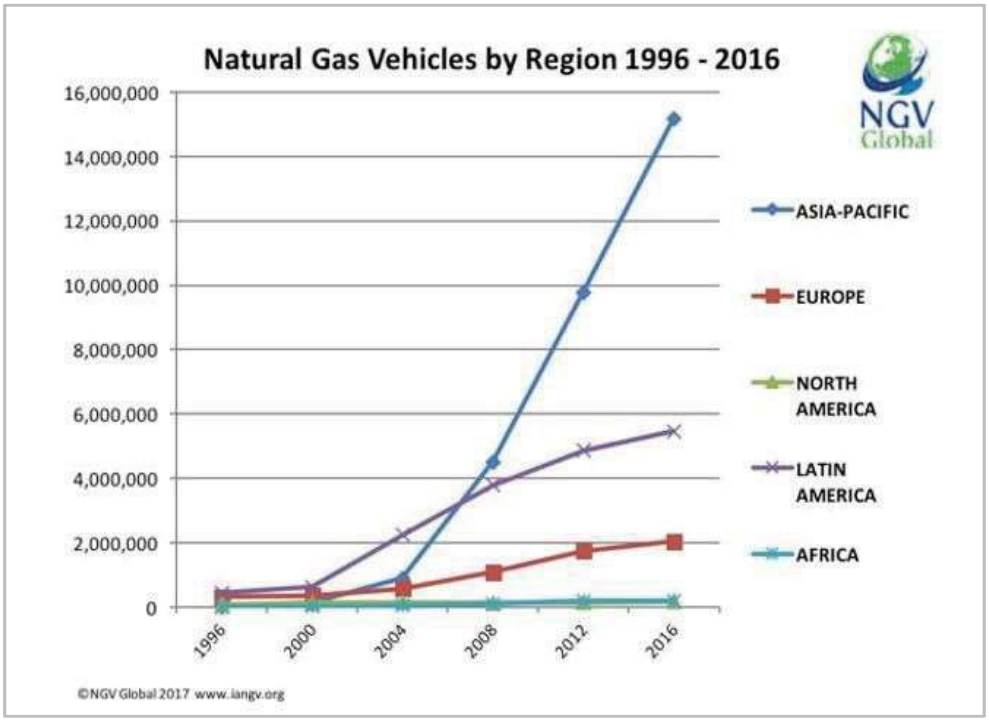


Figure 2.4: Global distribution of CNG-powered vehicles (Natural Gas Vehicle Global 2017, (http://www.iangv.org/current-ngv-stats/).

The Ministry of Infrastructure and Transport is negotiating with the European Commission's DG Move and the European Investment Bank for similar financing under the Commission's Clean Transport initiative. The aim is to renew a significant portion of the fleet of urban buses for urban transport in Athens and Thessaloniki as well as in other urban areas in Greece (where urban bus companies operate). A first step will be to include 90 new OASA urban buses in the Attica Regional Operational Programme. These buses are powered by alternative fuels, mainly electricity and natural gas. Based on its own strategic plans, the Ministry of Infrastructure and Transport has also applied for and set aside €80,000,000 so far as part of the NSRF 2014–2020 to further develop the OASA fleet, which will also be powered by alternative fuels, mainly electricity and natural gas.

Table 2.1: Estimated number of vehicles using alternative fuels[25,11,23,41]

ALTERNATIVE FUEL VEHICLES	Estimated number of vehicles		
	2020	2025	2030
Electric vehicles	3,500	8,000	15,000
Electric buses	N/A	40	90
CNG cars	13,500	35,000	70,000
Light-duty CNG vehicles	12,850	34,000	68,450
Heavy-duty CNG vehicles	150	200	350
CNG buses	500	800	1,200
LNG vehicles		**250**	**900**
Light-duty LNG vehicles	0	0	0
Heavy-duty LNG vehicles	0	250	900
LNG buses	0	0	0
Hydrogen cars	0	N/A	N/A
Light-duty hydrogen vehicles	0	N/A	N/A
Heavy-duty hydrogen vehicles	0	N/A	N/A
Hydrogen buses	0	N/A	N/A
Vehicles powered by LPG only	**450**	**600**	**750**
Light-duty LPG vehicles	430	N/A	N/A
Heavy-duty LPG vehicles	15	N/A	N/A
LPG buses	5	N/A	N/A
Vehicles using a mix of conventional fuels (unleaded gasoline, etc.) and LPG	**265,000**	**350,000**	**420,000**
Biofuel vehicles	**0**	**N/A**	**N/A**
Light-duty biofuel vehicles	0	N/A	N/A
Heavy-duty biofuel vehicles	0	N/A	N/A
Biofuel buses	0	N/A	N/A
Synthetic and paraffinic fuel cars	**0**	**N/A**	**N/A**
Light-duty synthetic and paraffinic fuel vehicles	0	N/A	N/A
Heavy-duty synthetic and paraffinic fuel vehicles	0	N/A	N/A
Synthetic and paraffinic fuel buses	0	N/A	N/A

LPG vehicles

As already stated, the use of LPG as a fuel is already quite widespread in Greece, especially in vehicles that can switch between LPG and gasoline (unleaded or not). Currently, there are 264,000 such vehicles and the number is gradually and steadily on the rise. Consequently, the number of existing facilities for LPG vehicles, such as filling stations and garages, is expected to increase slightly in the years to come.

Other alternative fuels

According to the Directorate for Hydrocarbons of the Ministry of the Environment and Energy, the following assessment can be made about other alternative fuels:

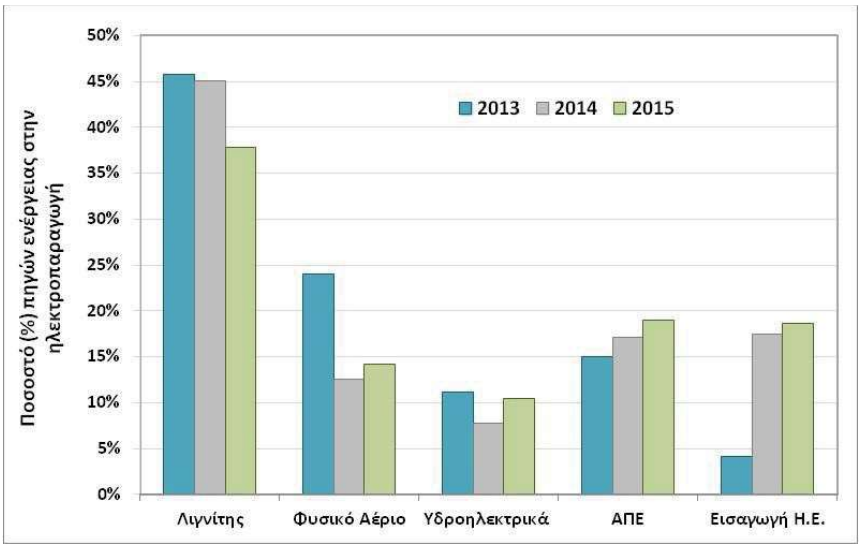
- Hydrogen: The promotion of hydrogen as a fuel in the transport sector is not expected in the coming years. Both the technology for vehicles using hydrogen and the infrastructure required to support the use of hydrogen are still at very early stages of implementation worldwide. For this reason, the use of hydrogen in the transport sector will not be examined at present.
- Biofuels: The existing strategy in the biofuels sector does not include obligations or incentives to market pure biofuels to end consumers for use in the transport sector. Plans for the biofuel sector will be made taking into account the existing legislative framework put into place by the European Commission for 'Clean Energy for All Europeans – unlocking Europe's growth potential' and, in particular, the new proposal for a Renewables Directive.
- Synthetic and paraffinic fuels: The existing strategy does not include obligations or incentives to promote the sale of synthetic and paraffinic fuels for use in the transport sector by end consumers.

2.3. INFRASTRUCTURE FOR SUPPLYING ELECTRICITY IN THE TRANSPORT SECTOR

Article 4 of Law 4439/2016 (Article 4 of Directive 2014/94/EU) on 'Electricity Supply for Transport' sets out the obligations and rules for developing electricity supply infrastructure both for electric vehicles (EV) and floating craft as well as stationary airplanes. This National Framework refers to the potential for deploying infrastructure for the supply of electric energy in Greece, in order to power various means of transport. It also refers to the necessary steps to complete the institutional framework required for the development of that infrastructure (licensing of facilities, technical specifications on operation, electricity supply tariffs, etc.).

However, it is important to draw attention to certain facts regarding the current state of the power generation system and electricity production in Greece, which have been taken into account in assessing the development of electricity supply infrastructure for all means of transport. Specifically, the situation in Greece is the following:

- according to the Eurostat method for evaluating the national targets referred to in Directive 2009/28/EC, the penetration of renewable energy in the electricity production market in Greece in 2015, including energy produced by hydroelectric units, was 22.9%;
- the percentage of net electricity imported (imports minus exports) in 2015 was 18% (Figure 2.5);
- the average electricity to primary power conversion rate over the last five years (consumption of primary power and electricity production), remains high at around 2.5, according to processed Eurostat data[8];
- the geography of Greece, with its many islands, has led to the development of numerous local electricity production plants, with limited technical capabilities in the immediate future. However, there is always scope for developing suitable infrastructure for storing and utilising available RES in each individual area in order to limit the islands' dependence on conventional fuels.



Share of energy sources (%) in electricity generation

-Lignite
-Natural gas
-Hydroelectric
-Renewables
-Imported Electricity

Figure 2.5: Share of energy sources (%) in electricity generation in Greece, based on Eurostat and ADMIE data.

Electric vehicle (EV) batteries could, in the future, be used as electricity storage infrastructure in the islands' electric power systems as well as in the interconnected system, provided a comprehensive online information system is developed to involve EV users.

Electric vehicle charging points

Article 4(1) of Law 4439/2016 states that an appropriate number of recharging points accessible to the public must be put in place by 31 December 2020, to make it easier for electric vehicles to circulate in urban/suburban agglomerations and other densely populated areas, and, where appropriate, within pre-determined networks. Publicly accessible recharging points can also be installed at public transport stations (such as inter-city bus stations etc.). At the same time, the capability to install recharging points at locations that are not publicly accessible must be ensured. The number of recharging points must be specified taking into account, among other things, the number of electric vehicles that are expected to be registered by the end of 2020, as well as best practices and recommendations issued by the Commission.

Article 4(7) of Law 4439/2010 provides for EV recharging points that are accessible to the public to be connected to **smart metering systems** such as those defined in Article 3 of Law 4342/2015 (Government Gazette Series I, No 143) and in accordance with the conditions and requirements set out in Article 11(2) of said Law. The conditions and requirements of Article 11(2) of Law 4342/2015 relate to energy distributors, distribution network operators and electricity retailers, and ensure suitable technical specifications and the proper operation of metering systems, protection of data and of consumer privacy, etc. Connecting charging points with smart metering systems is technically straightforward using available technology and, in most cases, it is economically feasible, since purchase costs are low compared to the initial cost of recharging point equipment. If publicly accessible recharging points are connected to metering systems, then it will be possible for electricity consumption to be checked and recorded, not just by recharging point operators and recharging service providers, but, above all, by the electricity network operator (DEDDIE), which must, amongst other things, ensure the adequacy and stability of the distribution network based on the estimated electricity demand of EV users. Connecting publicly accessible recharging points to smart metering systems will also make it possible to provide services to EV users who have a contract with a different service provider than the one managing or owning a charging point without a connection, as it will be possible to send and process charging/energy consumption data.

It is not easy to estimate the number of recharging points, while the data that is provided here regarding changes over time tends to be based on estimates, which could not be documented. Estimates are primarily based on the progress made in the use of electricity as a fuel globally, mainly in developed countries[12].

Conversely, the potential impact on the electricity network from the expected rise in the use of electricity as a fuel in an area can be estimated with quite a high degree of accuracy, by formulating specific scenarios [31,32] and assumptions, such as the number of electric vehicles, the number of recharging points, the charging time, the technical specifications of the distribution network, daily fluctuations in electrical load, etc. The features of EV chargers for each charging level[32,33] are as follows:

- Residential charging – AC single-phase connection, 16A, with capacity of up to 3.6 kW.

- Slow residential or public charging – AC three-phase connection, 16A, with capacity of up to 6.0 kW.
- Slow public charging – AC single-phase/three-phase connection, 32A, with capacity from 7.4 to 12.0 kW.
- Fast or ultra-fast public charging – AC single-phase/three-phase connection, 32A to 250A, with a capacity from 22.0 to 95.0 kW.
- Ultra-fast public charging – DC 600V connection, 400A, with capacity of 240.0 kW.

Increased electric vehicle usage in an area within the mainland interconnected electricity network is expected to increase the grid's peak demand (medium or low voltage) due to vehicles being charged. That would mean[31,32]:

- a reduction in the distribution grid's minimum voltage and a rise in voltage fluctuations without, however, exceeding the regulatory voltage operating limits;
- an increased load on the grid's electricity lines;
- increased losses.

If tariffs based on two time-of-use periods are used, the synchronisation of charging times will be further enhanced, placing greater pressure on the grid. However, it is always possible to apply different charging strategies by setting various tariffs based on multiple time-of-use periods or by adopting controlled charging systems in order to flatten out dips in the load curve and level out load distribution[31,32]. A fully controlled electricity grid and actively engaged electric vehicle users, a two-way exchange of power between the network and electric vehicles could be established. In other words, electric vehicles would operate in a similar fashion to static batteries. The two-way flow of power would allow for auxiliary services to be provided to support network operations, such as limiting peak loads, improving network frequency, etc.[32] Likewise, on islands with stand-alone electricity networks, the expected rise in the grid's peak demand is expected to have a stronger impact in terms of the drop in minimum grid voltage and in terms of increased voltage fluctuation. This would mean that if electric vehicle charging is not controlled and tariffs based on two time-of-use periods are applied, the regulatory limits (3%) for voltage fluctuations would be exceeded, even if the penetration rate of electric vehicle recharging points was low. Synchronisation of charging times in this case would have a significant impact on voltage[32].

Taking into account the current situation in Greece with regard to the use of electricity as a fuel, i.e. 3,500 electric vehicles by 2020 (Table 2.1), and the fact that the initial cost of acquiring electric vehicles is still extremely high in Greece, it is estimated that the number of electric vehicle recharging points (both public and private) by 2020 will not exceed 2,000 (Table 2.2.). On the contrary, the figure for the estimated number of recharging points in 2025 is more optimistic, with the total number of public and private recharging points rising to 12,000. This increase is based on the potential pressure that the tourism industry is expected to exert, especially on the mainland electricity grid. It is estimated that the majority of electric vehicle recharging points will be installed in urban and suburban areas and will initially offer slow charging (filling stations, public and private car parks, garages, etc.). It is expected that publicly accessible electric vehicle charging points along motorways will be developed at a later stage since they primarily require fast charging infrastructure and an extension of the electricity supply networks. It is estimated that by 2030 there will be over 25,000 electric vehicle charging points, the majority of which will be private, e.g. residential[10-11,32].

Floating craft charging points

Article 4(5) of Law 4439/2016 contains a provision for shore-side electricity supply for ships (boats, vessels, etc.) berthed at ports, which must be assessed first and foremost for ports in the TEN-T core network as well as other ports (maritime and inland waterway ports) by 31 December 2025. A key condition is that there must be demand and the costs must not be disproportionate to the benefits, including environmental benefits. Likewise, Article 4(6) of Law 4439/2016 states that shore-side electricity supply installations for maritime transport, constructed or renewed as of 18 November 2017 onwards, must comply with the technical specifications set out in point 1.7 of Annex II of that Law.

The provisions of Law 4439/2016 primarily relate to facilities and infrastructure for the supply of electricity to berthed ships (cold ironing), with particular emphasis on cruise liners and large recreational craft, in order to ensure that, while they are in port, they do not operate their own generators. However, it is always possible to develop facilities and infrastructure to supply electricity to ships (electric bunkering) at crossings, ports and short-sea connections and to vessels that support port operations (such as tugboats)[34-36]. Greece is the ideal location for deploying this technology given that it forms an archipelago, has a large number of areas with short or medium-distance sea connections and available renewables that could be utilised to generate power locally[34,37-39]. In this context, support for investments in renewables and the promotion of self-generated electricity produced using photovoltaic facilities or wind turbines, available free space permitting, would help promote electricity supply to ships. Moreover, the possibility for ships to participate in the electricity market (via energy suppliers) and for storage units to be installed are further contributions to that endeavour.

Shore-side electricity supply at maritime ports, both on the TEN-T core network and outside of it, is expected to be deployed in Greece in the coming years, with the port of Piraeus being the number one priority given its high levels of vessel traffic. Amongst other things, the Port of Piraeus welcomes a large number of cruise liners and other passenger and vehicle ferries, which remain berthed for several hours in some cases, burning conventional fuels and emitting large quantities of polluting gases. At present, the competent authorities are assessing the necessity for such an investment, along with all factors relevant to its viability[35]. As part of this endeavour, a proposal on electricity supply at the port of Piraeus has been submitted as part of the 2014–2020[40] 'Competitiveness, Entrepreneurship and Innovation' Operational Programme (EPAnEK), in order to conduct a feasibility study into the investment.

Also, as part of the pilot rollout of the ELEMED programme[34], the port of Kyllini will be equipped to supply electricity with four power supply points that have a total output of 500 kW (Table 2.2).

Recreational craft charging points

It is estimated that, in Greece, there are currently 72 tourist ports (marinas, harbours/anchorages for tourist vessels and hotel docking facilities) equipped with electricity outlets (electrical charging points) for tourist vessels, recreational craft, etc. at berth[20], as already stated above. However, the Ministry of Tourism has a detailed record of the number of tourist ports (153 in total) that have already been approved, and among the amenities on offer, they will also have electrical charging points for berthed tourist vessels. The estimated number of tourist ports, per category, where electrification will take place in the near future is as follows:

- 59 marinas

- 83 harbours/anchorages for tourist vessels
- 11 hotel docking facilities.

Note that the number of charging points depends on the number of berths for recreational craft etc., and depending on the size of the vessels to be accommodated, the technical characteristics will range from 16A/220 V (single-phase) up to 630A/380 V (three-phase) at each berth (in terms of electricity supplied).

Stationary airplane charging points

As stated above, fixed power supply points for **stationary airplanes** currently only exist at Athens International Airport (El. Venizelos) whereas other airports offer charging via mobile generators. The installation of new fixed charging points for stationary airplanes at airports, especially those with low levels of traffic (and increased traffic during the summer) is a solution that is not economically viable, primarily due to the high initial installation costs. However, the possibility of a pilot deployment will be explored in order for the Hellenic Civil Aviation Authority (YPA) to further evaluate the feasibility and viability of such charging points at specific airports.

It should also be noted that all infrastructure for the supply of alternative fuels to means of transport must, at the very least, meet the technical specifications in the Annexes and the regulatory provisions laid down in Directive 2014/94/EU and in Annex II to Article 9 of Law 4439/2016. Where there are no existing specifications based on standards or other provisions for the infrastructure referred to in Annex II to Article 9 of Law 4439/2016, the technical specifications which will be issued by the EU in accordance with Directive 2014/94/EU will apply. In addition, specific terms, conditions and technical specifications regarding the infrastructure for various types of alternative fuels apply or will apply. These will be set out in specific applicable provisions or they will be established by issuing the ministerial decisions required under Law 4439/2016.

Table 2.2: Estimated number of electrical charging/recharging points[10,11,23,34,39]

ELECTRICITY	Electricity supply points		
	2020	2025	2030
Charging points (public)	2,000	4,000	25,000
Charging points (private)		8,000	
Infrastructure for shore-side electricity supply at maritime and inland ports (terminals)	7	27	42
Infrastructure for shore-side electricity supply at marinas and other tourist ports	72 tourist ports	225 tourist ports	N/A
Infrastructure for charging stationary airplanes	N/A	N/A	N/A

2.4. NATURAL GAS

Article 6 of Law 4439/2016 (Article 6 of Directive 2014/94/EU) on 'Natural gas supply for transport', lays down the obligations and rules for deploying infrastructure for natural gas (CNG and LNG) supply to both motor vehicles (heavy-duty professional vehicles, tanker trucks, etc.) and floating craft. This National Framework refers to the potential for developing new and extending existing natural gas supply infrastructure in order to enable the loading of the various vehicles for the transportation of gas in Greece. It also outlines the schedule for completing the required institutional framework on the deployment of natural gas supply infrastructure, such as the licensing of facilities, technical operating specifications, tariffs, etc.

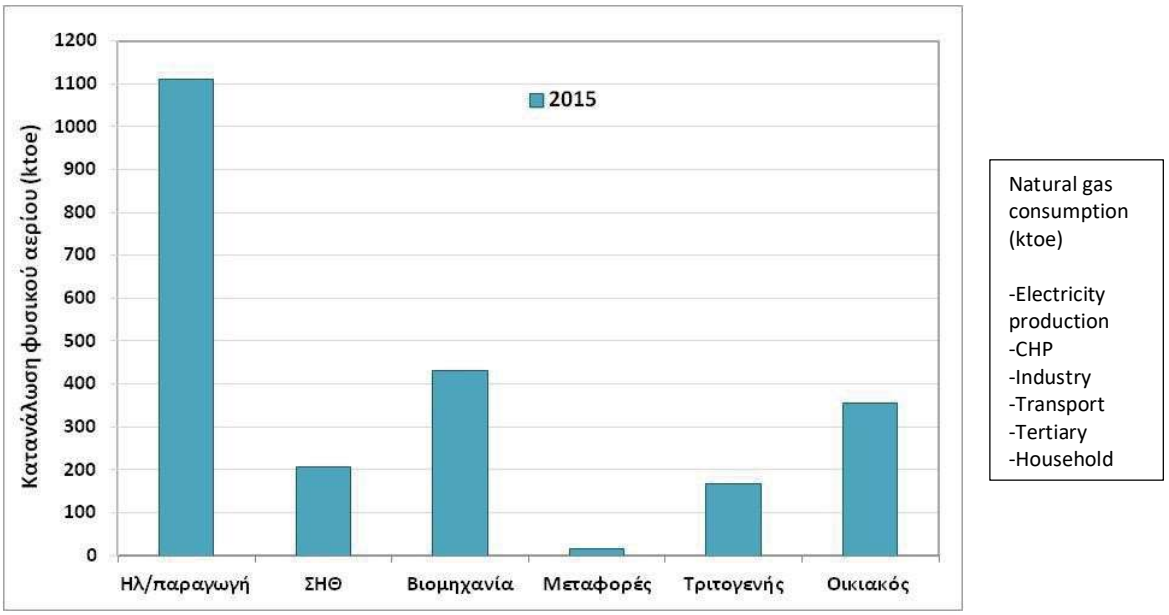


Figure 2.6: Natural gas consumption in Greece per end use (ktoe)[3,4]

Firstly, certain data about the current state of the National Natural Gas System (ESFA) in Greece needs to be provided. This data will be taken into account when deploying natural gas refuelling infrastructure for means of transport. The following points apply with regard to the natural gas system in Greece[42]:

- the National Natural Gas Transmission Network covers the majority of the eastern mainland section of Greece, from Eastern and Central Macedonia to the Prefecture of Attica and from Attica to Megalopolis. Western mainland Greece does not currently have a transmission network to supply natural gas to large and/or small consumers. However, DESFA[42] has registered the interest of large consumers (industries etc.) primarily for the supply of natural gas to areas of Western mainland Greece[42];
- as part of the ESFA development project, there are already plans to construct a high pressure pipeline which will connect the Komotini metering station with Thesprotia[42];

- to upgrade the ESFA, projects have been planned for the coming years to improve the network and its connections, for example, extending the distribution and transmission networks, installing new metering stations and improving existing ones, etc. These projects include the Nea Mesimvria metering/regulation station that will connect the Greek Natural Gas Transmission System (ESMFA) to the Trans Adriatic Pipeline (TAP), which will connect Greece to Italy via Albania;
- to meet demand for natural gas in areas without a transmission network, such as Western Greece, there are plans to transport LNG to large consumers, using truck loading. These consumers will then turn the natural gas back into its gaseous form at their own facilities. The 2016–2025 National Development Programme for the ESFA refers to the preparation of a basic plan to create the first LNG tank truck refuelling station at the facilities on Revythousa island;
- all natural gas is imported and is not a domestically generated energy source. In 2015 (Figure 2.6), 50% of natural gas imported to Greece was used in electric power generation and combined heat and power generation (CHP), 13.3% in the household sector, 6.2% in the tertiary sector, and just 0.6% was used directly in the transport sector, mainly by public transport.

Refuelling vehicles with natural gas

According to Article 6 of Law 4439/2016, taking into account current market needs, the potential for supplying means of transport with CNG and LNG must be assessed.

Paragraph 4(a) of that Article states that an appropriate number of public LNG refuelling points, at least along the existing TEN-T core network, must be available by 31 December 2025 in order to ensure that LNG heavy-duty motor vehicles can circulate on that network. Key conditions for the development of LNG supply infrastructure are demand and costs not being disproportionate to the benefits, including energy-related and environmental benefits. LNG infrastructure also includes facilities for loading trucks that supply LNG refuelling points.

In Greece, LNG is not used by heavy-duty vehicles and demand is not expected to change immediately, until a comprehensive LNG supply network is in place. The option of transporting LNG to all Greek regions presupposes the development of infrastructure to store LNG under suitable conditions. As already mentioned, DESFA's future plans include pilot projects to transport LNG using tank trucks, so that it can go on to be gasified and used as needed. By developing a comprehensive LNG transport and storage network, it appears that, over time, there will be potential for supplying LNG to a large number of Greek regions.

As part of that endeavour, partnerships can be formed with neighbouring Member States on an ad hoc basis to implement this requirement, in order to bolster the network of LNG refuelling points across the entire TEN-T network.

As for the supply of CNG to vehicles, Article 6(4) of Law 4439/2016 states that an appropriate number of public CNG refuelling points must be put in place:

- by 31 December 2020, so that CNG motor vehicles can circulate in urban/suburban agglomerations and other densely populated areas, and

- by 31 December 2025, at least along the existing TEN-T core network, to ensure that CNG heavy-duty motor vehicles can circulate on it.

Note that CNG refuelling points for motor vehicles developed or renewed as of 18 November 2017 onwards must comply with the technical specifications set out in Annex II, point 3.4 of Article 9 of Law 4439/2016.

In Greece, a small number of vehicles use only CNG as a fuel, out of which 463 are passenger vehicles, 127 are trucks and 310 are buses. Demand for natural gas is gradually rising but very slowly, and, in that context, a gradual increase in new CNG supply infrastructure is expected in the years to come, reaching 25 public and private supply points in 2020, 41 in 2025 and 65 in 2030 (Table 2.3)[5,22,42,43]. The CNG infrastructure development scenarios are conservative since a comprehensive natural gas transmission and distribution network requires time both to design and plan, as well as to build and put into operation. The outlook for LNG supply infrastructure is even more negative, with no rapid and immediate development expected.

As for the estimated number of CNG vehicle refuelling points, DEPA is conducting studies to investigate various scenarios and forecast expected demand, taking into account current conditions and needs, and also the potential for new technologies in CNG vehicles to be subsidised[44]. In that context, it has already implemented direct financial aid programmes, subsidising the initial cost of converting engines or purchasing natural gas engines.

To support the deployment of natural gas infrastructure for vehicles, Article 10 of Law 4439/2016 contains enabling provisions that allow a regulatory framework to be issued in the form of a joint ministerial decision, with regard to the on the installation of CNG and LNG supply pumps at existing fuel and energy supply stations or at stations that are in the process of being licensed. Article 12 of that law also contains enabling provisions that allow a regulatory framework to be issued in the form of a joint ministerial decision on for relevant infrastructure (garages) for the repair and maintenance of LNG-powered vehicles and the corresponding certification of the technicians responsible for those garages.

Refuelling floating craft with natural gas

Article 6(1) and (2) of Law 4439/2016 states that an appropriate number of LNG refuelling points must be available throughout the existing TEN-T core network:

- by 31 December 2025 at seaports, to enable LNG inland waterway vessels (ships, vessels, etc.) or seagoing ships to circulate;
- by 31 December 2030 at inland ports (on lagoons, rivers, etc.), to enable LNG-powered inland waterway vessels (ships, vessels, etc.) or seagoing ships to circulate.

In providing access to LNG refuelling points at the ports referred to above, account must also be taken of current market needs. Where necessary, there should be cooperation with neighbouring Member States to ensure adequate coverage of the TEN-T core network.

So far, LNG is not used by inland waterway ships carrying goods or passengers. Supplying LNG to maritime ports presupposes the existence of LNG storage facilities. In particular, Greece’s island geography and low traffic at ports are factors that hinder the development of economically viable storage infrastructure for

LNG at island ports, even if they are part of the TEN-T core network, such as the port of Heraklion on Crete. The potential for developing LNG storage infrastructure at island ports is being examined in conjunction with the parallel supply of CNG for use in both stand-alone electric power units and small and/or large consumers on islands.

Of the existing Greek ports in the TEN-T core network, according to DEPA data, only the Port of Piraeus has the potential to directly procure LNG from the Revythousa station, using suitably designed supply ships. However, DEPA is already assessing the potential for developing LNG facilities at ports in Western Greece and, in particular, for developing LNG facilities at the ports of Patras and Igoumenitsa (Table 2.3), as well as in the rest of Greece, for example at the ports of Thessaloniki and Heraklion in Crete. Such plans initially presuppose that a new institutional framework is put in place for LNG storage and distribution facilities, in order to lay down the rules and safety standards required when operating the facilities, and issues of tariff policy for operators who enter the LNG market. One factor hindering the safe operation of such facilities at ports, even those in the TEN-T core network, is the fact that they are located next to populated areas, and that the ports are busy areas with high visitor rates.

To support the installation of natural gas infrastructure (LNG) at ports, Article 11 of Law 4439/2016 contains enabling provisions that allow a regulatory framework to be issued in the form of a joint ministerial decision, with regard to the installation of LNG supply pumps within port zones and at tourist ports (marinas), to be made available exclusively to floating craft (ships and vessels).

Table 2.3: Estimated number of natural gas refuelling points[19,22,42]

NATURAL GAS	Refuelling points		
	2020	2025	2030
CNG refuelling points (public)	22	35	55
CNG refuelling points (private)	N/A	N/A	N/A
LNG refuelling points for heavy-duty motor vehicles (public)	1	2	4
LNG refuelling points for heavy-duty motor vehicles (private)	N/A	N/A	N/A
LNG refuelling points at maritime ports	1	2	4
LNG refuelling points at inland waterway ports	N/A	N/A	N/A

2.5. HYDROGEN

Article 5 of Law 4439/2016 (Article 5 of Directive 2014/94/EC) allows for the establishment of hydrogen refuelling points that are accessible to the public. In this case, an appropriate number of such points must be available by 31 December 2025, to ensure the circulation of hydrogen-powered motor vehicles, including fuel cell vehicles, within pre-determined networks, including, where appropriate, cross-border links. Publicly accessible hydrogen refuelling points that are deployed or renewed from 18 November 2017 onwards must comply with the technical specifications set out in point 2 of Annex II of the Law.

In Greece, at present, the conditions for deploying hydrogen infrastructure do not exist, since it is a fuel that is not yet available on the market. For this reason, the present National Policy Framework does not examine the potential for using hydrogen in the transport sector.

Nonetheless, if in the future it is decided to make hydrogen available on the market and deploy the supply infrastructure needed, Article 10 of Law 4439/2016 contains enabling provisions that allow a regulatory framework to be issued in the form of a joint ministerial decision, with regard to the installation of refuelling points to supply not just hydrogen but also other alternative fuels, as defined in Directive 2014/94/EU, at existing fuel and energy supply stations or those in the process of being licensed. Article 12 of Law 4439/2016 also contains enabling provisions that allow a regulatory framework to be issued in the form of a joint ministerial decision, with regard to infrastructure (garages) for the repair and maintenance of vehicles powered by the alternative fuels referred to in Directive 2014/94/EU and the corresponding certification of the technicians responsible for those garages.

Table 2.4: Estimated number of hydrogen refuelling points

HYDROGEN	Refuelling points		
	2020	2025	2030
Refuelling points	N/A	N/A	N/A

2.6. OTHER ALTERNATIVE FUELS

According to the provisions in force, the following apply to other alternative fuels:

- Biofuels: The existing strategy in the biofuels sector does not include obligations or incentives to market neat biofuels to end consumers, for use in the transport sector. Biofuels are sold mixed with refined petroleum products from existing infrastructure for the sale of refined products.
- Synthetic and paraffinic fuels: The existing strategy does not include obligations or incentives to promote the sale of synthetic and paraffinic fuels for use in the transport sector by end consumers. These fuels, mixed with refined petroleum products can be sold from existing infrastructure for the sale of refined products.

However, with a view to supporting the deployment of infrastructure for the sale of other alternative fuels, Article 10 of Law 4439/2016 contains enabling provisions that allow a regulatory framework to be issued in the form of a joint ministerial decision, with regard to the installation of refuelling points to supply not just hydrogen but also other alternative fuels, as defined in Directive 2014/94/EU, at existing fuel and energy supply stations or those in the process of being licensed. Article 12 of Law 4439/2016 also contains enabling provisions that allow a regulatory framework to be issued in the form of a joint ministerial decision, with regard to infrastructure (garages) for the repair and maintenance of vehicles powered by the alternative fuels referred to in Directive 2014/94/EU and the corresponding certification of the technicians responsible for those garages.

Given the enactment of fast-track, simplified licensing procedures for fuel and energy supply stations, contained in Chapter II of Law 4439/2016, it is estimated that the number of stations which will sell LPG will double to 1 500 over the next decade compared to the 800 currently in operation.

Table 2.5: Estimated number of other alternative fuel refuelling points[5,43]

Other Alternative Fuels	Refuelling points		
	2020	2025	2030
LPG refuelling points (publicly accessible)	1,100	1,500	N/A
LPG refuelling points (private)	N/A	N/A	N/A
Biofuel refuelling points (public)	N/A	N/A	N/A
Biofuel refuelling points (private)	N/A	N/A	N/A
Synthetic and paraffinic fuel refuelling points (public)	N/A	N/A	N/A
Synthetic and paraffinic fuel refuelling points (private)	N/A	N/A	N/A

3 MEASURES NEEDED TO ENSURE THE ACHIEVEMENT OF NATIONAL OBJECTIVES AND TARGETS

The EU's legislative proposals on sharing the effort to reduce GHG emissions among sectors not included in the EU Emissions Trading System (construction, agriculture, waste management and transport) set national targets for every Member State for the period 2021-2030. The target is a 16% reduction for Greece. As for other energy targets, by 2020, Greece must achieve a 24.7 Mtoe reduction in primary energy consumption and 18.4 Mtoe in end consumption. In addition, by 2020, 18% of energy must come from renewables. For **transport** in particular, each Member State must ensure that the share of energy from renewables in all forms of transport accounts for a least 10% of end consumption of energy in the transport sector by 2020.

3.1 LEGAL MEASURES

Infrastructure for alternative fuels in Greece is limited in the case of certain fuels, such as natural gas and electricity, whereas for other fuels, like LPG, the number of stations is considered satisfactory given current demand. The limited amount of infrastructure for certain types of alternative fuels inhibits their use by large and small consumers. The enactment of Directive 2014/94/EU lays down specific obligations on EU Member States, based on economic and market conditions, for the deployment of appropriate infrastructure for the use of alternative fuels in the transport sector, for vehicles, and floating craft.

In Greece, the existing institutional framework, which, amongst other things, relates to the deployment of infrastructure for the use of certain alternative fuels, covers the technical aspects required for installing and safely operating such infrastructure. Annex A presents a comprehensive picture of the current institutional framework in Greece on alternative fuel infrastructure as well as the institutional framework that needs to be introduced under enabling provisions in order to cover the statutory lacunae for certain alternative fuels specified in Law 4439/2016 and achieve national targets.

3.1.1 Measures for charging infrastructure

The measures that need to be taken immediately to support and promote the electric vehicle market in Greece are as follows[5,9,43]:

- reform of the institutional framework required to create charging infrastructure in accordance with Law 4439/2016 which transposed Directive 2014/94/EU of the European Parliament and of the Council into Greek law;
- reform of the institutional framework on the operation of electric vehicle charging infrastructure operators;
- provision for the use of electric vehicle chargers in newly constructed or radically refurbished buildings, along the lines of Directive 31/2010 (recast);
- transposition and implementation in Greece of the European Directives currently being issued regarding CO_2 emission standards and clean energy for transport etc.

In addition, certain measures that could support and promote the electric vehicle market in Greece are also being considered. These include[5,9,43]:

- putting in place an institutional framework to finance research projects and programmes on electric mobility, along the lines, for example, of the public-private partnership of the European Green Vehicles Initiative Association (EGVIA);
- direct or indirect financial incentives, such as tax breaks on electric vehicles and other 'clean' vehicles and on charging infrastructure;
- favourable provisions for the parking of electric vehicles or the use of bus/taxi lanes and/or financing of charging infrastructure.

As far as the use of electricity on **berthed ships** is concerned, the implementation of measures arising from European legislation, such as the ones below, is being examined and taken into account:

- Directive 2005/33/EC, which states that, while berthed, ships can make use of shore-side electricity to meet their energy needs instead of using low sulphur fuels;
- adoption of the proposal contained in the European Commission document entitled Communication from the Commission COM(10.10.2007) 575, to reduce the levels of air pollution from ships in ports by applying tax breaks for ships that use shore-side electricity supply;
- regulation and dissemination of the institutional framework on the development of charging infrastructure for berthed ships in accordance with Law 4439/2016 which transposed Directive 2014/94/EU into Greek law.

Note that the supply of electricity to berthed ships from the shore-side electricity network limits pollutant gas emissions and noise in the port area, thereby improving the immediate environment and the quality of life in the wider area. To that end, the potential for introducing a maritime electricity category will be examined, along with the relevant tax breaks under the provisions that apply to other maritime fuels too.

As far as **rail transport** and guided transport systems (metro and tram) are concerned, the use of electricity is a reality and is constantly on the rise. However, the potential for saving energy while carriages are in motion, through the use of aerodynamic structures, of special highly efficient electric motors or of hybrid engines that use diesel or other alternative fuels, is being comprehensibly explored.

With the planning phase complete, the extension to the Athens metro is expected to go ahead in the coming years, as is the completion of the Thessaloniki metro and the Piraeus tram systems. Construction of this infrastructure is expected to decongest the road network in the two prefectures (Attica and Thessaloniki) with the anticipated environmental and energy benefits that this will bring about. In addition, the extension to the suburban railway from Kiato to Patras is underway and plans are being made for the future extension of the suburban railway into other areas of Attica, such as Lavrio and Rafina.

The completion of these projects, coupled with the transport speed that will be achieved, is expected to bring about major changes in passenger and freight movements, so that Greece will gradually start to attain the average European usage rates for guided transport systems; the guided transport usage rate is currently significantly lower than that of other means of transport.

In that way, the change in means of transport (namely, the use of guided transport systems) by individuals who were used to getting around in cars without any passengers, will have major energy and environmental benefits.

3.1.2 Measures for natural gas infrastructure

Regulatory provisions entitled 'Technical regulations for CNG decompression facilities and auxiliary facilities' are in the final phase of being issued. They regulate the issue of how natural gas can be supplied to customers outside the transmission network, thereby extending the business operations of companies that trade in or use natural gas. In doing this, regions of Greece where development was not previously possible because of their great distance from the transmission network, can now develop, thereby providing the necessary backdrop for the growth of sound business.

To support and encourage the natural gas market in Greece, certain measures are being examined, as well as the possibility of issuing the relevant regulatory provisions. For **LNG**, specifically, those measures include[22, 41-44]:

- drafting port regulations on LNG refuelling operations for ships;
- enacting a framework that certifies LNG as a maritime fuel when supplied to ships;
- supplementing the institutional framework on activities relating to LNG refuelling for ships;
- enacting provisions on safety, proper operation and maintenance when LNG is being loaded from the LNG facility onto special tank trucks (to be transported by road), and on safe unloading at the end customer's LNG facilities etc.;
- enacting provisions on the construction, safe operation and maintenance of fuel and energy supply stations for the unloading of LNG at fuel stations for it to be supplied to vehicles;
- exploring the possibility of incentivising the use of LNG as a fuel for ships, for example through tax breaks (such as excise duty, as is the case with oil – see Law 2960/2001 on the National Customs Code).

Likewise, for **CNG** those measures include amongst other things[22, 41-44]:

- supplementing the regulatory framework on issues relevant to CNG;
- enacting or supplementing existing provisions on the construction, safe operation and maintenance of fuel and energy supply stations for the unloading of CNG at fuel stations for it to be supplied to vehicles;
- enacting provisions for tank truck supply facilities, to enable CNG to be supplied to small and large industries and warehouses.

3.1.3 Measures for biofuel infrastructure

In Greece, there is a certain (albeit limited) potential for biofuel gases to be produced and used in the transport sector, primarily by utilising agricultural and livestock farming waste for energy. So far, the use of biofuels in the transport sector has involved blending a certain proportion of biofuel with diesel. The prerequisites for planning and implementing new biogas production projects in Greece are[9,43]:

- reform of the institutional framework with a view to promoting the use of biomass and biogas, along the lines of the recommendation expected from the Working Group on reform of the

institutional framework on power generation from biomass and biogas of the Ministry of the Environment and Energy;

- drafting of technical regulations;
- reform of the institutional framework on the sale of biofuels;
- full implementation of the environmental legislation on waste;
- informing citizens about the environmental benefits of using such fuels.

3.2 POLICY MEASURES AND INVESTMENTS

The main relevant measures that could be adopted to promote the innovative, environmentally friendly technologies, which Directive 2014/94/EU introduces for the transport sector, can be divided into establishing investment and/or research programmes for the use and construction of alternative fuel vehicles and supply facilities, and financial incentives (whether direct or indirect) for the introduction and manufacture of alternative fuel vehicles, and the purchase of such vehicles by potential users.

Activities associated with alternative fuel infrastructure are subject to competition and require major investments, with the standard risks an economic investment entails. It is considered essential to explore alternative funding options for such investments through European or national funding.

Electricity: The use of electricity as a fuel is currently at embryonic stage, but there are prospects for growth, therefore the gradual introduction of electricity as a fuel should be examined[6]:

- for professional diesel-powered vehicles (taxis, buses/coaches, distribution companies, etc.);
- by imposing an annual environmental fee for daily access to the restricted traffic zone;
- by offering subsidies to purchase electric/plug-in hybrid taxis;
- by designating exclusive parking spaces with fast chargers for plug-in hybrid taxis.

In any event, the need to ***develop*** the electric vehicle market and vehicle charging points as part of an integrated regulatory framework has been noted. This framework must define a model for promoting/deploying charging points. The market model for comprehensive charging infrastructure (the Distribution System Operator (DSO) model) is mentioned by way of example. It has been chosen in other countries where the market is small and individuals have no particular interest in taking the initiative on their own. The network operator develops and runs a network of publicly accessible electric vehicle charging points, as an extension of the regulated service they provide. These points are owned by the distribution network and costs are covered on a regulated asset basis.

Alternatively, it is possible to adopt an independent market model for electric vehicle infrastructure, where public charging points are developed without the collaboration of the distribution system operator and the construction, ownership and management of charging points from a purely competitive business.

It is considered that the DSO model could be successfully deployed in Greece, since electrification is not yet developed. Publicly accessible charging infrastructure can be developed independently of the entry of electric vehicles onto the market and implemented in partnership with the current operator of the Greek distribution network DEDDIE[31,32,48]. DEDDIE has a prepared plan for the deployment of electricity as a fuel on the islands. In this context, the construction of 100-150 charging points for electric

vehicles will be promoted. That initial infrastructure will act as an incentive, attracting similar private investments.

In any event, the choice of model must take into account the Directive on the electricity market, which is being recast (COM(2016) 864 final).

Natural gas: The policy intentions when it comes to natural gas are as follows:

- to expand the natural gas distribution network to other areas in Attica and Thessaloniki and areas in the rest of Greece (towns in Sterea Ellada [Central Greece], Central Macedonia, Eastern Macedonia – Thrace and the rest of Greece);
- to promote the use of CNG. Infrastructure is already under development in Corinth, Lamia, Megalopolis and Alexandroupoli;
- to promote the use of LNG in maritime and land transport.

As part of the 2014-2020 programming period, the following projects are being promoted through the NSRF, to incentivise the use of natural gas. These projects will indirectly help increase the penetration of natural gas as an alternative fuel:

A. Construction of the LNG tank truck loading station at the LNG Station of Revythousa: The project entails the design and development of LNG tank truck transhipment facilities at the Revythousa facility. The loading station will consist of a 100m^3/hour supply point. The project will commence in 2018 and will be completed in 2019. The total budget is €5.3 million, of which €3.05 million is public expenditure.

B. Development of CNG distribution infrastructure nationwide: The project entails developing CNG distribution infrastructure in the areas of Corinth, Lamia, Plati, Komotini – Alexandroupoli and Megalopolis in order to supply remote consumers (industries, retail consumers, CNG filling stations) and distribution networks. The project will commence in 2018 and will be completed by the end of 2020. The total budget is €32.7 million, of which €10.00 million is public expenditure.

C. Development of distribution networks in the regions of Eastern Macedonia – Thrace, Central Macedonia and Sterea Ellada: Projects to develop and extend a natural gas distribution network in the regions of Eastern Macedonia – Thrace, Central Macedonia and Sterea Ellada are being funded under Regional Operational Programmes (ROP). The project is being implemented by the Gas Distribution Company for the Rest of Greece S.A. (DEDA) and involves the following:

- in the Eastern Macedonia – Thrace Region, there are plans to build 489.5 km of network and 9 metering / regulation stations in Komotini, Alexandroupoli, Drama, Xanthi, Kavala and Orestiada. The total budget is €64.73 million, of which €32.00 million is public expenditure;
- in the Central Macedonia Region, the plan is to build 333 km of network and 7 metering/regulation stations at Kilkis, Katerini, Serres, Veroia, Giannitsa and Alexandria. Funding will also be provided for a project to extend the distribution network by 267.5 km in the Thessaloniki region in 12 Municipalities and 7 new areas that currently have no network, as explained in the next paragraph. The total budget is €43.3 million, of which €21.21 million is public expenditure;
- in the Sterea Ellada Region, there are plans to build 305 km of network and 6 metering/regulation stations at Lamia, Chalkida, Thiva, Livadia, Amfissa and Karpenisi. The projects are expected to commence in 2018 and will be completed by the end of 2023. The total budget is €44.33 million, of which €21.22 million is public expenditure.

D. Extension of natural gas distribution infrastructure in Thessaloniki: The aim of the project is to extend the natural gas distribution network in the wider area of the Prefecture of Thessaloniki to 12 municipalities where there is an existing network (Thessaloniki, Ampelokipi–Menemeni, Delta, Thermaïkos, Thermi, Kalamaria, Kordelio–Evosmos, Neapoli–Sykees, Pavlos Melas, Pylaia–Chortiatis, Chalkidona, Oraiokastro) and 7 new areas where there is no existing network (Langadas, Chalastra, Trilofos–Plagiari/Municipality of Thermi, Filyro/Municipality of Pylaia–Chortiatis, Vasilika/Municipality of Thermi, Michaniona–Epanomi/Municipality of Thermaïkos, Koufalia/Municipality of Chalkidona). In total, 267.5 km of network will be built. The total budget is €41.82 million, of which €15.23 million is public expenditure, and will be implemented by the Thessaloniki Gas Supply Company.

Moreover, DEPA included the project entitled 'Study on a pilot CNG fuelling Station network across the Greek part of the Orient East Mediterranean Road Corridor' in the Connecting Europe Facility (CEF). This involves a study and pilot measures to deploy 13 CNG supply stations at 10 existing filling stations along the length of the core road network. These 10 filling stations are distributed throughout the road network, at Larissa, Thiva, Alexandroupoli, Igoumenitsa, Patras, Kozani, Kiato, Ioannina, Xanthi and Serres. The CNG refuelling points will be built at existing filling stations by extending the scope of their current licence. The project budget will total €9.088.300, of which 50%, or €4,544,150, will be covered by the CEF and the remaining 50% by private resources.

The European Commission has developed certain financing instruments, including the Connecting Europe Facility – CEF[46] for the TEN-T networks, which can be utilised to provide funding for such activities. The CEF finances projects that supplement incomplete connections in core infrastructure in the fields of energy, transport, and digital infrastructure in Europe. The CEF's objective is also to ensure the sustainable nature of the European economy by promoting cleaner means of transport and high speed broadband connections and by making it easier to use renewables in line with the Europe 2020 strategy. For the transport sector in particular, it seeks to improve European infrastructure at a European-wide level, build missing links and remove bottlenecks (http://lr-coordination.eu/el/cef). The CEF focuses on less polluting means of transport and seeks to make the transport system more sustainable, offering consumers a wider choice of transport modes. Note that, as part of the CEF, the POSEIDON MED (II) and ELEMED programmes have also been developed. These are presented in another section further on[34,47].

3.2.1 Support for development and construction

The penetration of alternative fuels in the market is the only way to go, since vehicle technology globally is heading towards highly energy-efficient vehicles with a low environmental footprint. To develop and build alternative fuel infrastructure for use in the transport sector (vehicles, floating craft), it is essential to properly plan and programme support measures, such as subsidised investment plans, through the appropriate financing instruments and implementing measures. In any event, the viability of the investments must be examined, while also taking account of the socio-economic criteria and current market needs.

In Greece, in particular, when it comes to the alternative fuel infrastructure sector, especially natural gas and charging, measures need to be designed and examined in order to assess their viability for the development of suitable infrastructure and for promoting vehicles that use alternative fuels such as[22,31-32, 41-42, 48].

- providing incentives to purchase vehicles that use alternative fuels, CNG/LNG/electricity and to develop infrastructure for making them available;
- adopting financial incentives (whether direct or indirect) to promote means of transport that use alternative fuels and to develop infrastructure for making such fuels available;
- using demand-side non-financial incentives: parking policies, especially in densely-populated areas, special traffic lanes, etc.;
- using public contracts to support alternative fuels;
- implementing Green Public Procurement;
- launching Green Public Tender procedures for public transport (to procure electric or natural gas buses, for example);
- implementing programmes to financially support research and technological development for means of transport (road, sea, etc.) which utilise alternative fuels;
- adopting appropriate flexible charging strategies to cope with the increase in variable load[31,32], which is expected to arise from the development of electricity as a fuel;
- forecasting electric vehicle penetration and the need to upgrade the electrify network's capacity;
- providing for investments to upgrade the electricity network, based on a comprehensive design and deployment plan from stakeholders.

At present, the use of investment programmes to support and develop alternative fuel infrastructure is under study. As already indicated, the Ministry of Infrastructure and Transport is holding negotiations with the European Commission's DG Move and the European Investment Bank for similar financing under the Commission's Clean Transport package in order to renew the fleet of urban buses to a considerable degree, for urban transport in Athens and Thessaloniki as well as in other urban areas in Greece (where urban bus companies operate), using technologies that employ alternative fuels, especially natural gas and electricity.

Table 3.1: Investment plan to develop and support construction

		Total expenditure					
Name of Investment Plan	**Brief Description**	**2015**	**2016**	**….**	**....**	**…..**	**……**
N/A		N/A	N/A				

3.2.2 Research, technological development and demonstration (RTD&D)

Electricity: The level of know-how among Greek educational and research institutions, on electric vehicles and biofuels, is particularly high. The active participation of such bodies in national and European subsidised research programmes has made a substantial contribution to technological development in that sector. Some of those programmes are[7]:

- the Green eMotion project: 15 charging points in Kozani and Athens, and leasing of 15 electric vehicles;
- the KRIPIS project run by I.MET/CERTH: 3 charging points at CERTH's facilities and 2 electric vehicles;

- the CityMobil 2 project, in the context of which, the city of Trikala participated in the pilot testing of 6 self-driving electric buses by Robosoft. The buses were used for urban transport in the city centre. They can hold 10 people and move at a speed of 20 km/hour.

In terms of shore-side electricity supply to ships, the **ELEMED project** [34] (Table 3.2), financed by CEF-Transport and implemented with the involvement of companies from Greece, Cyprus and Slovenia, is part of an international project to implement environmentally-friendly maritime transport in the Adriatic and Ionian Seas. The project runs from 1 April 2016 to 31 March 2018. It promotes shore-side electricity supply based on propulsion systems for boats and seeks to achieve high levels of environmental efficiency in shipping.

Table 3.2: Investment plan for research, technological development and demonstration[19.41]

Name of Investment Plan	Brief Description	2015	2016	2018	2020
POSEIDON MED II	The project aims to take all measures needed in order for LNG to be adopted as a marine fuel in the Eastern Mediterranean, thereby making Greece an international hub for the bunkering and distribution of LNG in Southeast Europe.	€33.4 million			
ELEMED	The project involves the introduction of shore-side electricity supply to the Eastern Mediterranean corridor (using cold ironing and electricity as an alternative solution for propulsion in short-sea connections). The project seeks to prepare technical studies and plans concerning infrastructure for cold ironing and for the supply of electricity to ships to power and fuel them. The purpose of the project is also to analyse the regulatory framework, to prepare a model-based financial analysis and to build facilities to supply electricity to ships at the port of Kyllini on a pilot basis.	€860,000, EU funding (with a budget of €1.3 million eligible expenditure for Greece).			

Natural Gas: In the natural gas sector, the **Poseidon Med II**[47] project (Table 3.2) is the roadmap for the wider adoption of LNG as a safe, environmentally-friendly and sustainable alternative fuel in shipping, driving maritime transport in the Eastern Mediterranean towards a greener future. Co-financed by the European Union and implemented by three countries (Greece, Italy and Cyprus) the project involves six European ports (Piraeus, Patras, Heraklion, Igoumenitsa, Limassol and Venice) and the LNG terminal station on Revythousa. Leading experts from the fields of shipping, energy and finance are working together on the project in order to design an integrated, efficient LNG supply chain (http://www.depa.gr/content/article/002005009/1891.html).

Biofuels: The prospects for biodiesel depend on the production of second-generation biofuels. Those biofuels come from agricultural and forest waste and spent oils, which are not competitive in the food chain. However, their production cost is high and that makes them non-viable at present. In this context, it is necessary to examine the adoption of appropriate

incentives by the state for the production of biofuels, including investments in R&D into innovative methods.

Hydrogen: As for the production of hydrogen from RES, Greece is performing particularly well in terms of scientific and research investigation, with many Greek research bodies playing a leading role in relevant European research endeavours. Support from the state is considered vital as is utilisation of the research personnel and existing innovative prototype devices for producing hydrogen in order to create exportable innovative hydrogen production techniques that utilise Greece's high-potential RES[9].

3.3 COOPERATION WITH NEIGHBOURING MEMBER STATES

For Greece, cooperation with neighbouring states is limited so far to transnational partnerships in the context of co-financed actions such as the CEF and INTERREG. Such actions seek to facilitate coordinated strategic responses to common challenges, such as transport.

However, in the context of implementing Law 4439/2016 on the deployment of alternative fuel infrastructure on the TEN-T core network, all future partnerships with neighbouring states will be examined.

4 MEASURES TO SUPPORT THE CREATION OF PRIVATE ALTERNATIVE FUEL INFRASTRUCTURE

4.1 LEGAL MEASURES

Private infrastructure for alternative fuels pertains to worksites, businesses, private buildings, etc. Law 4439/2016 already contains a provision on private infrastructure for alternative fuels and provisions for laying down terms and conditions on their operation. Specifically, for vehicle charging points at private or public buildings (residential or tertiary sector), there is a provision in Directive 31/2010/EU on the energy performance of buildings, which is being recast, to install charging points at parking spaces in new or radically refurbished buildings. After the recast directive enters into force, during the harmonisation process, the potential for providing incentives for charging points in buildings will be examined. In general, it is considered that the construction of infrastructure for alternative fuel vehicles in new (private) building projects is less expensive than the construction of new public charging points in existing buildings.

Moreover, in densely populated areas with limited private parking space, local authorities may set targets for the development of alternative fuel infrastructure, using measures applicable at local level to assist owners of electric vehicles by developing charging points based on demand. Specifically, an application made by private operators for charging points to be installed could also be combined with the construction of parking spaces. Incentives, such as prioritising license applications for parking spaces that will also offer vehicle charging points, will make a positive contribution in promoting electric mobility and will address the shortage of parking spaces in densely populated areas. As regards public parking spaces, an incentive would be to provide parking spaces that could also offer free or low-cost charging capacity.

4.2 POLICY MEASURES AND INVESTMENTS

4.2.1 Financial incentives

Both alternative fuel vehicles and infrastructure continue to be in a higher cost category compared to vehicles that use conventional fuels. Financial incentives are essential since they aid market penetration. Financial incentives are aimed at both vehicles and the necessary infrastructure and vary in form, ranging from direct subsidies to tax breaks.

At present, there is no provision for using investment plans to support and develop private infrastructure for alternative fuels but it is expected that such policies and actions will be examined in the future.

4.2.2 Statutory framework

The Ministry of the Environment and Energy is preparing a draft law on energy communities and promotion thereof through a set of incentives. The purpose and activities of energy communities will include: (a) developing, managing and operating electric vehicle charging stations and CNG and LNG, LPG or biogas refuelling points or managing sustainable means of transport, and (b) supplying members with electric vehicles (whether hybrid or not) and in general vehicles that use alternative fuels.

5 MEASURES TO SUPPORT THE CREATION OF ALTERNATIVE FUEL INFRASTRUCTURE FOR PUBLIC TRANSPORT SERVICES

5.1 NATIONAL OBJECTIVES AND TARGETS FOR PUBLIC TRANSPORT

In light of the interest expressed by bus/coach owners and the developments at international level in the sector, in terms of the technologies employed and the way in which vehicle prices are being set, it is estimated that by 2025 the number of electric buses/coaches in circulation in Greece will be almost zero whereas by 2030 the number of electric buses is expected to reach 90. The estimated number of buses using other alternative fuels is shown in Table 5.1 and primarily relates to vehicles using natural gas, whose market penetration also depends on how the infrastructure installation programme unfolds.

As already mentioned, the Ministry of Infrastructure and Transport is in negotiations with DG MOVE and the European Investment Bank for financing to be provided via the Clean Transport initiative in order to upgrade a large proportion of the urban bus fleet. A first step will be to integrate 90 new OASA urban buses into the Attica Regional Operational Programme, which will function using alternative fuels, mainly electricity and natural gas. Meanwhile, based on its own strategic plans, the Ministry of Infrastructure and Transport has also applied for and set aside €80,000,000 so far within the framework of NSRF 2014–2020, to further upgrade the OASA fleet, which will also be powered by alternative fuels, mainly electricity and natural gas.

Table 5.1: Number of buses per type of alternative fuel

	Public			Private		
	2020	**2025**	**2030**	**2020**	**2025**	**2030**
CNG	400	600	800	100	200	400
LNG	N/A	N/A	N/A	N/A	N/A	N/A
Electric	0	30	50	10	10	40
Hydrogen	0	0	0	0	0	0
LPG	3	N/A	N/A	2	N/A	N/A
Biofuels	0	N/A	N/A	0	N/A	N/A
Synthetic and paraffinic fuels	0	N/A	N/A	0	N/A	N/A

6 FACILITIES IN URBAN/SUBURBAN AGGLOMERATIONS AND OTHER DENSELY POPULATED AREAS AND THROUGHOUT INTER-CITY NETWORKS

6.1 URBAN/SUBURBAN AGGLOMERATIONS OR DENSELY POPULATED AREAS

By 2020, the number of electric vehicle charging points in urban and suburban areas could be around 2,000, most of which will be private (Table 2.2)[10-11, 23]. However, it is not possible to predict the number of charging and refuelling points in urban or suburban agglomerations or per area, even for 2020 (Table 6.1).

Table 6.1: Estimated number of recharging and refuelling points in urban/suburban agglomerations or densely populated areas – 2020

2020	No of residents	High-power charging points	Regular-power charging points	CNG refuelling points	LNG refuelling points	Hydrogen refuelling points	LPG refuelling points	Biofuel refuelling points	Synthetic and paraffinic fuel refuelling points
Name of region	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Name of region	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Likewise, it is estimated that by 2025 there will be 12,000 electric vehicle charging points in urban and suburban areas, of which 8,000 will be private and 4,000 will be public (Table 2.2), while that figure will exceed 35,000 in 2030.

6.2 TEN-T CORE NETWORK

Greece has a core network corridor that runs across the country, uniting it to the rest of Europe via the Balkan countries, and is a section of the TEN-T core network. The multi-modal TEN-T core network with core network corridors contributes significantly to European cohesion and strengthens the internal market[49]. Improved multi-modality for better railway networks, inland waterways and maritime infrastructure in a multi-modal TEN-T network along with new technologies in the transport sector, will lead to changes in transportation methods, reduce traffic load on the road network, limit GHG and pollutant emissions and boost the safety and protection of transport.

In Greece, Athens, Igoumenitsa, Heraklion, Thessaloniki and Patras are key nodes in the TEN-T core network. Table 6.2 presents the nodal points on the

TEN-T core network in Greece, which are depicted in Figure 6.1. based on Regulation (EU) No 1315/2013[49,50].

Table 6.2: Nodes in the TEN-T core network in Greece[50]

Name of node	Airport	Port	Road - rail road terminals (RRTs)
Athens	Core*	Core (Piraeus)	Core (Piraeus/Thriassio Plain)
Igoumenitsa	Core	Core	
Heraklion	Core	Core	
Thessaloniki	Core (Macedonia)	Core	Core
Patras		Core	Core

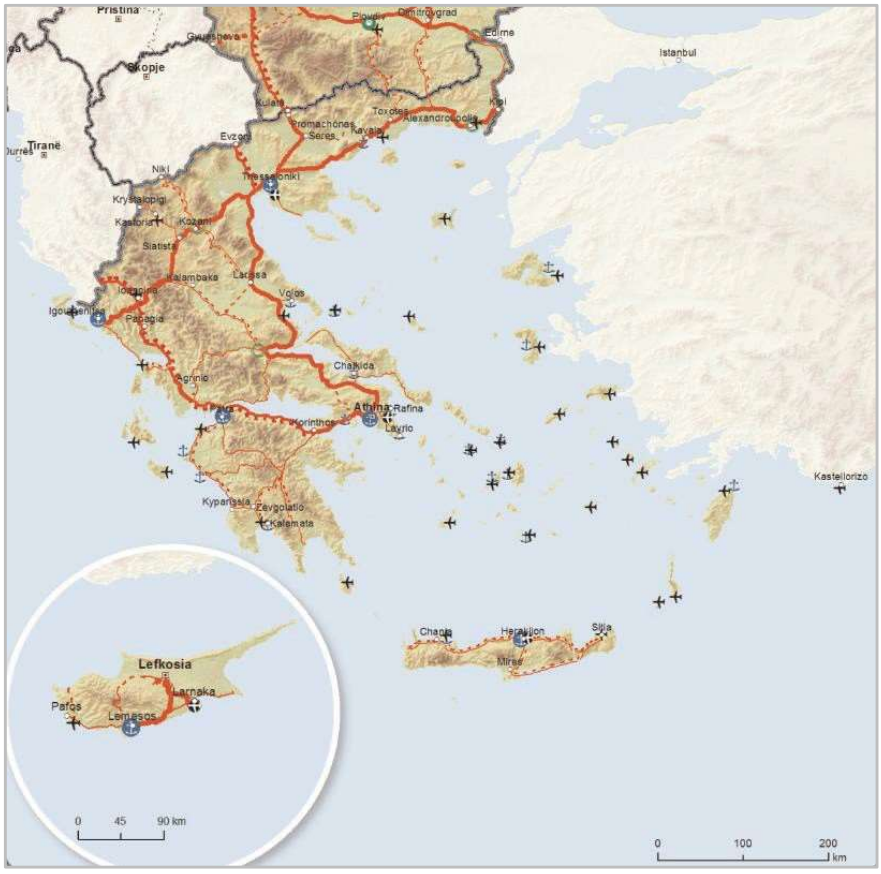


Figure 6.1: TEN-T core and extended network areas and corridors in Greece [50]

6.2.1 Recharging points

Of the total estimated number of recharging points, which is given in Table 2.2., it is not possible at present to forecast the number that will correspond to the TEN-T core network in Greece (road network, ports, etc.) per time period.

6.2.2 Natural gas refuelling points

Of the total estimated number of natural gas refuelling points, which is given in Table 2.3, it is not possible at present to forecast the number that will correspond to the TEN-T core network in Greece (road network, ports, etc.) per time period.

6.2.3 Hydrogen refuelling points

It is not expected that hydrogen infrastructure will be developed in Greece in the near future.

6.2.4 Other alternative fuel refuelling points

Given that the only biofuel used in Greece is biodiesel, which is mixed with conventional fuels at refineries, it is not expected that neat biodiesel supply points will be installed at fuel and energy supply stations on the Greek section of the European motorway network[23,43]. The existing and planned strategy in the biofuels sector does not include obligations or incentives for marketing neat biofuels to for use in the transport sector by end consumers. Likewise, it does not include obligations or incentives for the promotion of synthetic and paraffinic fuels. Consequently, it is not possible to estimate the number of refuelling points for those fuels on the TEN-T core network. The supply of such fuels mixed with refined petroleum products is possible using existing infrastructure[23,43].

Of the total estimated number of LPG refuelling points, which is given in Table 2.5, it is not possible at present to forecast the number that will correspond to the TEN-T core network in Greece, for any time period.

6.3 TEN-T EXTENDED NETWORK

Table 6.3 shows the nodal areas and corridors of the TEN-T extended network in Greece, which is depicted in Figure 6.1 based on Regulation (EU) No 1315/2013[50]. Most ports and airports are already included in the TEN-T extended network.

6.3.1 Recharging points

Of the total estimated number of recharging points, which is given in Table 2.2, it is not possible at present to forecast the number that will correspond to the TEN-T extended network in Greece, for any time period.

6.3.2 Natural gas refuelling points

Of the total estimated number of natural gas refuelling points, which is given in Table 2.3, it is not possible at present to forecast the number that will correspond to the TEN-T extended network in Greece, for any time period.

Table 6.3: Nodes in the TEN-T extended network in Greece[50]

Name of node	Airport	Port	Road – rail road terminals
Alexandroupoli	Extended		Extended
Araxos	Extended		
Astypalaia	Extended		
Volos		Extended	
Elefsina		Extended	
Zakynthos	Extended		
Ikaria	Extended		
Ioannina	Extended		
Kavala	Extended	Extended	
Kalamata	Extended	Extended	
Kalymnos	Extended		
Karpathos	Extended		
Kasos	Extended		
Kastelorizo	Extended		
Kastoria	Extended		
Katakolo		Extended	
Corfu	Extended	Extended	
Kefalonia	Extended		
Kozani			Extended
Kythyra	Extended		
Kyllini		Extended	
Kos	Extended		
Lamia			Extended
Lavrio (Sounio)		Extended	
Leros	Extended		
Limnos	Extended		
Milos	Extended		
Mykonos	Extended	Extended	
Mytilini	Extended	Extended	
Naxos	Extended	Extended	
Nea Agchialos	Extended		
Paros	Extended	Extended	
Preveza	Extended		
Rafina		Extended	
Rhodes	Extended	Extended	
Samos	Extended		
Santorini	Extended	Extended	
Sitia	Extended		
Skiathos	Extended	Extended	
Skyros	Extended		
Syros	Extended	Extended	
Chalkida		Extended	
Chania	Extended	Extended (Souda)	
Chios	Extended	Extended	

6.3.3 Hydrogen refuelling points

It is not expected that hydrogen infrastructure will be developed in Greece in the near future.

6.3.4 Refuelling points for other alternative fuels

Of the total estimated number of LPG refuelling points, which is given in Table 2.5, it is not possible at present to forecast the number that will correspond to the TEN-T extended network in Greece, for any time period.

6.4 OTHER ROUTES

Just as with the TEN-T core and extended network, so for the rest of the road network in Greece, there are currently no estimates for the number of alternative fuel facilities, locations, recharging points, refuelling points for natural gas/LPG/biofuel and other fuels.

7 LNG REFUELLING POINTS AT MARITIME PORTS AND INLAND WATERWAY PORTS ON THE TEN-T CORE NETWORK

Maritime transport is responsible for emitting 1,000 million tons of CO_2 into the air each year. This corresponds to 2.5% of all annual GHG emissions[51]. The Greek merchant fleet accounts for a large proportion of the pollutants emitted, since it holds the first position, accounting for around 20% of the entire fleet in terms of DWT globally and around 50% of the fleet in the European Union (EU)[51]. It consists of almost 5,000 ships with an average age of under 10 years, which belong to around 650 Greek-interest companies. 20% of the fleet flies the Greek flag.

Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL) of the International Maritime Organization (IMO)[45]), dated 2005, seeks to gradually limit gaseous emissions including nitrogen oxides (NOx), sulphur oxides (SOx), volatile organic compounds (VOCs) and particulate matter (PM), whose emission thresholds are known as Tier I-III standards[51].

In the context of international and European regulations, directives and agreements to limit emissions from ships, the Greek shipping sector has already begun to seek out new technologies in order to power ships in a more cost-effective manner and limit emissions. To that end, it appears that there is currently considerable interest in using LNG, both for new and existing ships, provided it is technologically feasible and economically efficient.

7.1 MARITIME PORTS IN THE TEN-T CORE NETWORK

There are five maritime ports in the TEN-T core network (Table 7.1) and these are the ports with the highest traffic in Greece. The geographical location of the ports is such that they could fully meet the LNG demands of a ship travelling within the country. However, LNG requires storage facilities and needs to be transported by ship.

Table 7.1: LNG facilities at maritime ports – TEN-T core network[19,22,41-42]

PORT NAME	2020	2025	2030
Port of Piraeus	1	1	1
Port of Patras	1*	N/A	N/A
Port of Igoumenitsa		1*	N/A
Port of Thessaloniki		1*	N/A
Port of Heraklion		1*	N/A

* under examination

At present, except for the port of Piraeus, which can meet its LNG needs from Revythousa, for other ports major interest in such facilities has been expressed by economic entities and businesses involved in shipping. In this context,

DEPA has already started investigating the potential in installing LNG infrastructure at TEN-T core network ports. At present, DEPA is carrying out a study into planning the development of LNG infrastructure at the ports of Piraeus, Igoumenitsa and Heraklion (Crete) and will subsequently proceed to study the case of the Port of Thessaloniki.

7.2 INLAND WATERWAY PORTS IN THE TEN-T CORE NETWORK

There are no inland waterway ports in the TEN-T core network in Greece.

8 ASSESSMENT OF THE NEED TO INSTALL LNG REFUELLING POINTS AT MARITIME PORTS OUTSIDE THE TEN-T CORE NETWORK

11 of the 18 ports in the TEN-T extended network are located on islands. The installation of LNG infrastructure at those ports to supply floating craft does not appear to be a cost-effective investment because of the seasonality of demand. However, the combination of refuelling ships with LNG and providing LNG to potential small and large customers in the area could ensure that the cost-effectiveness criterion is met. At present, the possibility of such a future design for the TEN-T extended network is being explored by DEPA[41], both in relation to island ports and in relation to mainland Greece.

8.1 MARITIME PORTS OUTSIDE THE TEN-T CORE NETWORK

The development of LNG refuelling stations at other maritime ports outside the TEN-T core network is being explored at present, as already stated. According to DEPA, the greatest interest is in the maritime terminal at Alexandroupoli and in supply to islands for parallel, other energy uses (electricity generation, etc.)[19,22,41-42].

Table 8.1: LNG facilities at maritime ports – Outside the TEN-T core network

PORT NAME	2020	2025	2030
Port name	N/A	N/A	N/A

8.2 INLAND WATERWAY PORTS OUTSIDE THE TEN-T CORE NETWORK

In Greece, inland waterway ports (on lakes and rivers) are of limited scale (usually small infrastructure to serve one vessel) and use, and only serve a very small number of vessels used for specific professional purposes.

9 SHORE-SIDE ELECTRICITY SUPPLY AT MARITIME PORTS

Shore-side electricity supply reduces emissions from ships within the port zone, which is usually located close to populated areas, and allows berthed ships to use electricity from the local network and therefore turn off their conventional fuel engines. Shore-side electricity supply to a vessel significantly reduces its GHG emissions. In addition to reducing emissions and complying with new environmental regulations, powering ships with electricity leads to increased energy efficiency and reductions in noise and vibration while afloat. Coupled with the use of batteries, it also increases the ship's life span and reduces the use of resources[34,39].

In recent years, the number of ships being built with shore-side connectivity already installed has gradually increased. However, to ensure such facilities are cost-effective, a satisfactory number of users needs to be ensured in order to cover investment and running costs[52].

According to representatives from the Ship-Owners Association[36], initial interest lies in installing shore-side electricity supply systems at main ports like Piraeus, so that when ships are berthed there, they do not use their on-board generators. It is then expected that interest will shift to meeting ship charging capabilities (converting ship engines and installing infrastructure) for short-distance journeys, for example to the islands in the Argosaronic Gulf. Key factors examined in relation to the use of electricity to fuel ships are the recharging time required, the reliability of storage systems and the initial cost of investment and maintenance.

In order to convert existing conventional fuel ships into all-electric ships (battery-powered ships), it is vital to change the electrical switchboard in dry dock. The scale of conversion costs varies depending on the size of a ship, ranging from €30,000 to €300,000. Power can be supplied using parallelism, i.e. without turning off the ship's engines when switching over from diesel to electricity. Switch-overs of this kind entail higher cost but are necessary when there are passengers on board[39], as in the case of cruise liners.

9.1 MARITIME PORTS IN THE TEN-T CORE NETWORK

As part of the ELEMED programme, one of the aspects being explored is the potential for investing in charging facilities at ports in the TEN-T core network. Specifically, it is deemed that the gradual pilot installation of charging points at ports could at least meet the needs of ships that have the infrastructure to connect to the shore-side electricity supply network. However, the size of the substation required to supply the port (in terms of kVA) will differ depending on the number of charging points, as will the space required to house the substation. Table 9.1 gives estimates for the number of ship charging points that could facilitate ships in the TEN-T core network[34,39].

Table 9.1: Shore-side power supply points at maritime ports – TEN-T core network[34,39]

PORT NAME	NAME OF TERMINAL	2020	2025	2030
Piraeus[34]	Passenger terminal	2	5	7
Piraeus	Cruise liner terminal	1	3	5
Piraeus	Container terminal	1	2	3
Piraeus	Car terminal	0	1	2
Piraeus	Other uses (tugboats etc.)	1	2	2
Thessaloniki	Container terminal	N/A	1	1
Thessaloniki	Cruise liner terminal	1	2	3
Heraklion	Heraklion	0	1	1
Patras	Patras	0	1	2
Igoumenitsa	Igoumenitsa	0	1	1

9.2 MARITIME PORTS OUTSIDE THE TEN-T CORE NETWORK

As far as maritime ports outside the TEN-T core network are concerned, there are plans for the direct shore-side supply of electricity to floating craft at Kyllini, as part of the pilot implementation of the ELEMED programme[34,39] (Table 9.2). Moreover, other small ports outside the TEN-T core network are expected to be supplied with electricity, especially due to investor interest from shipping companies that operate short-sea ships[36].

Table 9.2: Shore-side power supply points at maritime ports – Outside the TEN-T core network

PORT NAME	NAME OF TERMINAL	2020	2025	2030
Kyllini	Passenger port	1	2	4
Katakolo	Cruise liner	0	0	1
Kavala	Main port	0	1	1
Aegina	Port	0	1	1
Poros	Port	0	1	1
Corfu	Passenger	0	1	1
Corfu	Cruise liner	0	0	1
Kefalonia	Poros	0	0	1
Kefalonia	Sami	0	1	2
Astakos	Port	0	0	1
Zakynthos	Port	0	1	1

9.3 TOURIST PORTS OUTSIDE THE TEN-T CORE NETWORK

Electricity for berthed vessels is already available at a large number of tourist ports, the majority of which are outside the TEN-T core network (Table 9.3) and so far 153 tourist ports have already obtained land use licenses and will operate in the years to come[20].

Table 9.3: Estimated number of shore-side power supply points at tourist ports

TYPE OF PORT	2020	2025	2030
Marinas	35	94	N/A
Harbours, tourist craft anchorages	30	113	N/A
Hotel docking facilities	7	18	N/A

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ANNEX A: INSTITUTIONAL FRAMEWORK

A.1 MINISTRY OF INFRASTRUCTURE AND TRANSPORT

EXISTING AND FORTHCOMING INSTITUTIONAL FRAMEWORK RELATING TO THE INFRASTRUCTURE AND SUPPLY OF ALTERNATIVE FUELS IN THE TRANSPORT SECTOR (ROAD, MARITIME TRANSPORT, ETC.)

EXISTING INSTITUTIONAL FRAMEWORK REGARDING INFRASTRUCTURE FOR ALTERNATIVE FUEL REFUELLING POINTS, GARAGES AND TECHNICIANS					
Ser. No	**Legislative or regulatory provision**	**Enabling provision**	**Scope of provisions**	**Competent Ministries**	**General description – Comments**
1	Law 4439/2016		Transposing Directive 2014/94/EU on the deployment of infrastructure for alternative fuels, simplifying the licensing process for fuel and energy supply stations, and other provisions into Greek legislation	Ministry of the Interior Ministry of the Economy and Development Ministry of Education, Research and Religious Affairs Ministry of Foreign Affairs Ministry of Finance Ministry of the Environment and Energy Ministry of Infrastructure and Transport Ministry of Shipping and Island Policy Ministry of Tourism	Chapter I lays down the minimum specifications for establishing alternative fuel infrastructure, including recharging points and natural gas (LNG and CNG) and hydrogen refuelling points. It also lays down the technical specifications for recharging and refuelling points and specifications on how users are to be informed about them. Finally, it specifies the procedures for simplifying licensing for filling stations selling liquid fuel, neat LNG and for mixed filling stations. In Chapter II, the licensing process for filling stations selling liquid fuel and mixed filling stations selling liquid fuel and LPG has been simplified (abolishing unnecessary supporting documents and procedures such as on-site inspections to verify the suitability of the property's location in order to grant an establishment licence) and accelerated (by setting time limits for the issue of establishment licences, operating licences and for a change of license holder and by enacting a 'tacit' approval procedure).

2	Law 4070/2012 (Government Gazette, Series I, No 82).		Chapter II on matters relating to the establishment of filling stations and other provisions amends the provisions on liquid fuel filling stations such as Law 2963/2001 and Law 3897/2010	Ministry of Infrastructure and Transport	Article 114 provides for the establishment of filling stations that supply alternative forms of fuel called 'fuel and energy supply stations'. This specific group of filling stations includes those selling mixed fuels or LPG only and those selling natural gas only. The Article also provides that in addition to the above fuels, these filling stations can sell neat biofuels (such as bioethanol and biodiesel), electricity and hydrogen, and other alternative types of fuel to passing wheeled vehicles.
3	Presidential Decree 595/1984 (Government Gazette, Series I, No 218)	Article 1(2), Legislative Decree 511/1970.	Terms and conditions for installing and operating filling stations that distribute LPG	Ministry of Infrastructure and Transport Ministry of the Environment and Energy	This lays down the terms and conditions and technical specifications for establishing and operating filling stations that only sell LPG or mixed filling stations (gasoline, diesel and LPG). In Chapter II of Law 4439/2016 (Government Gazette, Series I, No 222) the licensing process for mixed filling stations selling liquid fuel and LPG has been simplified (abolishing unnecessary supporting documents and procedures such as on-site inspections to verify the suitability of the property's location in order to grant an establishment licence) and accelerated (by setting time limits for the issue of establishment licences, operating licences and for a change of licence holder and by enacting a 'tacit' approval procedure).
4	Ministerial Decision No 13935/930/2014 (Government Gazette, Series II, No 674)	Article 115 (8) Law 4199/2013.	Terms and conditions for establishing and operating filling stations that distribute natural gas and mixed filling stations that distribute liquid fuel, LPG and natural gas	Ministry of Infrastructure and Transport	This designates the competent bodies and lays down the terms and conditions for establishing and operating filling stations that distribute CNG and mixed filling stations that distribute liquid fuels, LPG and CNG, in any combination. Article 10 of Law 4439/2016 provides for a joint ministerial decision to be issued with a view to simplifying and speeding up the licensing process for filling stations that distribute CNG and mixed filling stations that distribute liquid fuels, LPG and CNG.

5	Joint Ministerial Decision No 71287/6443/ 2015 (Government Gazette, Series II, No 50)	Article 15 of Law 4233/2014	Terms and conditions for installing and operating charging devices for electric vehicle batteries at existing 'fuel and energy supply stations' or those in the process of obtaining a licence, at indoor or outdoor car parks, at maintenance and repair workshops for cars, motorcycles, and motorbikes and at public or private vehicle roadworthiness testing centres	Ministry of Infrastructure and Transport Ministry of the Environment and Energy	This Article lays down the terms and conditions for installing charging devices for electric vehicle batteries at existing 'fuel and energy supply stations' or those in the process of obtaining a licence, at indoor or outdoor car parks, at maintenance and repair workshops for cars, motorcycles, and motorbikes and at public or private vehicle roadworthiness testing centres. Article 10(b) of Law 4439/2016 provides for amendments to the joint ministerial decision in order to transpose the technical specifications for recharging points, set out in Annex II to Directive 2014/94/EU, into Greek law (Article 9 of Law 4439/2016).
6	Joint Ministerial Decision No 72983/6562/14/2015 (Government Gazette, Series II, No 88)	Article 12(1) Law 3710/2008	Terms and conditions for establishing and operating liquid fuel, LPG and natural gas filling stations within port zones and tourist ports (marinas) to enable fuel to be exclusively sold to ships	Ministry of Infrastructure and Transport Ministry of Shipping and Island Policy	This lays down the terms and conditions for establishing and operating liquid fuel, LPG and CNG filling stations within port zones and tourist ports (marinas) to enable fuel to be exclusively sold to ships. Article 11(2) of Law 4439/2016 provides for amendments to this joint ministerial decision.
7	Ministerial Decision No 41871/3068/ 2010 (Government Gazette, Series II, No 1519)	Article 9(4b) Law 3710/2008	Terms and conditions for licensing gaseous fuel (LPG, CNG) garages	Ministry of Infrastructure and Transport	This lays down the terms and conditions (regarding space, internal layout, equipment, machinery) and licensing procedure for garages dealing with gaseous fuels (LPG, CNG).
8	Presidential Decree 66/2010. (Government Gazette, Series I, No 117)	Article 9(4a) Law 3710/2008.	Terms and conditions for practicing the profession of gaseous fuel (LPG and CNG) technician	Ministry of Infrastructure and Transport	This lays down the qualifications and procedure for acquiring a professional practice licence for gaseous fuel (LPG and CNG) technicians.

9	Joint Ministerial Decision No 71287/6443/ 2015 (Government Gazette, Series II, No 50)	Article 114 (7). Law 4070/2012, (Amended by Article 15 of Law 4233/2014)	Lays down the terms, conditions and technical specifications for recharging devices for electric vehicle batteries, for the installation of these at existing 'fuel and energy supply stations' and those in the process of obtaining a licence, at existing indoor and outdoor car parks or those in the process of obtaining a licence, at existing car, motorcycle, and motorbike maintenance and repair workshops or those in the process of obtaining a licence, and at existing public or private vehicle testing centres or those in the process of obtaining a licence.	Ministry of Infrastructure and Transport	The following provisions are laid down with regard to electric vehicles: 1. Technical specifications for electric vehicle battery recharging devices 2. Minimum internal safety distances and layout of electric vehicle battery charging device facilities 3. Licensing–approval procedure for the installation of electric vehicle battery charging devices. It is necessary to amend–extend the scope of this joint ministerial decision, which, in accordance with Article 15 of Law 4233/2014, will lay down the terms, conditions and technical specifications for installing devices to supply alternative fuels, such as biofuel and hydrogen, at existing 'fuel and energy supply stations' or those in the process of obtaining a licence.
10	Ministerial Decision No 10852/725/ 2014 (Government Gazette Series II, No 1466)	Article 6 Law 1108/1980 (Government Gazette Series I, No 304)	Lays down technical specifications for special equipment makes it possible to use CNG to power motor vehicles and terms and conditions for the inspection and safe circulation thereof.	Ministry of Infrastructure and Transport	The scope of the decision is to lay down technical specifications and terms under which vehicles are powered by compressed natural gas (CNG) and, also, the terms and conditions for the inspection and safe circulation of those vehicles. This decision applies to retrofitting systems to be installed in M and N class vehicles as defined in Joint Ministerial Decision No 29949/1841/09 (Government Gazette, Series II, No 2112) which are converted into bi-fuel vehicles. It lays down a procedure similar to that which applies for the installation of LPG systems. It also lays down the requirement for certification of the natural gas system under regulation R115 and certification of each part individually under regulation R110, in order to reduce the cost of installation.

11	Ministerial Decision No 59683/3936/ 2015 (Government Gazette, Series II, No 2733)		Lays down technical specifications for special equipment that makes it possible to use LPG to power motor vehicles and terms and conditions for the inspection and safe circulation thereof.		Lays down the technical specifications for the special equipment needed to use LPG to power motor vehicles and the terms and conditions for the inspection and safe circulation thereof. New regulation for the use of LPG in diesel-powered vehicles (bi-fuel).
12	Ministerial Decision No 21935/756/15 (2754 Government Gazette, Series II, No 2754/2015)	Article 12 Law 4233/2014 (Government Gazette, Series I, No 22)	Lays down technical specifications for special equipment that makes it possible to use CNG to convert cars into bi-fuel vehicles and the terms and conditions for the inspection and safe circulation thereof.		Lays down the technical specifications for the special equipment needed to CNG to convert cars into bi-fuel vehicles and the terms and conditions for the inspection and safe circulation thereof. The use of CNG in diesel-powered vehicles (bi-fuel) is also determined.

PLANNED REGULATORY FRAMEWORK REGARDING INFRASTRUCTURE FOR ALTERNATIVE FUEL REFUELLING POINTS – IN PROCESS OF BEING DRAFTED					
No	**Legislative or regulatory provision**	**Enabling provision**	**Scope of provisions**	**Competent Ministries**	**General description**
1	Joint Ministerial Decision	Article 10, Law 4439/2016.	Terms, conditions and technical specifications **for the installation of electric vehicle charging devices.** Amendment to Joint Ministerial Decision No 71287/6443/31-12-2014. Government Gazette, Series II, No 50/15-1-2015).	Ministry of Infrastructure and Transport Ministry of the Economy and Development Ministry of the Environment and Energy Ministry of the Interior Ministry of Tourism Ministry of Shipping and Island Policy	Lays down terms and conditions and technical specifications **for the installation of electric vehicle charging devices** at: existing car parks or those in the process of obtaining a licence, located within port zones and/or tourist ports (marinas); existing indoor and outdoor car parks or those in the process of being licensed; existing car, motorcycle and motorbike maintenance and repair shops or those in the process of being licensed; existing public or private vehicle roadworthiness testing centres or those in the process of being licensed; publicly accessible recharging points throughout the urban, intra-urban and national road network; parking facilities in public and private buildings; terminal stations or transit stations for passengers using public transport. Currently being drafted.
2	Joint Ministerial Decision		Amendment to Ministerial Decision No 13935/930/2014 (Government Gazette, Series II, No 674/18-3-2014).	Ministry of Infrastructure and Transport Ministry of the Environment and Energy	Laying down the competent bodies and terms and conditions on establishment and operation of natural gas (CNG, LNG) and mixed liquid fuel, LPG and natural gas, or LPG and CNG or liquid fuel and natural gas filling stations. This simplifies and establishes a fast-track licensing procedure for natural gas filling stations, in accordance with the provisions of Law 4439/2016, by a mutatis mutandis application of the rules regarding liquid fuel filling stations and LPG (neat or mixed) filling stations. Currently being drafted.
3	Joint Ministerial Decision No		Terms and conditions for the installation of refuelling points for the supply of hydrogen, biofuels, synthetic and paraffinic fuels.	Ministry of Infrastructure and Transport Ministry of the Environment and Energy	Lays down the terms and conditions and technical specifications for the installation of refuelling points for the supply of hydrogen, biofuels, synthetic and paraffinic fuels at existing 'fuel and energy supply stations' or those in the process of obtaining a licence.

4	Joint Ministerial Decision No	Article 11 Law 4439/2016.	Terms and conditions on the establishment and operation of vehicle parking facilities and liquid fuel filling stations within port zones	Ministry of Infrastructure and Transport Ministry of the Economy and Development Ministry of Shipping and Island Policy	Lays down terms and conditions for the establishment and operation within port zones and tourist ports (marinas) of parking facilities and filling stations (refuelling points) selling liquid fuels, LPG and LNG, in any combination, and recharging points for the exclusive supply of such alternative fuels to floating craft (ships and vessels). Draft of joint ministerial decision pertaining to liquid fuels only (not LPG and natural gas) is in its final stages of preparation.
5	Ministerial Decision	Article 21 of Law 4439/2016.	Development operation and maintenance of a digital register of fuel and energy supply stations in operation	Ministry of Infrastructure and Transport	Lays down the terms and conditions for the creation, development, operation and maintenance of a digital register of operating 'fuel and energy supply stations', referred to in Article 114(7) of Law 4070/2012, as in force, liquid and gaseous fuel filling stations in operation under Joint Ministerial Decision No 72983/6562/2014 (Government Gazette, Series II, No 88), indoor car parks with fuel pumps under Presidential Decree 455/1976, as in force, and all manner of stations supplying fuels for public and private use, and all other necessary and relevant details. Draft of joint ministerial decision in its final stages of preparation.
6	Ministerial Decision	Article 26 of Law 4439/2016.	Laying down the procedure, conditions and technical details for sealing filling stations that supply gaseous fuel	Ministry of Infrastructure and Transport	Lays down the procedure, other conditions and all technical details for sealing filling stations that supply LPG only or LPG mixed with other fuels.
7	Ministerial Decision	Article 26 of Law 4439/2016.		Ministry of Infrastructure and Transport	Lays down the procedure, other conditions and all technical details for sealing filling stations that supply CNG only or CNG mixed with other fuels.
8	Joint Ministerial Decision	Article 24 of Law 4439/2016.	Lays down the procedure and conditions (experience, training, length of training, etc.) and all other relevant matters regarding managers of 'fuel and energy supply stations'.	Ministry of Infrastructure and Transport Ministry of Education, Research and Religious Affairs	Lays down the procedure and other conditions (experience, level of knowledge, professional training, length of training, curriculum, appropriately certified training structure) and all other relevant details for the appointment of managers of filling stations supplying LPG only or LPG mixed with other fuels.
9	Joint Ministerial Decision	Article 24 of Law 4439/2016.		Ministry of Infrastructure and Transport Ministry of Education, Research and Religious Affairs	Lays down the procedure and other conditions (experience, level of knowledge, professional training, length of training, curriculum, appropriately certified training structure) and all other relevant details for the appointment of managers of filling stations supplying CNG only or CNG mixed with other fuels.

PLANNED REGULATORY FRAMEWORK REGARDING INFRASTRUCTURE FOR ALTERNATIVE FUEL GARAGES AND TECHNICIANS – IN PROCESS OF BEING DRAFTED					
No	**Legislative or regulatory provision**	**Enabling provision**	**Scope of provisions**	**Competent Ministries**	**General description**
1	Presidential Decree	Article 12 Law 4439/2016.	Lays down the qualifications for technicians and mechanics working with vehicles that use alternative fuels	Ministry of Infrastructure and Transport Ministry of the Economy and Development Ministry of Education, Research and Religious Affairs	Lays down the qualifications and procedure for granting a certificate of commencement of the profession of repair and maintenance technician for vehicles powered by hydrogen, biofuels and synthetic and paraffinic fuels.
2	Joint Ministerial Decision No	Article 12 Law 4439/2016.		Ministry of Infrastructure and Transport Ministry of the Economy and Development Ministry of Education, Research and Religious Affairs	Lays down the length of training, training structure and method, content of curriculum and the procedure and terms and conditions for extending the professional licence of gaseous fuel technicians under Presidential Decree 66/2010 on the repair and maintenance of engine power supply and operation parts in LNG-powered vehicles.
3	Joint Ministerial Decision No	Article 12 Law 4439/2016.		Ministry of Infrastructure and Transport Ministry of the Economy and Development Ministry of Education, Research and Religious Affairs	Lays down the length of training, training structure and method, curriculum content and the procedure and terms and conditions for extending the professional licence of mechanical technicians, electrical technicians, automotive engineers (university education) and automotive engineers (technical education) in relation to the repair and maintenance of electric vehicles.
4	Joint Ministerial Decision No	Article 12 Law 4439/2016.	Lays down the terms and conditions, the internal layout, mechanical equipment and prohibitions relating to proximity and safety distance, for extending the scope of a garage's services	Ministry of Infrastructure and Transport Ministry of the Economy and Development Ministry of the Environment and Energy	Requirements for the extension of the scope of services offered by garages dealing with gaseous fuel under Article 1(2) of Ministerial Decision No 41871/3068/31-8-2010 relating to the repair and maintenance of engine power supply and operation parts of LNG-powered vehicles.
5	Joint Ministerial Decision	Article 12 Law 4439/2016.		Ministry of Infrastructure and Transport Ministry of the Economy and Development Ministry of the Environment and Energy	Requirements for the extension of the scope of services offered by garages dealing with gaseous fuels under Article 1(2) of Ministerial Decision No 41871/3068/31-8-2010 relating to the repair and maintenance of electric vehicles.
6	Joint Ministerial Decision	Article 12 Law 4439/2016.		Ministry of Infrastructure and Transport Ministry of the Economy and Development Ministry of the Environment and Energy	Requirements for granting a certificate of lawful operation to garages offering repair and maintenance services for vehicles powered by hydrogen, biofuels and synthetic and paraffinic fuels.

A.2 MINISTRY OF THE ENVIRONMENT AND ENERGY

EXISTING AND FORTHCOMING INSTITUTIONAL FRAMEWORK RELATING TO THE INFRASTRUCTURE AND SUPPLY OF ALTERNATIVE FUELS IN THE TRANSPORT SECTOR (ROAD, MARITIME TRANSPORT, ETC.)

EXISTING AND FORTHCOMING INSTITUTIONAL FRAMEWORK REGARDING INFRASTRUCTURE FOR ALTERNATIVE FUEL REFUELLING POINTS, GARAGES AND TECHNICIANS					
No.	**Legislative or regulatory provision**	**Enabling provision**	**Scope of provisions**	**Competent Ministries**	**General description – Comments**
1	Law 3054/2002 (Government Gazette Series I, No 230).		'Organisation of the petroleum product market and other provisions' The purpose of the law is to regulate matters relating to Greece's petroleum policy. The provision of services and all activities relating to refining, trade in, transport and storage of petroleum and petroleum products are subject to the provisions of this law and serve the general interest.	Ministry of the Environment and Energy	Article 15A: Biofuels shall be sold in the Greek market in neat form or mixed with refined petroleum products provided the technical specifications laid down in decisions of the Supreme Chemical Council are met. Article 5A: The idea of a biofuel selling permit is introduced. The holder of a biofuel selling permit may produce or import neat biofuels and bioliquids (liquid fuels made of biomass for energy purposes other than transport) and sell them in the domestic market, to holders of a refining permit, a class A trading permit and to end consumers.
2	Law 3468/2006 (Government Gazette, Series I, No 129)		Production of electricity from Renewable Energy Sources and High-Efficiency Combined Heat and Power generation and other provisions.	Ministry of the Environment and Energy	Transposes Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market, into Greek law, and also promotes as a matter of priority, in the internal energy market, based on rules and principles, the production of electricity from RES and High-Efficiency Combined Heat and Power plants (HECHP). National targets for RES based on Directive 2009/28/EC (OJ L 140/2009).
3	Law 3986/2011 (Government Gazette Series I, No 152).			Ministry of Finance	Article 35 lays down the registration fees and road tax for alternative vehicles, hybrid vehicles, etc.

4	Law 4062/2012 (Government Gazette, Series I, No 70)		Criteria for the sustainability of biofuels and bioliquids (Transposition of Directive 2009/30/EC).	Ministry of the Environment and Energy	Transposition of Directive 2009/30/EC Its provisions transpose the provisions of Articles 2 and 7a to 7e of Directive 98/70/EC into national law, as amended by and added with Article 1 of Directive 2009/30/EC.
5	Law 4001/2011 (Government Gazette, Series I, No 179)		‘ ‘For the functioning of the electricity and natural gas energy markets, for research, production and transport networks for hydrocarbons and other provisions’	Ministry of the Environment and Energy	Transposition of Directive 2009/72/EC concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC and Directive 2009/73/EC concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC. Lays down rules for the production, supply, purchase, transport and sale of natural gas and electricity, and the storage and liquefaction of natural gas and the gasification of LNG within the territory of Greece. These activities are of general interest and are supervised by the state.
6	Joint Ministerial Decision No 316/2010. (Government Gazette, Series I, No 501/2012).		Transposition into national law of Directive 2009/30/EC, other than Articles 7a to 7e 98/70/EC as amended by Article 1 of Directive 2009/30/EC. The objective is to bring national law in terms of the quality of petrol and diesel fuel into line with the Directive	Ministry of Finance Ministry of the Ministry of the Environment and Energy	This decision lays down the technical specifications, which take account of health and environmental factors, for fuels used by motor vehicles and non-road mobile machinery, agricultural and forestry tractors and recreational craft when not at sea, taking into account the technical requirements of their engines.

7	Ministerial Decision No 33749/2015. (Government Gazette, Series II, No 623)		Replacement of paragraphs 4 and 5 of Article 115 'Signage and signboards by holders of retail trading permits for liquid fuels and LPG and CNG (filling stations)' under Ministerial Decision No A2-718/2014 (Government Gazette, Series II, No 2090/2014).	Ministry of the Economy and Development	An obligation is imposed on holders of retail trading permits to display special signage at retail points selling biofuels mixed with refined oil products at a ratio not exceeding 10% by vol. Holders of biofuel selling permits who sell neat biofuels to end consumers, are also obliged to display special signage. Signage issues are also regulated for other by vol. contents of refined oil products in biofuels.

8	Ministerial Decision No Δ3/Α/13225 / 2013 (Government Gazette, Series II, No 2055)		Technical regulations entitled 'Technical guidelines for storing and transporting biofuels to refining facilities and to petroleum product storage and transport facilities'.	Ministry of the Environment and Energy	Approves the technical regulations entitled 'Technical guidelines for storing and transporting biofuels to refining facilities and to petroleum product storage and transport facilities".
9	Ministerial Decision No 175700/2016. (Government Gazette, Series II, No 1212).		Sustainability system for biofuels and bioliquids.	Ministry of Finance Ministry of the Environment and Energy Ministry of Rural Development and Food	Lays down the procedures for certifying and verifying compliance with the biofuel and bioliquid sustainability criteria.
10	State Supreme Chemical Council Decision No 52/2016. (Government Gazette, Series II, No 3956/2016)		Liquid petroleum products – fatty acid methyl ester as biofuels and bioliquids – Requirements and test methods	Ministry of Finance Ministry of the Economy and Development Ministry of the Environment and Energy	This decision lays down the specifications for fatty acid methyl esters (FAME), which are intended for use as fuel in diesel engines (biofuels) etc.
11	Decision No 314/2010 of the Supreme Chemical Council (Government Gazette, Series II, No 69/2012)		Vehicle fuels – Ethanol of biological origin (bioethanol) as an ingredient to be mixed into petrol – Requirements and test methods	Ministry of Finance Ministry of the Environment and Energy	The decision lays down the specifications for neat bioethanol.

12	Joint Ministerial Decision in process of being issued	Article 134 of Law 4001/2011 (Government Gazette Series I, No 179)		Ministry of Finance Ministry of the Economy and Development Ministry of Infrastructure and Transport Ministry of the Environment and Energy	Article 53(2) requires a joint ministerial decision to be issued with regard to trade in electric energy for electric vehicles. Specifically, it states that: 2. Operators of electric vehicle charging infrastructure shall be exempted from the obligation to obtain a permit to supply or trade in electricity. A joint decision of the Ministers for Finance, Development and Competitiveness, Infrastructure, Transport and Networks and the Environment, Energy and Climate Change, after obtaining the opinion of RAE, shall specify the beneficiaries, terms and conditions pertaining to the establishment and running of electric vehicle charging infrastructure operators, the obligations of operators to other consumers, the obligations to disclose information, especially in relation to demand for power and energy on an annual basis, and the relevant cost, how existing operators have adapted to the provisions thereof and all other issues relating to the running and obligations of electric vehicle charging infrastructure operators. In process of being issued.

Article 3
Entry into force

This Decision shall take effect from the date of its publication in the Government Gazette.

This Decision shall be published in the Government Gazette.

Athens, 27 October 2017

The Ministers for

The Interior **PANAGIOTIS SKOURLETIS**	Economy and Development **DIMOS PAPADIMITRIOU**	Education, Research and Religious Affairs **KONSTANTINOS GAVROGLOU**
Foreign Affairs **NIKOLAOS KOTZIAS**	Finance **EUCLID TSAKALOTOS**	Environment and Energy **GEORGIOS STATHAKIS**
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