

# Spain's booming hybrid electric vehicle market: A summary of supporting policy measures

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## Introduction

Sales of hybrid electric vehicles (HEVs) in the Spanish market have seen a much faster uptake than in most countries of the European Union (EU). Between 2017 and 2018, sales of hybrid electric passenger cars increased by 36% to almost 75,800, one of the highest absolute sales numbers recorded among the EU Member States (European Automobile Manufacturers Association [ACEA], 2019a). This paper provides an overview of the development of the HEV market in Spain. It quantifies the growth in HEV sales across Spain and its regional markets, and describes key policies at the national, regional, and local levels.

HEVs represent a viable interim solution for the transition to a low-carbon transport system, helping to achieve global greenhouse gas (GHG) and local air pollution reduction targets. At the same time, HEVs can help vehicle manufacturers reduce the average carbon dioxide (CO<sub>2</sub>) emissions of their new car fleets to ensure compliance with regulations, such as the EU CO<sub>2</sub> target of 95 grams (g) of CO<sub>2</sub> per kilometer (km) for 2021 (International Council on Clean Transportation, 2019). From a technological perspective, HEVs are powered by an internal combustion engine running on gasoline or diesel with one or more supplementary electric motors fed by energy stored in batteries. The battery cannot be recharged from the electricity grid, unlike in plug-in hybrid electric vehicles

(PHEVs), but the electric power train is capable of moving the vehicle on its own, unlike in mild HEVs. Compared to a conventional gasoline and diesel car, HEVs can reduce fuel consumption and CO<sub>2</sub> emissions by up to 35% (German, 2015). In contrast to battery electric vehicles (BEVs) and PHEVs, another advantage is that HEVs do not rely on recharging infrastructure.

Figure 1 compares the HEV market share in selected EU countries from 2001 to 2018. The countries reflect those markets where absolute HEV sales exceeded 20,000 in 2018. Among those countries were France, Germany, Italy, the Netherlands, Spain, and the United Kingdom. As shown in Figure 1, Spain plays a major role in growing the HEV market in the EU. With almost 75,800 HEVs sold in 2018, Spain accounted for 13% of the HEV sales in the EU, over 4 percentage points more than its almost 9% share of total passenger car sales. Sales of hybrid electric passenger cars have climbed steadily in Spain since 2001, with the exception of a slight drop between 2012 and 2014, and have significantly increased since 2014. By the end of 2018, HEV sales reached 5.7%. This share was surpassed only by Sweden (5.8%), Lithuania (7.2%), and Finland (9.8%), however fewer vehicles in terms of absolute numbers were sold in these markets due to their smaller market size (ACEA, 2019a). In the Netherlands, similarly high HEV market shares were recorded as early as

2009. This development was mainly driven by substantial tax exemptions: From mid-2006 until 2010, purchasers of HEVs received a one-time bonus on registration, ranging between €2,500 and €6,000 depending on the year. Until 2014, owners of a gasoline HEV emitting less than 110 g CO<sub>2</sub>/km also were exempt from paying the regular motor vehicle tax. In addition, in 2008, a lower rate for taxing low-emission company cars was introduced. For example, the rate for a gasoline HEV emitting up to 95 g CO<sub>2</sub>/km was 14% of the catalogue price compared to 25% for a conventional gasoline or diesel car (Tax and Customs Administration, n.d.; International Energy Agency, n.d.).

A combination of national, regional, and local policies distinguishes the Spanish market from other European markets. These include environmental car labeling, incentive programs for purchasing low-emission vehicles, access to low-emission zones (LEZs), and discounts on parking and road tolls. The impact of these policies has been reinforced by the announcement and implementation of bans for high-emission vehicles in urban centers. All of these key policies have helped to spur and shape the HEV market in Spain.

The following sections describe the development of the Spanish HEV market, focusing on policies that may be associated with their continuous uptake.

### Market Development

HEV sales in Spain increased from 0.7% in 2010 to 5.7% in 2018. Following the diesel emissions scandal, Spain saw a major drop in new diesel registrations with a decrease of 21% between 2015 and 2018. This paved the way for a corresponding increase in sales of gasoline vehicles and HEVs by almost 18% and 3%, respectively (Mock, 2018; ACEA 2019a, 2019b).

Figure 2 and Figure 3 provide a closer examination of HEV registration and market share by regional markets in Spain, including the 17 autonomous communities and the two autonomous cities Ceuta and Melilla. Figure 2 shows that in 2018, the greatest number of HEVs were registered in the community of Madrid with almost 30,400 new HEVs sold. This was followed by the communities of Catalonia (approximately 12,400), Andalusia (more than 8,400), and Valencia (6,200). The growth rates from 2017 to 2018 show wide variations, ranging between -1% (Ceuta and Melilla) to +99% (Canary Islands). In fact, 12 out of the 19 autonomous communities saw HEV growth of more than 25% (Asociación Española de Fabricantes de Automóviles y Camiones [ANFAC], 2018, 2019a).

In terms of market share, three Spanish communities registered the highest HEV shares in 2018 (see Figure 3). In Catalonia, La Rioja, and Ceuta and Melilla the share was more than 5%. Despite accounting for the highest relative shares of new HEV registrations in 2018, the autonomous community La Rioja and the autonomous cities Ceuta and Melilla recorded the lowest number of HEV sales in absolute numbers—about 420 and 135 respectively—because of the relatively small size of the market. On the contrary, Catalonia had the highest HEV share and at the same time the second highest number of total HEV registrations with 12,400 (ANFAC, 2019a).

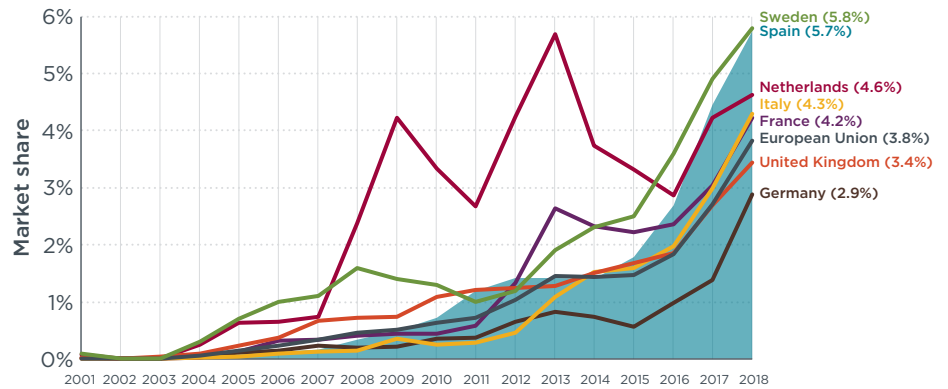


Figure 1. Market share of new hybrid electric passenger cars in selected EU countries up to the end of 2018 (Mock, 2018; ACEA, 2019a, 2019b).

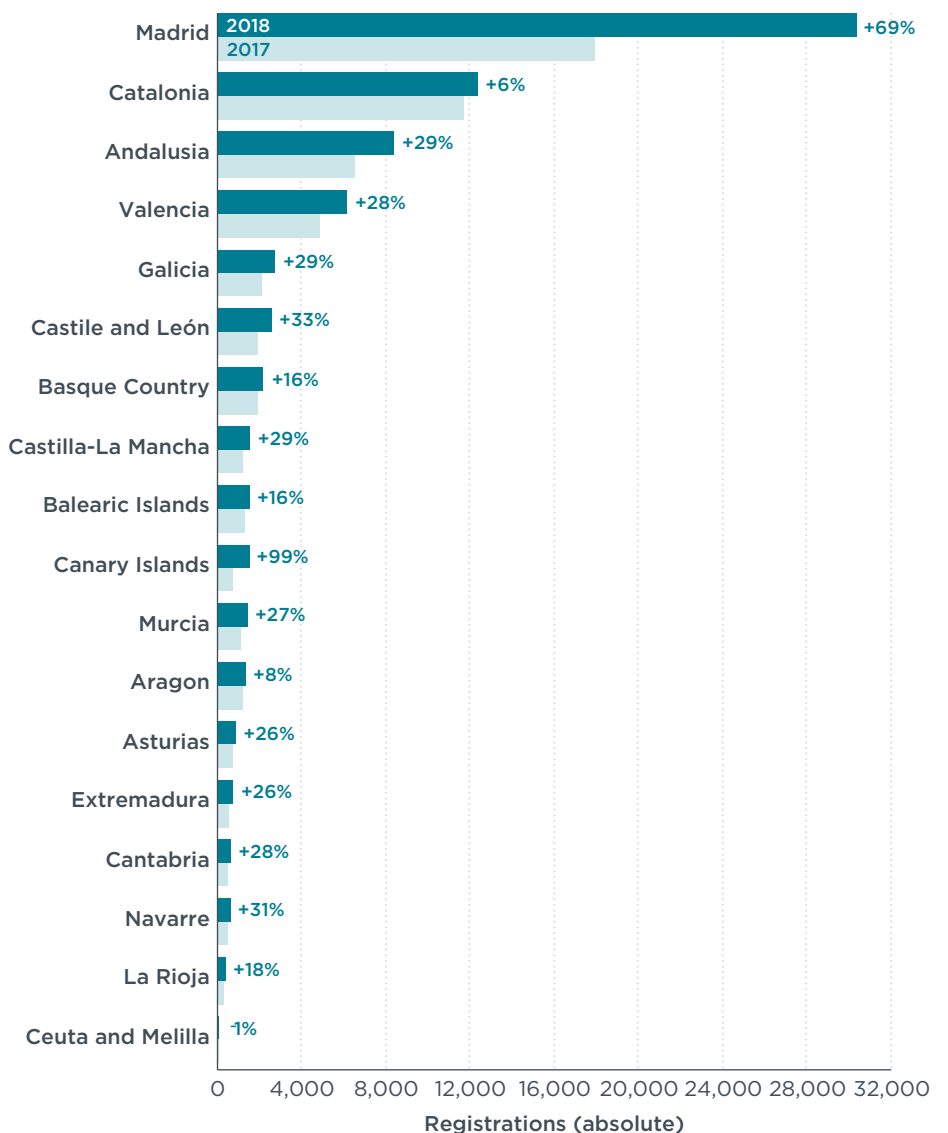


Figure 2. New HEV registration in the Spanish autonomous communities/cities from 2017 to 2018, including hybrid electric quadricycles, commercial and industrial vehicles, and buses (ANFAC, 2018, 2019a).

The number of vehicles sold is also closely linked to the availability of different models on the market (Slowik & Lutsey, 2018). Figure 4 shows the total number of HEV registrations in relation to HEV models available in Spain, plotted for the 2001 to 2017 time frame (Mock, 2018). The figure illustrates that between 2001 and 2011, both the number of HEV registrations and the availability of HEV models continuously increased. Despite an increasing number of HEV models available on the Spanish market, HEV registrations stagnated between 2011 and 2013. Starting in 2014, HEV registrations went up significantly whereas model availability dropped in 2016. The development since 2011 indicates that other aspects in addition to model availability seem to influence consumers' purchase decisions.

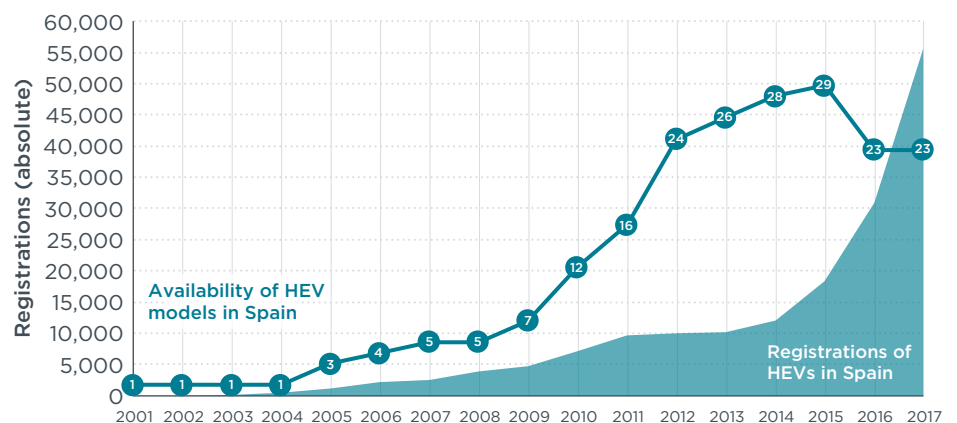
Next to the increasing offer of HEV models, the development of the HEV market in Spain as described above is based also on a comprehensive mix of policy measures at the national, regional, and local levels. The following sections describe in more detail the underlying factors that may have contributed to spurring the HEV market in Spain.

## Policy Background

According to the Effort Sharing Regulation, which requires each Member State to reduce GHG emissions, Spain must reduce national GHG emissions by 26% by 2030 compared to 2005 levels (European Commission [EC], 2018). However, at the national level, the Spanish government has not set a binding CO<sub>2</sub> reduction target for the transport sector. Despite this lack, there are various programs and strategies defining local, regional, and national policies to reduce GHG emissions from transport, such as the Climate Change and Clean Energy Strategy 2007–2012–2020 (Government of Spain, 2007a). Meanwhile, the National Plan for Air Quality 2017–2019 defines reduction targets for specific pollutant emissions, for example that emissions



**Figure 3.** Share of newly registered HEVs by Spain's autonomous communities in 2018, including hybrid electric quadricycles, commercial and industrial vehicles, and buses (ANFAC, 2019a).



**Figure 4.** Sales of HEVs in relation to HEV models available in Spain, from 2001 to 2017 (Mock, 2018). Due to a lack of robust data on HEV model availability in Spain, we consider the number of different HEV models customers bought. We assume that if a HEV is for sale on the market, it will likely be purchased at least a certain number of times.

of nitrogen oxides (NO<sub>x</sub>) shall be reduced by 41% compared to 2005 levels in 2020, and by 62% as of 2030 (Government of Spain, 2017).

Policies for the uptake of HEVs can be found mostly at the regional or local level, such as part of local mobility strategies. For example, the Air Quality and Climate Change Plan (short Plan A) of the city of Madrid, approved by the City Council in September 2017, includes a policy

measure specifically aiming at the uptake of HEVs in taxi fleets through incentive programs (City Council of Madrid, 2017). The strategy calls for grants for the acquisition of clean vehicles or the renewal of municipal fleets including HEVs. The Plan for Energy, Climate Change and Air Quality of Barcelona 2011–2020 also encourages new technologies, specifically the increased incorporation of HEVs in municipal fleets (City Council of Barcelona, 2011).

## Environmental Car Labeling

An important measure spurring alternative fuel vehicle adoption and improving air quality in cities and regions in the Spanish market is environmental car labeling. In April 2015, the Spanish traffic authorities (DGT) published a guideline for labeling zero-emission vehicles. This was followed in April 2016 by a directive classifying vehicles in four categories according to their level of pollution (see Table 1) (Ministry of Interior, General Directorate of Traffic, 2015). According to this directive, HEVs are classified under the ECO label. The four different categories of the environmental car labeling are applied to determine, for example, local and regional subsidy amounts for the purchase of a new vehicle or to regulate access to LEZs such as in Madrid or Barcelona (see following sections). The labels are stickers that generally can be voluntarily displayed on the windshield. In Madrid, since April 2019, the labels have been mandatory for owners of all motor vehicles that access, circulate, or park in the municipality of Madrid (City Council of Madrid, 2018a).




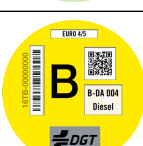
## Incentives and Other Benefits

In the past, the Spanish central, regional, and local governments have introduced a variety of programs to promote the purchase of alternative fuel vehicles (AFVs), including natural gas-powered vehicles using liquified petroleum gas (LPG) and compressed natural gas (CNG), HEVs, and electric vehicles—BEVs, PHEVs, range extended electric vehicles (REEVs), and fuel cell electric vehicles (FCEVs).

### INCENTIVES AND BENEFITS AT NATIONAL/REGIONAL LEVEL

Between 1994 and 2007, the Spanish government provided benefits on registration tax for the replacement of an older vehicle in favor of any new

**Table 1.** Classification for passenger cars and light commercial vehicles in Spain (Ministry of Interior, 2016).

Classification	Badge	Eligible cars
<b>Zero-emission label</b>		<ul style="list-style-type: none"> <li>Battery electric vehicles (BEVs)</li> <li>Range extended electric vehicles (REEVs)</li> <li>Plug-in hybrid electric vehicles (PHEVs) with minimum range autonomy of 40 km</li> <li>Fuel cell vehicles (FCVs)</li> </ul>
<b>ECO label</b>		<ul style="list-style-type: none"> <li>Plug-in hybrid electric vehicles (PHEVs) with a range autonomy less than 40 km</li> <li><b>Hybrid electric vehicles (HEVs)</b></li> <li>Liquified petroleum gas vehicles (LPGs)</li> <li>Compressed natural gas vehicles (CNGs)</li> </ul>
<b>C label</b>		<ul style="list-style-type: none"> <li>Gasoline Euro 4, 5 and 6</li> <li>Diesel Euro 6</li> </ul>
<b>B label</b>		<ul style="list-style-type: none"> <li>Gasoline Euro 3</li> <li>Diesel Euro 4 and 5</li> </ul>
<b>A label</b>	No badge	<ul style="list-style-type: none"> <li>Gasoline cars produced before 2000</li> <li>Diesel cars produced before 2006</li> </ul>

vehicle including HEVs. These benefits were granted in the framework of the Renove Plan (1994–1996) and PREVER Program (1997–2007) (Government of Spain, 1994, 1997).

In November 2008, the Spanish government announced a new aid program under the name VIVE Plan (Innovative Vehicle-Ecological Vehicle). The 2-year program aimed at replacing vehicles older than 10 or 15 years in favor of a new or second-hand passenger car with a maximum age of 5 years. Special financing conditions were offered to purchasers of passenger cars rated up to 140 g CO<sub>2</sub>/km. This benefit included that the first €10,000 of the amount of the vehicle's purchase price could be financed without cost, which is to say with an interest rate of 0%. For example, the purchaser of a vehicle with a purchase price of €20,000 would have paid a monthly fee of €63 instead of €125, assuming an interest rate of 7.5%. The maximum purchase price was capped at €30,000. Eligibility for the grants was limited

to individuals, freelancers, and small- and medium-sized businesses (Government of Spain, 2008a, 2008b).

Between 2009 and 2010, the Plan 2000 E provided grants for the purchase of new passenger cars and commercial vehicles as well as used vehicles up to 5 years old. Purchasers of a passenger car emitting up to 149 g CO<sub>2</sub>/km, including HEVs, could receive a minimum one-time bonus of €1,500, the cost of which was split between the national government (€500) and the car manufacturers or importers (€1,000) (Ministry of Industry, Tourism and Trade, 2009). In addition, autonomous communities could supplement that amount with additional funding. For example, Aragon, Asturias, Cantabria, and Murcia provided additional funding. In contrast, Madrid and La Rioja did not contribute to the plan, rather incentivizing the acquisition of low-emission vehicles by providing exemptions on registration tax. In the case of Galicia, the decision was in favor of its own regional funding program for



passenger cars including HEVs. Grant eligibility extended to individuals as well as micro-, small-, and medium-sized businesses (“Plan 2000 E,” 2009).

In 2012, the Spanish government set up two further national scrapping schemes to promote the substitution of old vehicles including financial assistance for the purchase of HEVs:

- One program entitled PIVE (Efficient Vehicle Incentive Program) included eight separate campaigns, the first one (PIVE 1) started in October 2012 and the last program (PIVE 8) began in May 2015. The program aimed at incentivizing the scrapping of passenger cars over 12 years old and light commercial vehicles more than 10 years old, then replacing them with any new vehicle, including AFVs and conventional gasoline and diesel vehicles. Under this scheme, buyers of a HEV originally received a one-time bonus of at least €2,000—a €1,000 subsidy funded by the national government plus a minimum discount of €1,000 provided by the manufacturer/importer at the point of sale. For the seventh phase of the scheme (PIVE 7), the minimum total incentive was reduced to €1,500, again split equally between government and the manufacturers. During the PIVE program term between October 2012 and July 2016, more than 15,700 purchasers of HEVs—which is to say almost every fourth purchaser received approval for grants. (“Beneficiarios ayudas,” n.d.).
- The second scrapping program, called PIMA Aire (Plan for Promotion of the Environment), aimed to replace commercial vehicles at least 7 years old with new vehicles up to 1 year old. Buyers of commercial AFVs, including HEVs weighing less than 2,500 kg, received

a national one-time subsidy of €1,000, whereas those in the market for a vehicle equal to or heavier than 2,500 kg were eligible to receive €2,000. The program was divided into four phases. The first phase (PIMA Aire 1) started in February 2013 with the last one (PIMA Aire 4) commencing in November 2014 (Associació Empresarial de Tallers de Reparació i Venedors d’Automoció [ASTAVE] 2014, 2015; Plan PIMA-Aire, n.d.).

Between 2009 and 2017, additional national programs provided incentives in the form of one-time bonus payments for the acquisition or lease of low-emission vehicles. These programs—Plan MOVELE, Plan MOVEA, and Plan MOVALT—included a total of 10 separate rounds of funding. Eligible vehicles for a grant included AFVs, however HEVs were not included in these programs (Government of Spain, 2011; Ministry of the Presidency, 2015; Ministry of the Presidency and for territorial administrations, 2017; Plan MOVALT Vehículos, n.d.). A new scrapping scheme (MOVES Plan) was approved in mid-February 2019, granting aid for the purchase of electric vehicles. Like the previously mentioned programs, purchasers of a HEV do not benefit from a one-time bonus payment granted by the national government (Government of Spain, 2019).

### **INCENTIVES AND BENEFITS AT THE REGIONAL AND LOCAL LEVELS**

Some regional and local authorities in Spain also provide financial assistance for the acquisition of new low-emission vehicles. Four specific examples are:

1. The city of Madrid grants help for the renewal of the local vehicle fleet in different programs. Over the years, the city has for example targeted the taxi sector,

providing grants for scrapping an old car in favor of a low-emission vehicle including HEVs. The latest program, TAXIFREE 2018, provided grants for HEVs of €1,000 for taxis or €3,000 for eurotaxis adapted for people with reduced mobility that were registered between June 2017 and July 2018, but only for those running on gasoline fuel (City Council of Madrid, 2016, 2018b, 2018c).

2. At a regional level, the autonomous community of the offers two plans that do include grants for HEVs—the PIAM Plan (Auto-taxi Incentive Plan) and the PIVCEM Plan (Incentive Plan for light commercial, efficient, auxiliary and service vehicles). The PIAM Plan, first launched in November 2013, initially provided €2,000 for licensed taxi services replacing a vehicle with a new HEV. In 2018, the grant aid was €3,000 for vehicles eligible for an ECO label, including HEVs (Community of Madrid 2013, 2018). In 2014, the autonomous community of Madrid also launched a plan for the renewal of light commercial vehicles aiming at small- and medium-sized companies and self-employed workers (PIVCEM Plan). In 2018, purchasers of a light commercial vehicle eligible for an ECO label including HEVs received a one-time payment of €3,000 (Community of Madrid 2014, 2018).
3. In the autonomous community of Catalonia, taxi services, vehicles for commercial use, and other service vehicles that operate in the region’s special areas of atmospheric protection also receive a one-time grant on car purchase. In 2018, buyers of a gasoline HEV with emissions of up to 60 milligrams (mg) NO<sub>x</sub>/km, and which fulfills the Euro 6

emissions limit<sup>1</sup> or higher, qualified for a subsidy of €1,000 per car. The regulatory base for subsidies for the promotion of the acquisition of low-emission vehicles was first approved by the regional government of Catalonia in October 2014 (Government of Catalonia, 2016, 2018).

4. The government of the autonomous community Castilla-La Mancha also offers funding for the acquisition of alternative fuel vehicles including HEVs, targeted at companies, individuals, and local entities alike. The one-time bonus amount for the purchase of a HEV in this case is €3,000 for applications submitted between August 2018 and May 2019. The regulatory base for the subsidies was established in early 2016 (Castilla-La Mancha, 2018; Ministry of Economy, Business and Employment, 2017).
5. In February 2019, the Basque government announced a new aid plan for the renewal of the regional vehicle fleet. Scrapping a car at least 10 years old in favor of a HEV will be financially supported with a one-time grant amount of €2,250. The maximum price for a new HEV is capped at €25,000. Individuals, companies, and municipalities are eligible for these grants (Basque Government, 2019).

These local and regional incentive programs, of which only a selected sample have been mentioned, reduce the costs of new vehicle acquisition. As an example, the Toyota Yaris, available as a gasoline as well as a hybrid electric variant on the Spanish market, has a sales price of €14,450 including value added tax (VAT), for the gasoline

variant, or €17,150 for the hybrid electric variant. Only in the city of Madrid and the autonomous community of Castilla-La Mancha would the €3,000 bonus make the purchase cost of a hybrid electric car similar to the comparable gasoline Toyota Yaris model. In the Basque Country and Catalonia, the hybrid variant would still cost €450 or €1,700 more, respectively.

In the past, other Spanish regions offered one-time bonus payments for the purchase of a HEV. These included the following examples, which also represent only a sample of autonomous communities and relevant actions:

1. In 2008, the Valencian Energy Agency announced a program to incentivize the acquisition of energy efficient vehicles. Under the program CO<sub>2</sub>TXE 2008 purchasers of a HEV received a maximum bonus of €2,000. Eligible for a grant were legal entities or natural persons whether they were private or public. The program was relaunched on a yearly basis between 2009 and 2011, with HEVs receiving a maximum bonus of €2,300 (Valencian Community, 2008, 2009).
2. Andalusia incentivized the purchase of a HEV starting in August 2005. Initially, 50% of the price difference between a conventional vehicle and a hybrid car was covered by the Andalusian Energy Agency, with a maximum one-time bonus of €3,000. Companies, administrations, and individuals all benefited from the bonuses. Between 2008 and 2010, almost 1,700 HEVs were subsidized by the Andalusian Energy Agency, the majority in the city of Seville (about 580) and Malaga and Cádiz (about 280 and 250, respectively). About 340 subsidies across Andalusia were requested by the taxi sector within these two years (Bolaños, 2006; “Unos 1.700 andaluces,” 2019).

3. Castile and León was the first autonomous region in Spain to implement an aid program for the acquisition of AFVs. In December 2001, it was ratified that companies, self-employed persons, individuals, associations, and nonprofit organizations as well as local entities could receive a grant for the acquisition of a HEV up to a maximum amount of €4,800 (Board of Castile and León, 2001).

4. The autonomous region of Extremadura set the regulatory base for purchase incentives including HEVs in April 2009. The grant amount was 15% of the vehicle's price including VAT, with a maximum aid of €2,300 for HEVs. Eligible persons included individuals or micro-, small-, and medium-sized businesses. Between 2009 and 2012, about 120 purchasers of HEVs received incentives in the autonomous community of Extremadura (Board of Extremadura, 2012; “Las ayudas para la compra,” 2012).

In addition to national, regional, and local incentives in the form of one-time bonus payments on car purchases, some regional and local authorities in Spain provide additional incentives for drivers of low-emission vehicles, further reducing the cost of owning a low-emission car compared to conventional gasoline or diesel cars. For example, the government of the autonomous community of Catalonia offers discounts on motorway tolls for low-emission vehicles including HEVs. Drivers of HEVs that meet Euro 6 or higher are granted a 30% discount on the regular road toll, reducing the costs for using road infrastructure (Department of Territory and Sustainability, n.d.).

The city of Madrid also offers discounts on parking that apply specifically to drivers of HEVs. In mid-2014, the city introduced a regulated car parking scheme in certain areas of

<sup>1</sup> Euro Emission Limits define limit values for exhaust emissions of new passenger cars and light commercial vehicles sold in Europe. Emission limits range from Euro 1 to Euro 6, with Euro 6 differentiating between Euro 6a, 6b, 6c, and 6d.

the city aimed at making better use of public space, easing parking congestion, and reducing the number of high-emission vehicles entering these zones. The parking fees are composed of a base rate with discounts or surcharges dependent on a vehicle's emission level. If driving a HEV, the base parking rate is reduced by 50% (City Council of Madrid, 2018d).

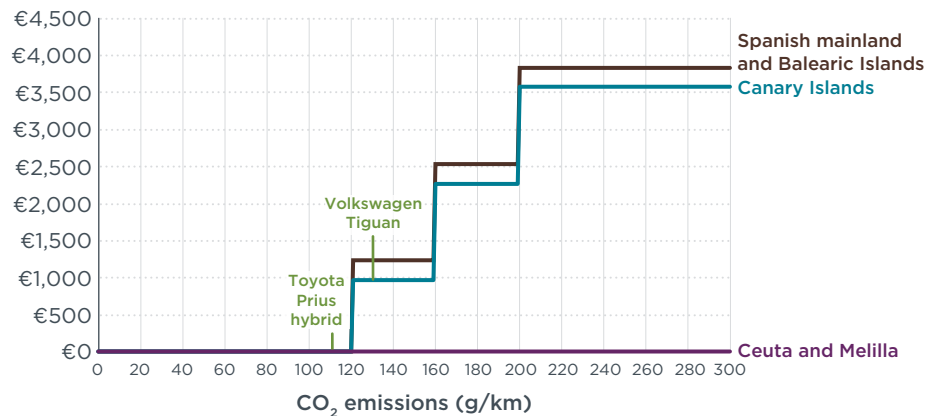
## Tax Incentives and Benefits

Both buyers and owners of HEVs in Spain also benefit from certain tax exemptions.

### TAXES ON CAR PURCHASE

Purchasers of a new car in Spain pay 21% VAT on car purchases, although there is an exemption for the Canary Islands. In March 2019, the Parliament of the Canary Islands approved the proposal of a law that eliminates the 7% General Indirect Canary Tax (IGIC) on goods and services (similar to VAT) for alternative fuel vehicles including HEVs with emissions up to 110 g CO<sub>2</sub>/km, reducing the initial vehicle costs (ANFAC, 2019b).

Buyers of a new car in Spain pay a one-time registration tax to the National Tax Agency when registering a vehicle for the first time. The tax is based on a vehicle's CO<sub>2</sub> emissions and is divided into four bands. Each tax band defines a certain percentage applied to the sales price. Since January 2008, registration tax is based on CO<sub>2</sub> emissions. Vehicles emitting up to 120 g CO<sub>2</sub>/km are exempt from the registration tax. Above 120 g CO<sub>2</sub>/km, the tax rates range from 4.75% to 14.75% for buyers on the Spanish mainland or the Balearic Islands, whereas rates for the Canary Islands are slightly lower. The cities of Ceuta and Melilla do not levy tax on new registrations (Government of Spain, Tax Agency, n.d.; Government of Spain, 2007b). Figure



**Figure 5.** One-time registration tax in the autonomous communities/cities of Spain for 2019 based on a car with a sales price of €26,000 (average sales price of a newly registered car in Spain in 2017) (ACEA, 2018).

5 illustrates the registration tax applicable to the autonomous communities on the Spanish mainland, the Balearic Islands, the Canary Islands, and the cities of Ceuta and Melilla for a car purchase price of €26,000, the average price of a new vehicle registered in Spain in 2017 (Mock, 2018). For example, the purchaser of a Toyota Prius hybrid in this price segment, emitting 112 g CO<sub>2</sub>/km (according to the New European Driving Cycle, or NEDC) would not have to pay registration tax across Spain. In contrast, the registration tax would be about €1,000 or €1,250 for a vehicle equivalent in price but with emissions between 121 and 159 g CO<sub>2</sub>/km (e.g., the Volkswagen Tiguan, emitting 128 g CO<sub>2</sub>/km according to NEDC).

### TAXES FOR OWNING A VEHICLE

In addition to tax exemptions on registration of cars emitting up to 120 g CO<sub>2</sub>/km, many municipalities or regions in Spain offer reductions to owners of a HEV on the annual ownership tax. The rate payable depends on the taxable horsepower of a car, the vehicle age, and the municipality in which the car is registered. Generally, each city in Spain sets its own rates. The reduction rate city councils can apply for HEVs can be as much as 75%, based on a decree by the Spanish government in 2004 (Government

of Spain, 2004). The length of time that the reduction rate applies varies widely. For example, in the city of Madrid, the benefit is 75% during the first six years after registration. In the city of Seville, the same reduction applies but only for the first four years, whereas cities such as Barcelona grant a 75% reduction for HEVs (gasoline hybrid up to 120 g CO<sub>2</sub>/km) without a time limitation. In contrast, the city of Valencia does not provide reductions on ownership tax for HEVs (City Council of Madrid 2018e, 2018f; City Council of Seville, 2018; Municipal Tax Institute of Barcelona, 2018; City Council of Valencia, n.d.).

Figure 6 illustrates the ownership tax to be paid in the two largest Spanish cities in terms of population, Madrid (for the first six years of ownership) and Barcelona. In Madrid, yearly rates for conventional gasoline and diesel passenger cars range between €20 and €224, and between €23 and €217 in Barcelona, whereas yearly rates for eco-friendly vehicles are only €5 to €56 in Madrid and €6 to €53 in Barcelona. For example, in Madrid the owner of a hybrid Toyota Yaris with a taxable horsepower of 11.2 pays annually just €15 for the first six years. The owner of the same model in the gasoline version with the same taxable horsepower would pay a higher yearly rate of €59.

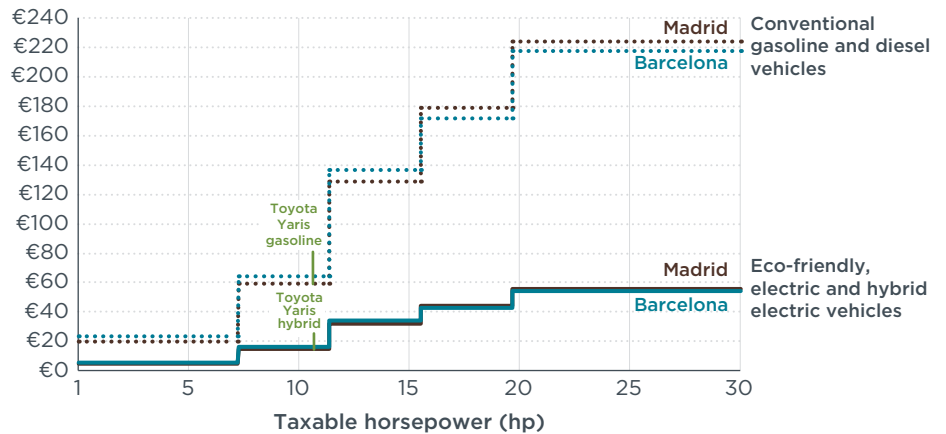
**TAXES FOR CONSUMING FUEL**

In general, fuel taxes in Spain are the sum of three components: 21% VAT; a general state tax, which is 30.7 cents per Liter (ct/L) for diesel fuel and a higher rate of 40.1 ct/L for gasoline fuel (unleaded 95 gasoline); and a special hydrocarbon state tax of 7.2 ct/L (applied to both fuels). As a consequence of the lower general tax for diesel fuel, the taxation share in the consumer end price for fuel is only 48% for diesel versus 55% for gasoline as of March 18, 2019 (Head of State, 2018; State Agency, 2018; EC, 2019a).

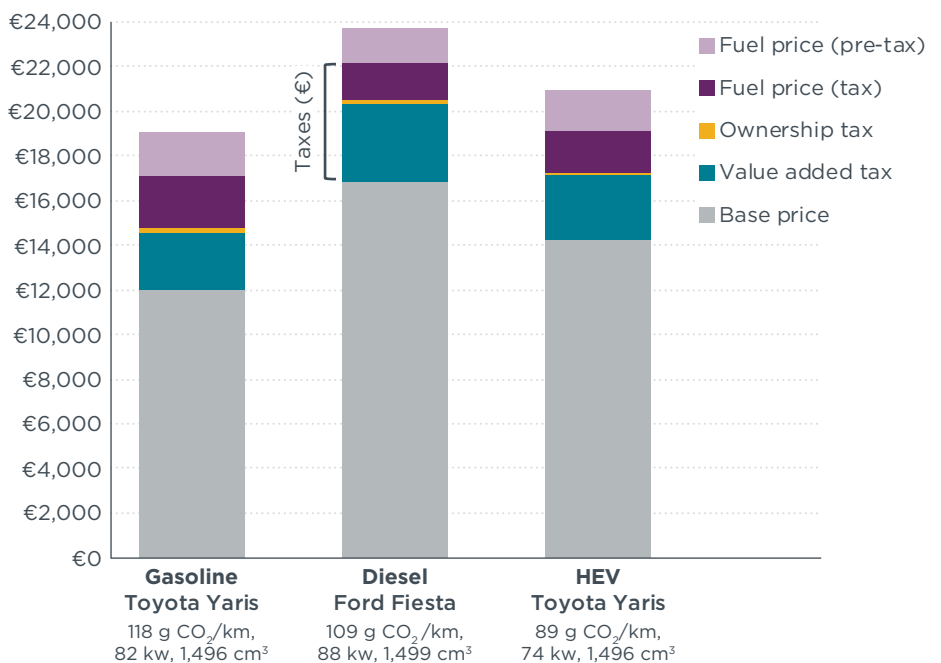
Because HEVs can reduce fuel consumption by up to 35%, total costs (including taxes) are lower if comparing a conventional diesel car with a diesel HEV, or a conventional gasoline car with a gasoline HEV, respectively. Although diesel HEVs benefit from cost advantages on fuel costs compared to gasoline HEVs, because of the lower fuel taxes, the effect of this difference on purchase decisions is negligible due to a lack of diesel HEVs on the market.

**COMPARISON OF TAXATION LEVELS ON OWNERSHIP COSTS**

The effects of different taxation levels on ownership costs from the perspective of a private consumer are illustrated in Figure 7. For comparison, we chose a Toyota Yaris, which is available as a gasoline and gasoline hybrid electric model on the Spanish market, and a diesel car, the Ford Fiesta. We have assumed a four-year ownership period and a 6% discount rate, in line with similar studies (Wappelhorst, Mock, & Yang, 2018). We consider the one-time costs on car purchase (base price, VAT, registration tax), annual cost of ownership (ownership tax), and fuel costs, differentiated by pre-tax and tax price. The quoted CO<sub>2</sub> emission levels of the cars are according to NEDC. To reflect vehicle real-world consumption for fuel cost calculation, the NEDC fuel consumption for the HEV and conventional



**Figure 6.** Annual ownership taxes for car owners living in Madrid (first 6 years) and Barcelona in 2019.



**Figure 7.** Four-year consumer ownership costs for a private car registered in the city of Madrid.

gasoline and diesel vehicle was multiplied by adaption factors of 1.5, 1.36, and 1.40, respectively (Riemersma & Mock, 2017; Plötz, Funcke, & Jochem, 2017). Fuel prices as of February 25, 2019, were used, assuming an average distance traveled per year of 13,000 km<sup>2</sup> (ACEA, 2017; EC, 2019b).

Considering these assumptions and comparing acquisition costs of the

three vehicle models—including base price and VAT (registration tax does not apply because the selected vehicles emit less than 121 g CO<sub>2</sub>/km)—the hybrid electric Toyota Yaris turns out to be more than €2,700 more expensive than the gasoline model, but more than €3,100 cheaper than the diesel Ford Fiesta. After the first four years of ownership, the Toyota Yaris hybrid is the second-costliest option, at €20,900, resulting in a four-year cost advantage of almost €2,800

2 Official statistical data for Spain was not available, so the European average was used.



toward the diesel and a cost disadvantage of approximately €1,900 toward the gasoline car. Hence, this particular case provides an indication that vehicle taxation for private households alone does not offer enough benefits for consumers to opt for a HEV.

### TAXES FOR THE PRIVATE USE OF A COMPANY CAR

In addition to tax benefits for HEVs in private ownership, there are also advantages for company car users. For example, employees in Spain privately using a company car usually must declare the “benefit in kind” as income on their tax calculations. In such cases, employees benefit from reduced income tax rates on hybrid cars compared to a conventional gasoline or diesel car. Generally, the yearly taxable benefit in kind is 20% of the vehicle’s purchase price including taxes. However, since July 2015 tax reductions can be applied to low-emission vehicles. In the case of HEVs, the reduction is 20% of the benefit in kind capped at a purchase price of €35,000 (see Table 2) (Government of Spain, 2015). An example of the benefit-in-kind calculation is as follows: Assuming a purchase price of €20,000 (base price plus VAT) and the vehicle being used 220 days per year for business and 145 days per year for private purposes, the yearly benefit in kind amounts to  $€20,000 * 20\% * (145 \text{ days} / 365 \text{ days}) = €1,589$ . In the case of a HEV, this amount can be reduced by 20% to €1,271 for an annual tax reduction of €318.

### Urban Access Regulations

Some Spanish cities have introduced urban access regulations to improve congestion, pollution, noise, and/or accessibility.

In the case of Madrid, restricted access regulations to defined inner-city centers, so called Residential Priority Zones, were first established in 2005. A LEZ, termed Central Madrid,

**Table 2.** Reduction rates for low-emission vehicles when taxing the benefit in kind (Government of Spain, 2015).

Type of vehicle	Price limit before taxes	Reduction
Euro 6 < 120 g CO <sub>2</sub> /km	€25,000	15%
<b>Hybrid electric vehicles</b> , or powered by an internal combustion engine (ICE) that can use alternative fossil fuels (LPG, CNG)	€35,000	20%
BEV, PHEV with a minimum electric drive range of 15 km, REEV	€40,000	30%

uniting and extending these zones, was introduced in November 2018 with the aim of reducing both air pollutant emissions and traffic noise, as well as increasing availability of public space in the central Madrid area. Full access to the Central Madrid LEZ is granted to residents, people with reduced mobility, safety and emergency services, and owners of vehicles with zero-emission or ECO labels, including HEVs. In contrast to zero-emission vehicles, parking for vehicles with an ECO label is limited to two hours. Owners of a vehicle with a B or C label (gasoline and diesel cars) may enter the zone, but are only permitted to park in car parks and not on-street. Owners of a gasoline vehicle registered before 2000 or a diesel vehicle registered before 2006 with no label are completely banned from entering the LEZ (City Council of Madrid, 2018g; 2018h).

Access for passenger cars to Barcelona’s LEZ, which includes most of the city of Barcelona and parts of the adjacent municipalities, is also restricted with the aim of combating the negative health effects of traffic pollution. Starting in December 2017, restrictions apply during episodes of elevated atmospheric pollution, in other words when suspended particulate matter (PM<sub>10</sub>) or nitrogen dioxide (NO<sub>2</sub>) emissions rise above defined maximum levels. During these incidents, vehicles with no environmental car label are not allowed to enter the LEZ. For labeled cars, access is progressively restricted in descending order (B, C, ECO, zero-emission) according to the severity of the pollution episode. This regulation will be

expanded until restrictions become permanent in 2020 (City Council of Barcelona, 2018).

### RAISING AWARENESS

Another important aspect of stimulating low-emission vehicle sales and general uptake is informing people and raising public awareness about the benefits of electrified power trains. A wide range of information and awareness raising campaigns and channels have been deployed at national, regional, and local levels to promote HEVs including internet platforms, brochures, advertisements, personal or direct mail information. The following paragraphs provide a selection of these measures.

To support the national funding allocations described earlier in this paper, the Spanish government has set up an accompanying homepage that provides motorists with information about alternative drive technologies and helps publicize the purchase-incentive programs themselves. Because the current program excludes HEVs from national funding, the homepage does not include information about HEVs specifically (Government of Spain, 2018b). In the past, when HEVs could receive grants, information was provided likewise. At the regional level, the city of Barcelona, its metropolitan area, and the government of Catalonia have set up an internet platform called LIVE platform (Logistics for the Implementation of the Electric Vehicle) that does include information about HEVs. Launched in 2011, the homepage explains the

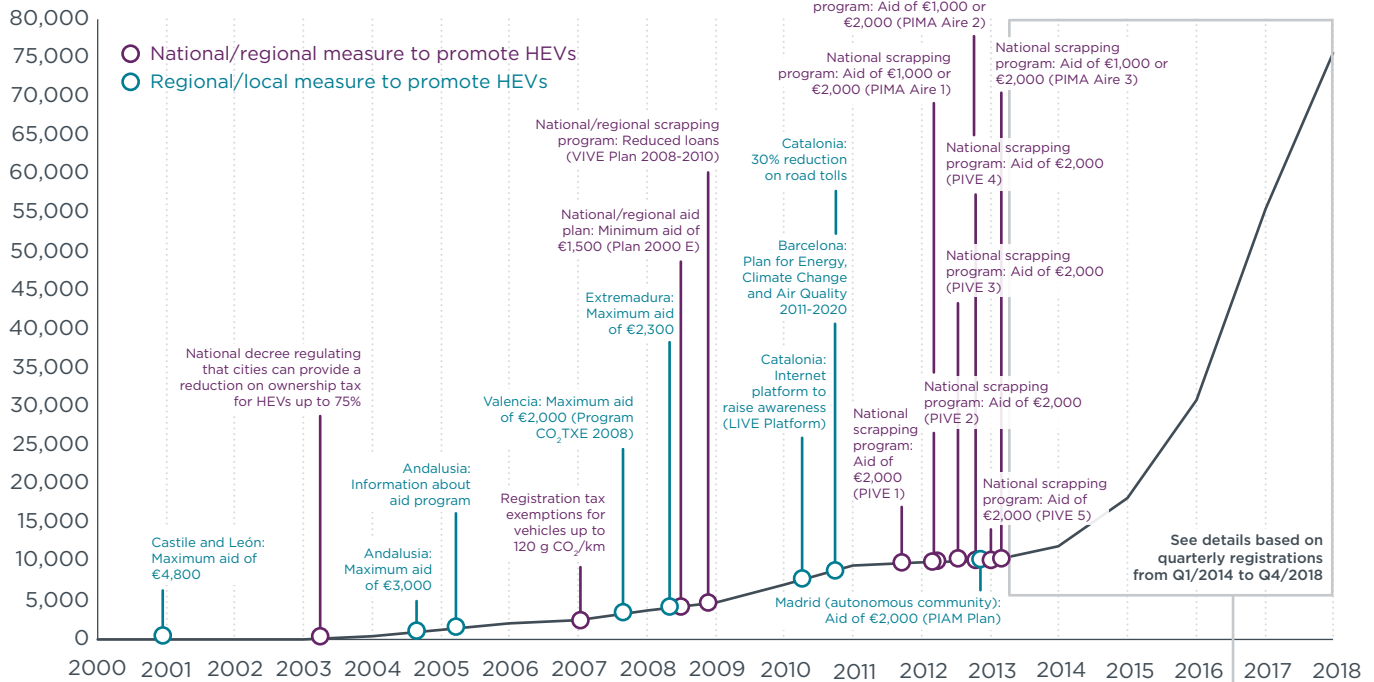
various financial assistance schemes and other incentive programs—national, regional, and local—for the purchase and operation of alternative fuel vehicles in Spain. It also offers a cost comparison tool for the different

vehicle technologies available, including HEVs (Live, 2018).

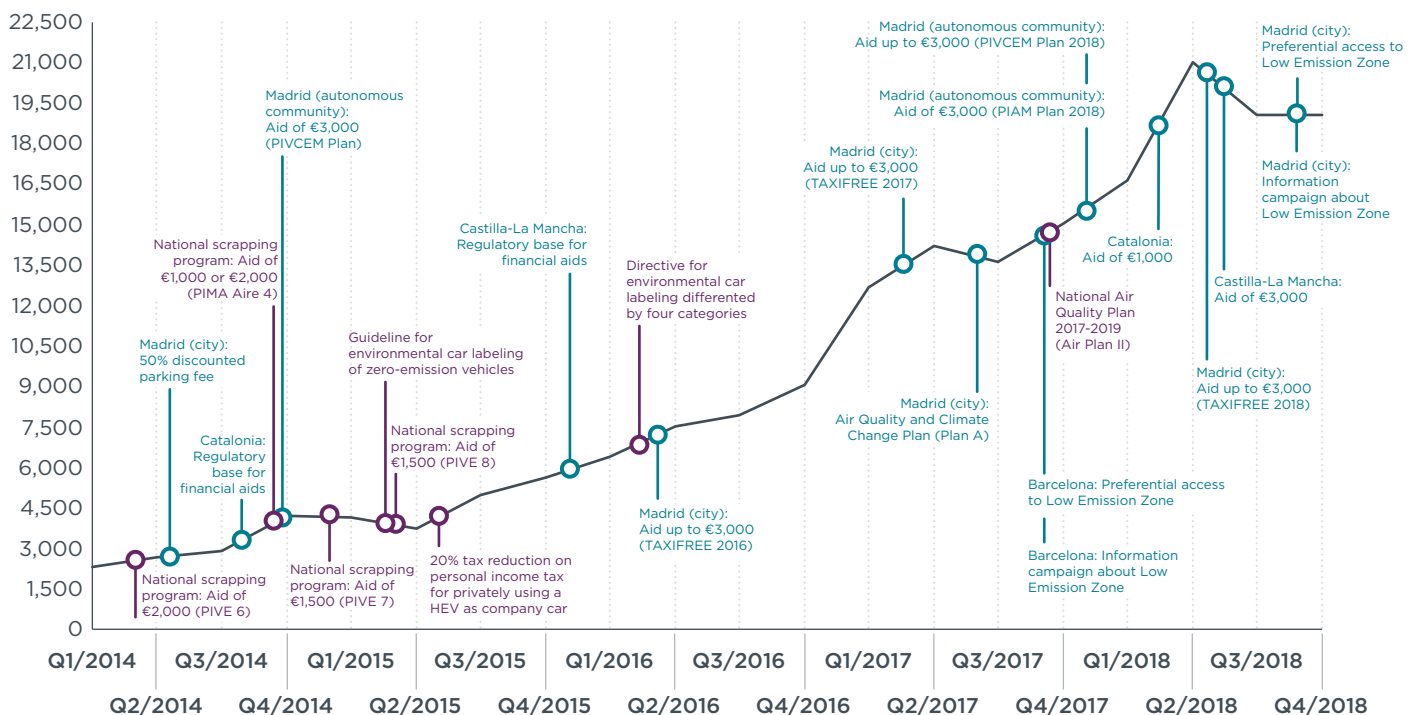
The city of Madrid as well as the City Council of Barcelona and its Metropolitan Area, carried out information

campaigns when they introduced new access regulations or anti-pollution measures, also affecting drivers of a HEV (City Council of Madrid, 2018; Open Metropolis Barcelona, 2017). A range of further actions were taken

**Registrations (yearly)**



**Registrations (quarterly)**



**Figure 8.** HEV registrations and selected national, regional, and local measures to promote HEVs.

in the past to raise awareness. For example, in the beginning of 2006 the Andalusian Energy Agency launched a campaign in dealerships, distributing brochures to inform specifically about the advantages of HEVs and the regional aid program including purchase incentives for HEVs (Bolaños, 2006).

## Concluding Thoughts

Spain is one of the strongest HEV markets in Europe in terms of total sales volumes and relative European market shares. In the past, a variety of measures have been adopted at the national, regional, and local levels to stimulate the growth of alternative fuel vehicles including HEVs. Figure 8 plots a selection of key national, regional, and local measures launched from 2001 to 2018 in relation to HEV sales. The measures are marked by the date on which they were coming into effect. The duration of incentive programs or preceding announcements on new programs or changes in policy—for example, the introduction of Madrid's new LEZ in November 2018—which might have affected consumer's purchase decisions in favor of a HEV prior to the implementation date, are not illustrated. However, Figure 8 shows that particularly since the beginning of 2015, sales of HEVs have increased steadily despite the termination of the national scrapping programs. Accompanying regional and local measures of the past have helped to spur the HEV market in Spain, driven by Madrid and Barcelona.

Based on the findings in this report, the following key aspects should be highlighted:

- **The transition to HEVs in Spain is driven largely by a series of push-pull regulations and incentives.** The Spanish national government as well as devolved regional and local authorities implemented a range of measures—including financial incentives, discounts, preferential access to LEZs, and awareness-raising campaigns—to spur the uptake of alternative fuel vehicles including HEVs across all market sectors. At the same time, gasoline and diesel vehicles with high emissions have been subject to a gradual tightening of their regulatory framework with mechanisms including higher tax levels, or total bans from inner-city LEZs. In addition, the HEV market benefited from the decreasing sales of diesel cars in the aftermath of the diesel scandal in 2015.
- **Over the past three years, regional and local authorities have been the main agents of growth in the Spanish HEV market.** Previous national efforts have focused mainly on financial incentive programs, however they proved to be complex and inconsistent due to multiple programs covering short time periods with gaps between transitional periods and consecutive phases, as well as inadequate funding to meet the resultant demand generated by certain schemes. Thus, the current transition toward HEVs is led mostly by regional and local policies. This is supported by the continued increase in hybrid sales after the end of the last national incentive program. The autonomous community Madrid—which made up for 40% of all HEV sales in Spain

in 2018, rising by 8 percentage points compared to 2017—has incorporated a mix of measures such as tax benefits, financial incentives on car purchase targeting specific user-groups, and reduced road tolls and parking fees, all reducing a vehicle's cost of acquisition and ownership. In addition, HEVs eligible for an ECO label have prioritized access to the LEZ introduced in November 2018, while access for high emission vehicles is becoming more and more restricted in this area.

For the future, there are several upcoming policies scheduled for 2019 and subsequent years. These include the official implementation of Madrid's LEZ in the beginning of 2019, and the progressive restriction of high-emission gasoline and diesel cars in Barcelona and its metropolitan area. Following the previous trends, these measures should help to further expand the Spanish market for alternative-fuel and low-emission vehicles, including HEVs.

From a European and global perspective, Spain is an interesting case study for the uptake of HEVs. The Spanish HEV market development shows that despite the lack of high tax advantages for HEVs, national and particularly regional and local incentive programs reducing the acquisition and ownership costs as well as preferential access to restricted urban areas can have a strong influence on consumers' purchase decisions in favor of a HEV. As such, Spain can provide a best-practice example for how particularly regional and local measures can help to spur HEV sales also in other markets.

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