

# PREVISIÓN DE LA EVOLUCIÓN DEL PARQUE DE VEHÍCULOS EN ESPAÑA

## FORECASTING THE EVOLUTION OF THE VEHICLE FLEET IN SPAIN

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### 1. INTRODUCTION

There is a broad consensus among the scientific community on the influence of increasing greenhouse gas (GHG) emissions on global temperature. According to the Emissions Database for Global Atmospheric Research (EDGARv6.0) [1], transport is one of the main contributors to the increase in GHG emissions on our planet, accounting for more than one fifth (20.27%) of total carbon dioxide (CO<sub>2</sub>) emissions. Transport emissions come from road, rail, aviation, maritime and pipeline transport activities, with an overall growth of 58% since 1990. If we look at the European Union (EU-27), transport is the only sector in which emissions have not been reduced, having grown by 8% between 1990 and 2020, which highlights the difficulty of decarbonising this sector [2].

GHG emissions and energy demand are mainly concentrated in urban areas, transport, production and commercial activities [3]. Within transport, the majority of emissions come from road transport of people and goods, accounting for 79% of total emissions in this sector [2]. This article therefore focuses on the analysis of the foreseeable evolution of the vehicle fleet in Spain, both from a quantitative (number of vehicles) and qualitative (percentage of each type of vehicle) point of view. This evolution will have a direct impact on GHG emissions, energy demand and the mobility model. We are moving towards a more sustainable and connected mobility, where the electric vehicle is set to be the main player. By the end of July 2023 [4], hybrid vehicle registrations (36.6%) already exceed those of diesel engines (13.1%) and are close to those of petrol vehicles (43.2%). In fact, alternative engines already account for 43.7% of registrations,

The size, composition and age of the vehicle fleet are key aspects for analysing the evolution of this sector, which accounts for 10% of Spanish GDP (Gross Domestic Product), and which contributes, together with other sectors such as energy, infrastructures and telecommunications, to the new configuration of sustainable mobility.

The analysis of the evolution of the vehicle fleet in Spain, its conditioning factors and macro trends in mobility are the objectives of this article, whose main contribution is the identification of these factors, and the quantitative and qualitative analysis of the possible evolution of the Spanish vehicle fleet up to 2035 based on various scenarios and hypotheses.

The article begins by analysing the origin of emissions generated by transport, as well as the historical evolution of the vehicle fleet in Spain from 2010 to 2022 (section 2.1). We then identify the macro trends in new mobility, as well as the factors that condition the vehicle fleet (sections 2.2 and 2.3). Section 3 presents the results of our estimates on the foreseeable evolution of the vehicle fleet over the coming years, in terms of number of vehicles, average age and type of motorisation, based on different hypotheses and scenarios, contrasting it with other predictions found in the literature. Finally, conclusions are drawn from the analysis of these estimates and market trends (section 4).

### 2. MATERIALS AND METHOD

As mentioned in the introduction, the transport sector contributes more than 20% of the planet's emissions [2]. In Spain, this percentage rises to 29% (271.5 Mt of CO<sub>2</sub> in 2021), and also represents approximately 40% of total energy consumption [5]. Emissions are generated by the combustion of fossil fuels, with consequences that result in rising sea levels, desertification, extreme weather events, etc. [6]. In addition, transport also causes adverse health effects as a result of emissions of nitrogen oxides NO<sub>x</sub> (42%) and particulate matter PM<sub>10</sub> and PM<sub>2.5</sub> (9.4%), which cause cardiovascular and respiratory diseases [7].

## 2.1. Evolution of the vehicle fleet in Spain

Within the sector, road transport of persons and goods is the largest generator of emissions, accounting for 79% of the total, with the majority coming from light-duty vehicles (54%) [2]. Light-duty vehicles are considered to be those in category M1 ("motor vehicles with at least four wheels, designed and constructed for the carriage of passengers and their luggage, having not more than eight seats in addition to the driver's seat and no space for standing passengers") [8].

Table 1 shows the historical evolution of the vehicle fleet in Spain [9], the registrations and scrappages of vehicles included in group M1 over the last fifteen years.

Vehicle fleet (.000)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	19.801	19.943	20.023	19.968	19.853	19.897	20.149	20.626	21.195	21.712	22.126	22.272	22.405
Registrations (.000)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	982	808	700	723	855	1.034	1.147	1.235	1.321	1.258	851	859	893
Scrapped cars (.000)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	1.011	676	631	797	1.005	1.050	978	865	856	858	525	713	587

Table 1: Evolution of the vehicle fleet, registrations and scrappage in Spain (M1) [9].

Another important aspect in the distribution of the vehicle fleet by age bracket in Spain is the low percentage of vehicles in the 0 to 5 years age bracket (less than 25% of the total). This conditions the average age of the fleet, which stood at 12.6 years in 2022, but which only one year later has risen to 13.3 years [4]. As their age increases, their potential to emit more GHGs and pollutants (NO<sub>x</sub>, volatile organic compounds and PM10 and PM2.5 particles)<sup>1</sup> increases.

With regard to the distribution according to the type of propulsion of the vehicles in the fleet, and the weight of each of these types in each age bracket [4], it can be seen that the number of registrations of new propulsion systems continues to increase, while those of diesel vehicles are decreasing and those of petrol vehicles are increasing. In fact, in the 0 to 5 year age bracket, the percentage of petrol vehicles is already higher than that of diesel vehicles, which is the opposite of the situation in other age brackets.

From a quantitative perspective, most studies agree in forecasting a growth trend in the number of vehicles in the fleet in the short term, which could range between 0.1 and 0.6% per year. However, in the medium and long term, they predict a decrease in the fleet, as transport decarbonization measures are implemented and the dates set by the EU-27 for regulatory changes for these vehicles in 2035 and 2050 approach.

## 2.2 Vehicle fleet trends: conditioning factors

Multiple factors can condition the evolution of the vehicle fleet. Based on our extensive experience in the sector and on the bibliography consulted, these factors have been classified into two large groups. In the first, we include those factors that have a direct quantitative effect on the number of vehicles in the fleet. In the second, we place those factors whose repercussion is mainly qualitative (type of motorization).

Direct factors:

- a. New vehicle registrations and their propulsion types.
- b. Scrapping of end-of-life vehicles.

Indirect factors:

- a. The evolution of the population of driving age.
- b. GDP per capita.
- c. Average household expenditure.
- d. The evolution of Renting in Spain.
- e. The implementation of new legal regulations:

<sup>1</sup> Particles with diameters of 10 microns and 2.5 microns respectively.

1. National Integrated Energy and Climate Plan.
2. Entry into force of new Low Emission Zones (LEZ).
3. Entry into force of the Euro 7 standard.

### 2.2.1 Direct factors

Factors having a direct quantitative impact on the volume of the fleet<sup>2</sup>.

#### a.- New vehicle registrations.

Table 1 shows the trend changes in the number of registrations in Spain [9]. There is a decrease in the period 2010-2012, growth between 2013 and 2018, and drastic reductions from 2020 onwards due to COVID19 and the microchip crisis.

In the period 2002-2021, 22.9 million M1 vehicles were registered, with an annual average of 1.145 million vehicles per year, a figure very similar to the current fleet as shown in table 1. According to a report by BBVA-Research [10], the main factors that could affect car purchases are falling consumer income, increases and decreases in fuel prices, higher financing costs, increased uncertainty, product unavailability and advances in electric vehicle charging infrastructures.

#### b.- The scrapping of end-of-life vehicles.

Table 1 shows the evolution of the number of vehicles scrapped annually from 2010 to 2022 in Spain [9]. The cumulative total reaches ten million units (average annual scrapping: 0.759 million vehicles), which is lower than the number of new registrations per year during the same period (0.974 M), which has led to a continuous ageing of the fleet.

### 2.2.2 Indirect factors

Population between 19-75 years (.000)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	36.023	36.010	35.933	35.739	35.421	35.330	35.214	35.245	35.391	35.658	36.038	36.066	36.077
GDP Annual (M€)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	1.073	1.064	1.031	1.021	1.033	1.078	1.114	1.162	1.204	1.246	1.118	1.207	1.329
Var GDP (%)	0,2%	-0,8%	-3,0%	-1,4%	1,4%	3,8%	3,0%	3,0%	2,3%	2,0%	-11,3%	5,5%	5,5%
Average expenditure per person (€)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	11.275	11.280	11.012	10.715	10.780	10.981	11.312	11.726	12.018	12.151	10.848	11.779	12.780
Fleet volume Renting	2.010	2.011	2.012	2.013	2.014	2.015	2.016	2.017	2.018	2.019	2.020	2.021	2.022
	491.056	470.223	433.294	401.194	408.095	447.623	486.486	551.730	629.260	711.616	743.388	796.683	853.644
Weight over Total Park	2,5%	2,4%	2,2%	2,0%	2,0%	2,3%	2,6%	2,7%	3,1%	3,4%	3,4%	3,6%	3,8%

Table 2: Indirect factors [9] [11]

#### a.- Evolution of the population of driving age.

Based on the age pyramid of the Spanish population [11], the 19-75 age bracket fell during the period from 2014 to 2018, recovering in 2019, and remaining stable at around 36 million people from 2020 to 2022.

Population trend forecasts in Spain suggest that this stability will be maintained in the coming years. If anything, the greater sensitivity of the new generations to climate change may lead them to opt for vehicles with lower emissions. The ratio between the population and the vehicle fleet up to 2020 is 0.5, which indicates that Spain currently has one vehicle for every two inhabitants.

#### b.- GDP per capita.

Table 1 shows that over the last 20 years, GDP in Spain has experienced an average annual growth of 1.41% [11]. This factor has a major influence on the renewal and new registration of electric vehicles (EVs), due to the higher cost of EVs compared to traditional combustion vehicles. There is a clear relationship between GDP per capita and the share of EVs in the EU.

#### c.- Average expenditure per household and per person.

The average expenditure per person in Spain [11] has undergone slight variations over the last fifteen years (see table 2), so it is unlikely that there will be large variations in the future.

#### d.- Leasing evolution in Spain.

<sup>2</sup> Imports and exports of already registered vehicles have not been considered because they account for a very small percentage.

The vehicle purchase model through *leasing* is the one that has seen the greatest progression and growth in recent years (see Table 2). Data from the Spanish Association of Vehicle Renting (AER) [12] show sustained growth in recent years, although the relative weight it still has within the total fleet is small (3.58% in 2021). What is most remarkable is the weight that this sales model is acquiring in registrations in recent years, favoured by the opening of the model to private individuals, currently exceeding 25% of annual registrations. Registrations of vehicles using alternative energies (electric, hybrid, gas and hydrogen) are also increasing, rising from 1.06% in 2015 to 29.15% in 2021.

#### d.- Implementation of new legal regulations.

The EU has established various regulations with the aim of reducing emissions, setting targets for reducing the number of polluting vehicles and support for the development of charging infrastructure.

##### ▪ National Integrated Energy and Climate Plan

The European Climate Law of 2021 sets a target of 55% reduction of GHG emissions by 2030, including the transport sector. Spain, through the National Integrated Energy and Climate Plan, has the objective of reaching 5 million pure electric or plug-in hybrid vehicles by 2030, a clear qualitative determinant of the future evolution of the Spanish fleet.

The EU wants to ban the sale of vehicles with polluting propulsion systems by 2035. In 2021, Spain reached 3% of the target, which, translated into number of vehicles, means that 300,000 vehicles were on the road, including pure electric vehicles with battery and plug-in hybrids.

Sales of vehicles with alternative combustion systems in Spain are slower than in other European countries. The reasons that could explain this difference are:

- Limited support for the purchase of electric vehicles (EVs)..
- The final selling price of EVs is still high compared to traditional vehicles..
- The range of EVs is still low.
- The charging infrastructure is progressing at a slower pace than desired.
- The rising cost of electricity.

##### ▪ Low Emission Zones (LEZs) implementation. [13].

It affects all municipalities with more than 50,000 inhabitants, which, before the end of 2023, will have to approve sustainable urban mobility plans, promoting the use of public transport and non-polluting means of transport. These measures will have a clear impact on the vehicle fleet, both in terms of the type of vehicle that will circulate in these areas and the number of vehicles concentrated in them.

The LEZs regulate the access, circulation and restricted parking of vehicles according to their classification by pollution level, generating a greater scrapping of vehicles that are not suitable for use in these zones and a consequent reduction in the average age of the fleet. As we approach 2030, the limitations established will be increasingly demanding, with a progressive increase in demand and presence of non-polluting vehicles being foreseeable. Other consequences are: the rise of so-called personal mobility vehicles and the increase in demand for car sharing, an effect that may also favor a reduction in the volume of the fleet.

##### ▪ Euro 7 standard implementation.

The implementation of the new Euro 7 standard will set more stringent limits on GHG emissions and air pollutants for road transport in passenger cars, vans and heavy-duty vehicles, generating a market shift towards less polluting vehicles, mainly electric. Figure 3 summarizes the different factors analyzed and their impact on the evolution of the vehicle fleet.

FACTORS		Impact on the Vehicle fleet		Comments
Direct		Quantitative	Qualitative	
a.-	Registrations	↑↑↑	↑	Contributing factor to the direct increase in the fleet. The inclusion of different types of registered vehicles has not been considered in this section.
b.-	Scraped cars	↓↓	↓	Their increase leads to a shrinking fleet, an imbalance with registrations leads to a further ageing of the fleet.
Indirect or conditioning factors		Quantitative	Qualitative	
a.-	Evolution of the population with age susceptible to drive a vehicle	↑	↑	An increase or decrease in this population group would have a direct impact on potential car buyers.
b.-	Evolution of GDP. GDP per capita.	↑↑	↑	Greater wealth would increase users' purchasing potential as well as their choice of models or types.
c.-	Average expenditure per household and person.	↑	↑↑	Increased purchasing/spending power would increase the qualitative nature of purchasing/spending by widening choice.
d.-	Leasing evolution in Spain.	↓	↑↑	The values of sustainability, connectivity, electrification and digitalisation that they champion have a qualitative impact on the types of vehicles incorporated.
e.-	Implementation of new regulations: Integrated National Energy and Climate Plan.	↓↓	↑↑	The objectives set out in the new regulations are clearly oriented towards the development of a fleet made up of non-polluting vehicles and where the use of Public Transport is encouraged. The LEZs will restrict the widespread use of thermal vehicles. The entry into force of the new Euro 7, which is more demanding in terms of emissions for new vehicles, will also help to reduce emissions from the most polluting fleet.
	Entry into force of new LEZs.	↓	↑↑↑	
	Entry into force of new Euro 7.	↓	↑↑↑	

Table 3: Factors conditioning the evolution of the vehicle fleet. Source: Own elaboration.

### 3. RESULTS AND DISCUSSION

The following section estimates and analyses the possible evolution of the vehicle fleet in Spain over the coming years, both in number (quantitative analysis) and in the types of engines that make it up (qualitative analysis). The values obtained will make it possible to evaluate the different impacts that may be produced in terms of the economy, emissions, employment and ancillary automotive services. However, we should not forget the complexity and high level of uncertainty of our analysis, since, as Muratori et al. [14] point out, "The projection of personally owned vehicles is particularly challenging because decisions are made by millions of independent decision-makers who value different vehicle attributes, based on incomplete information and with limited financial flexibility".

Table 4 shows different estimates found in various reports published by reputable consultancy firms, allowing us to compare our results with those of these reports.

		ESTIMACIONES CUANTITATIVAS							
		2022		2025		2030		2035	
		Registrations K uds	Vehicle Fleet (M1) M uds	Registrations K uds	Vehicle Fleet (M1) M uds	Registrations K uds	Vehicle Fleet (M1) M uds	Registrations K uds	Vehicle Fleet (M1) M uds
Price Waterhouse (pwc) [17]	2018					+34%	-25%		
		Data from the Eascy Report at European level: 25% decrease in the fleet by 2030 and 34% increase in registrations. This would imply a significant renewal of the vehicle fleet.							
BNEF [18]	2021								
		39% of the fleet will still be made up of combustion vehicles in 2035.							
AUTOINFORM [19]	2021		22,6		23,4		24,8		
		Estimated annual growth between 1.1% and 1.2%. 0-5 year olds will not overtake the rest until 2026-2027. 1.5 M annual growth in registrations far from what is necessary. The fleet age is expected to continue to increase for a few more years.							
GANVAM [20]	2023	893		1.075		1.278			
		Forecast annual increases in registrations vs previous year: 2023 +16.2% - 2024 +7.6% - 2025 +5.8% - 2026 +5.4% - 2027 +3.7% - 2029 +2.8% - 2030 +2.6%.							

Table 4: Comparison of estimates from various reports and consultancy firms<sup>3</sup>. Source: Own elaboration.

### 3.1 Development forecasts: Quantitative and qualitative analysis

#### 3.1.1. Quantitative Analysis

Few references have been found in the scientific literature on forecasts of the evolution of the vehicle fleet in Spain. Using this first approach, we predict the evolution of the vehicle fleet in number from 2022 to 2035, by means of an equation in which the volume of the vehicle fleet in a given year is obtained by adding to the volume of the vehicle fleet in the previous year, the registrations and discounting the scrappages in the current year.

$$PV(t) = PV(t-1) + M(t) - A(t)$$

Being::

- PV(t): Vehicle fleet volume in year t.
- PV(t-1): Volume of the vehicle fleet in the previous year (t-1).
- M(t): Number of registrations in year t.
- A(t): Number of scrappages in year t.

The forecasts presented below are based on data compiled from scientific articles, studies and work carried out by specialist automotive consultants, market trends, as well as the first author's more than 30 years of professional experience in this sector. Likewise, in order to design the scenarios and establish the hypotheses, the last fifteen years have been considered, a figure that corresponds to the average age of the current fleet. In order to make our estimates, three scenarios have been defined with the following hypotheses:

<sup>3</sup> K: Miles, M: Millions

- E1: Intermediate model where registrations exceed scrappages by an average of 100,000 units per year, resulting in an average annual fleet growth of around 0.5%.
- E2: Model where registrations are below annual scrappages, leading to a slight decrease in the current fleet.
- E3: The fastest growing model where registrations exceed scrappages by an average of 138,000 units per year, which will generate a fleet growth of around 2 M vehicles by 2035.

According to our estimates, figure 1 shows that the number of vehicle fleet units in Spain could be anywhere within the ranges obtained for each year in the period 2022-2035.

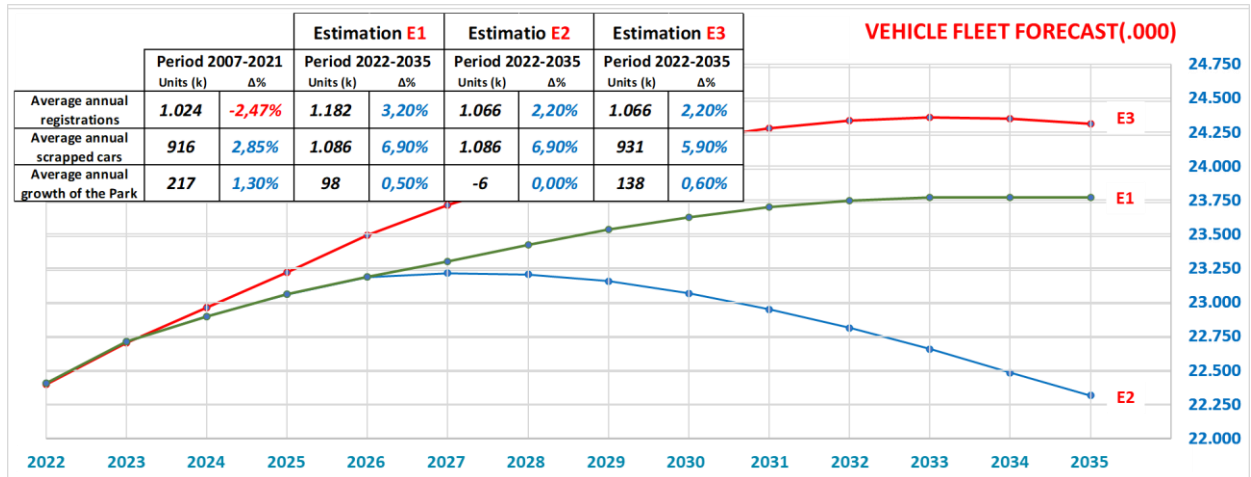


Fig. 1: Estimated evolution intervals of the vehicle fleet in Spain. Source: Own elaboration.

The results obtained are similar to the forecasts made by OVEMS (Observatorio del Vehículo Eléctrico y la Movilidad Sostenible - ICAI/ICADE - Figure 2) [15]:

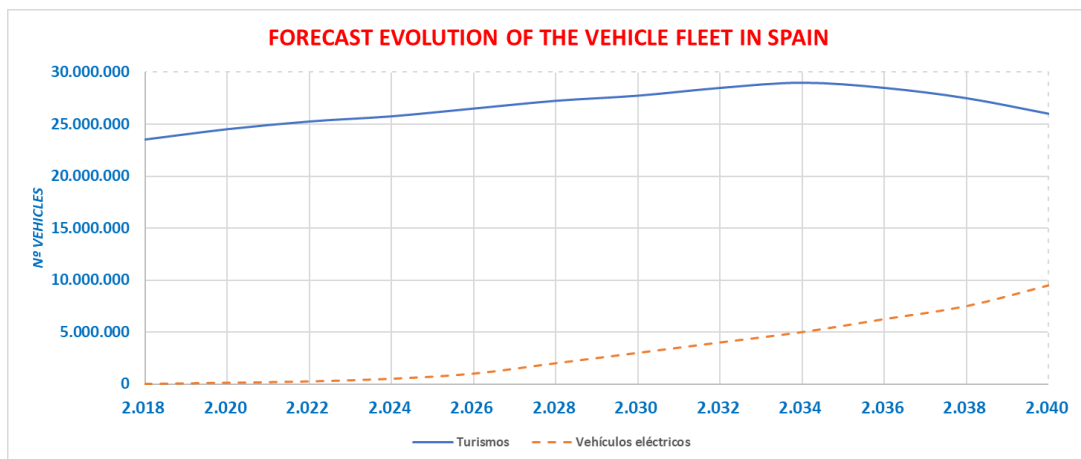


Fig. 2: Projection of the evolution of the vehicle fleet in Spain [15].

### 3.1.2 Qualitative Analysis

Most of the forecasts found in the literature are qualitative and refer to the percentages of the different types of engines. EVs are expected to gradually replace internal combustion engines (ICE) [14]. Figure 3 presents our forecasts for the qualitative evolution of M1 vehicle registrations in Spain over the next few years:

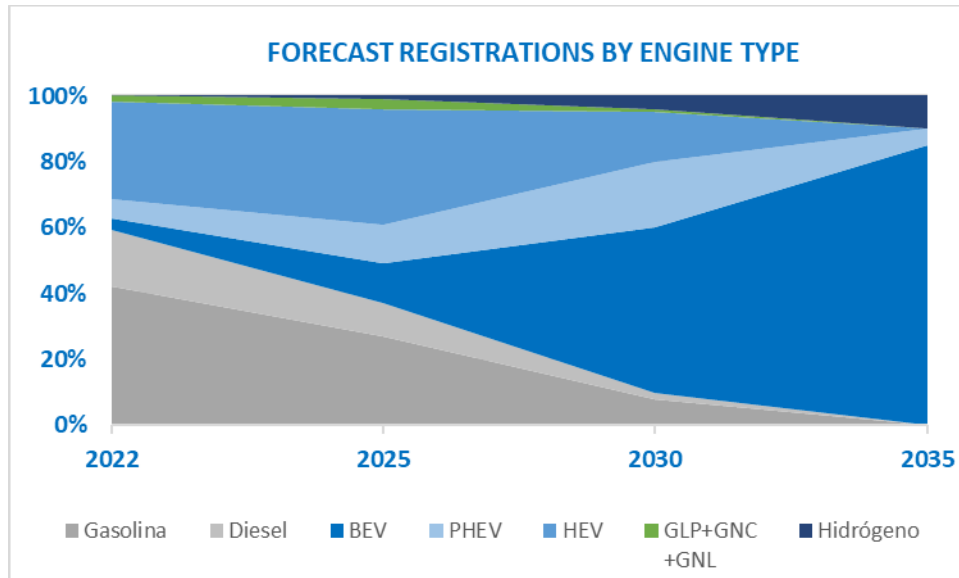


Fig. 3: Forecast development of registrations by engine type<sup>4</sup>. Source: Own elaboration

The results obtained show an evolution of the fleet similar to Deloitte's forecasts [16] shown in figure 4.

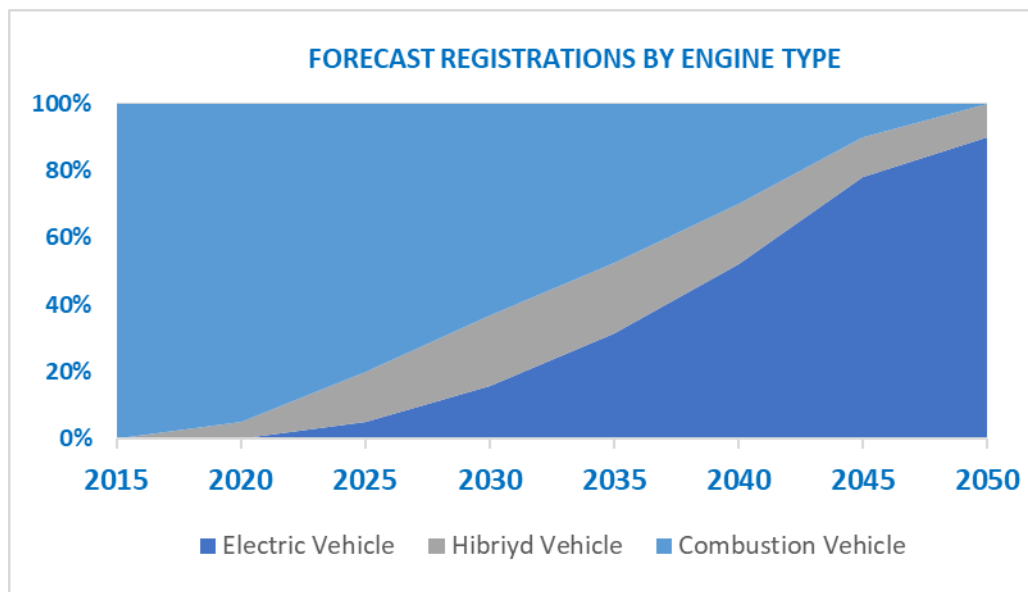


Fig. 4: Forecast of the evolution of vehicle registrations in Spain according to Deloitte [16].

<sup>4</sup> ICE: Internal Combustion Engine; BEV: Battery Electric Vehicle; PHEV: Plug-in Hybrid Electric Vehicle; HEV: Hybrid Electric Vehicle; GLP: Liquefied Petroleum Gas; GNC: Compressed Natural Gas; GNL: Liquefied Natural Gas

## 4. CONCLUSIONES

Based on the results obtained, a slow and progressive increase (average growth estimated at between 0.1% and 0.6%) in the Spanish vehicle fleet is foreseeable over the coming years, although lower than that experienced in previous decades (average growth of 1.2%). The progressive implementation of more low emission zones (LEZs) and the increase in taxes on vehicles with higher emissions will lead to an increase in the scrapping of this type of vehicle, which currently stands at around 0.8 million vehicles per year, which will foreseeably mean that scrapping will exceed the number of registrations. This situation will lead to a progressive decrease in the vehicle fleet and its average age. In addition, the growth in car sharing, as well as the increased use of public transport, will also contribute to this foreseeable reduction in the fleet.

As for the evolution of registrations, these will be very different according to the types of propulsion. The number of internal combustion engines is declining, with diesel vehicles falling more rapidly than petrol vehicles. The entry into force of the Euro 7 standard, scheduled for 2025, and the subsequent legal limitation of their production, initially set for 2035, will mark the possible end point for new additions of these models to the vehicle fleet. However, they will coexist with electric vehicles (EVs), estimated to account for around 40% of the fleet by 2035. It is to be expected that the presence of thermal engines will gradually diminish. On the other hand, if we add to the implementation of more ZBEs by municipalities, the growth of shared mobility and public transport, other factors such as the greater awareness of the new generations for the environment, the increase in the supply of lower-cost electrified vehicles, the greater weight of leasing and the greater development of autonomous driving, we can expect EV registrations to increase, either rapidly or incrementally, topping the sales of new vehicles. Initially, hybrid vehicles will be the protagonists of the transition, but over time they will be replaced by pure electric vehicles, and to a lesser extent by plug-in hybrids. By 2050, zero-emission vehicles are expected to make up 100% of the vehicle fleet.

As limitations of the study and its future developments, other factors such as progress in the implementation of charging infrastructure, battery range, or the price of electric vehicles are not included in this analysis.

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