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USING VEHICLE TAXATION POLICY TO LOWER TRANSPORT EMISSIONS

AN OVERVIEW FOR PASSENGER CARS IN EUROPE

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EXECUTIVE SUMMARY

Transport emissions of carbon dioxide (CO₂) have not decreased nearly as much as CO₂ from all other sectors in Europe. As a result, current policy discussions center on how the transport sector can reasonably contribute to meeting agreed climate-protection goals at the European Union and member state level. One key policy option is taxation: increasing the tax burden for vehicles with high emissions while providing tax benefits for those with low emissions. Different taxation levels can strongly influence vehicle purchase decisions. If designed appropriately, taxes can help to leverage efforts to reduce CO₂ emissions. Together with emission limits that require manufacturers to develop, offer, and sell more low-emission vehicles, taxes can help accelerate reductions by giving consumers incentives for buying low-emission vehicles, creating a market-pull effect.

Our report provides an overview of vehicle taxation policy across Europe. The aim is to inform how governments might induce consumers to opt for low-emission vehicles and reduce CO₂ emissions of national vehicle fleets. We start with a general summary of taxation policy for passenger cars in Europe, followed by a detailed review of five selected European markets including France, Germany, the Netherlands, Norway, and the United Kingdom. We assess the impact of taxation policy in these markets on total consumer vehicle costs for selected models. Based on these findings, we (1) compare the vehicle taxation policies in these five markets and (2) identify which policies offer the highest cost-benefit for consumers choosing a low-emission vehicle.

Figure ES-1 illustrates the different strategies for taxing vehicle emissions in the five markets. The results show four-year tax amounts minus subsidies for a privately owned car assuming different CO₂ emission levels. For this report, we use the specifications of several Volkswagen Golf models encompassing various types of combustion and electrically powered drive trains. We chose the Golf as a reference because it is the best-selling car in Europe and represents a good middle point in the average consumer market in terms of price and size.

Markets such as Germany and the United Kingdom offer consumers comparatively fewer tax benefits for low- compared with high-emission vehicles in the 0–200 grams (g) CO₂ per kilometer (km) emission range assessed for this report. The tax payment curve is relatively balanced in these two markets, with minimal cost increases for owners of cars emitting more than 50 g CO₂/km in the case of the United Kingdom or more than 95 g CO₂/km for Germany. The arc of the tax payment curve is more dynamic in France. It starts as a step-wise function, similar to the curves in Germany and the United Kingdom, but it then exponentially increases if a car emits more than 119 g CO₂/km, with tax payments capped at 191 g CO₂/km. The Netherlands and Norway show the greatest variations in tax-payment curves. In the Netherlands, the four-year tax payment is piecewise linear in the 1–49 g CO₂/km range and also above 50 g CO₂/km. Between 50 g CO₂/km and 78 g CO₂/km, taxes for a gasoline car are lower than for a plug-in hybrid electric vehicle (PHEV) emitting 49 g CO₂/km. In Norway, the tax payment curve also is a step-wise function up to 50 g CO₂/km. Between 70 g CO₂/km and 200 g CO₂/km it is piecewise-linear, with the most significant slope change at 126 CO₂/km. The four-year tax advantage of a zero-emission vehicle over a car emitting 200 g CO₂/km is the lowest in Germany at about €6,000 and the highest in Norway at almost €40,000.

Privately owned car

Tax costs minus bonus payments over a four-year holding period (€)

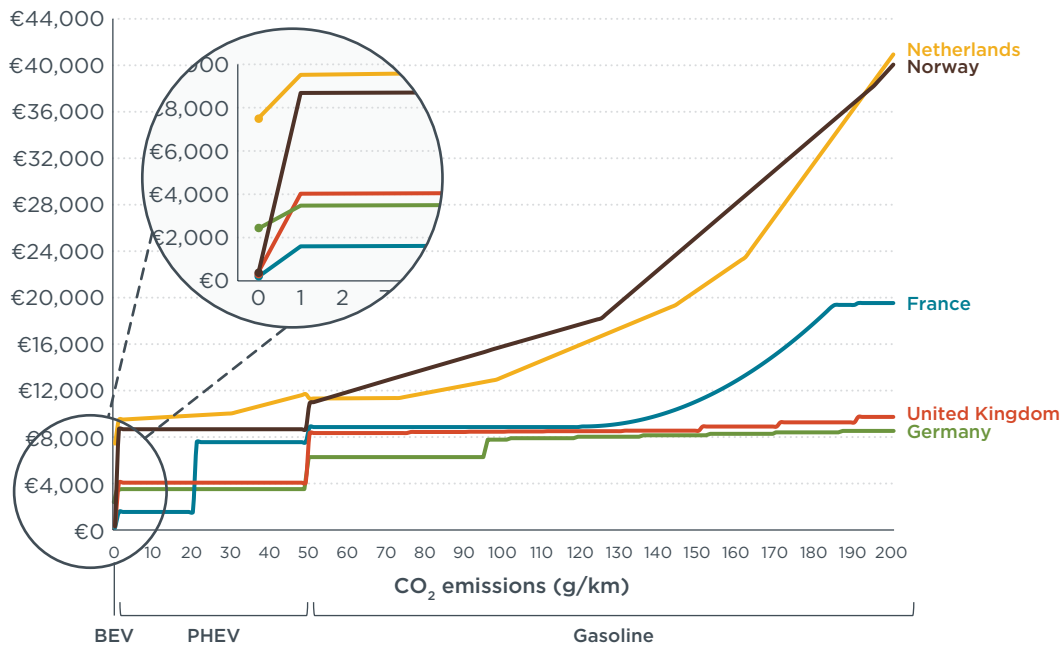


Figure ES-1. Comparison of tax liability for a privately owned car depending on CO₂ emissions. Vehicle specifications for the battery electric vehicle (BEV), plug-in hybrid electric vehicle (PHEV) and gasoline bands are based on comparable VW Golf models. Applicable for the tax year 2018 (starting April 2018).

Based on our findings, we make the following recommendations on how governments might encourage the purchase of low-emission passenger cars via taxation policy:

- » **Create significant tax advantages for low-emission vehicles at the point of purchase.** Tax payments or tax advantages at the point of purchase have a stronger influence on consumer choice than annual tax payments. This plays an important role in influencing consumer behavior. In Norway and the Netherlands, private buyers of low-emission cars benefit from significant tax breaks upon registration, and purchasers of higher emitting cars pay higher taxes. In France, the government has implemented a bonus-malus scheme, providing incentives for purchasers of low-emission vehicles in the form of one-time bonus payments while at the same time penalizing the purchase of a high-emission vehicle on registration with higher rates. Both approaches increase the cost difference and reduce the initial cost of vehicles with low CO₂ emissions. The same effect can be achieved by exempting vehicles with low emissions from value added tax (VAT). In Norway, for example, zero-emission vehicles are exempt from a 25% VAT, reducing the initial vehicle costs by a significant margin and providing an incentive for consumers to buy low-emission vehicles.
- » **Ensure continued tax benefits for low-emission vehicles during their use.** Lower taxes and lower total costs for consuming electricity compared with higher taxes and total price at the pump for gasoline and diesel fuel can serve as an incentive for consumers to opt for a car with an electric drive train. The differential between

total costs for consuming electricity compared with gasoline and diesel is most significant in Norway, due primarily to variation in taxes. The French government progressively adjusts and increases taxes on gasoline and diesel, serving as a disincentive for diesel cars and a further incentive for electrified vehicles. By contrast, high taxes on electricity and fuel, combined with marginal differences between total end prices as in Germany, do not provide notable cost advantages to consumption for electric vehicles from the consumer standpoint. In addition to taxes on fuel or electricity consumption, road charges that provide exemptions or reduced rates for zero-emission vehicles as in Norway or vehicles with certain CO₂ emission levels as in London can serve as a supplementary incentive for consumers to drive low-emission vehicles.

- » **Account for the emissions of a vehicle as part of the company-car tax system.** Company cars play an important role in Europe as they make up the highest proportion of new-car registrations in markets such as France, Germany, and the United Kingdom. In Germany and France, the tax advantages for users of a company car with low emissions are negligible as the percentage tax base is the same for all vehicle types and technologies. Conversely, employees in the Netherlands and Norway privately using a zero-emission company car benefit from significant income tax advantages due to lower percentages applied when calculating the benefit in kind. Moreover, in the United Kingdom, employees using vehicles emitting 50 g CO₂/km or less profit from distinct tax relief. These cost advantages for a low-emission vehicle provide an incentive for an employee to decide in favor of a low-CO₂ company car.
- » **Balance and regularly re-adjust the tax system to be self-sustaining.** In Norway, notable and differentiated tax breaks for private buyers of a BEV or PHEV in combination with increased taxes for conventional gasoline and diesel cars are sufficient to make BEVs and PHEVs significantly less expensive than comparable gasoline or diesel cars. In Germany and the United Kingdom, tax benefits for BEVs or PHEVs are insufficient to provide significant cost advantages over gasoline or diesel cars. As a consequence, these countries rely on subsidies in the form of one-time payments to consumers when purchasing a vehicle with a certain CO₂ emission level. However, this kind of mechanism should be considered only as a transitional measure for the market. To ensure a self-sustaining tax system, vehicle-related taxes need to take into consideration all vehicles, ensure that high-emission vehicles generate the tax revenue to provide tax breaks for low-emission vehicles, and be adapted annually or every two years to account for changes in market structure—similar to the bonus-malus system adopted by the French government.

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ABBREVIATIONS

BEV	Battery electric vehicle
CO ₂	Carbon dioxide
cm ³	Cubic centimeter
EC	European Commission
EFTA	European Free Trade Association
EU	European Union
EV	Electric vehicle
FCEV	Fuel cell electric vehicle
g	gram
km	kilometer
kWh	kilowatt hour
L	liter
mg	milligram
NEDC	New European Driving Cycle
NOK	Norwegian krone
NO _x	Nitrogen oxides
PHEV	Plug-in hybrid electric vehicle
t	ton
VAT	Value added tax

GLOSSARY

List price	The price of a car as provided by car manufacturers, including value added tax (VAT) and registration tax if applicable as well as subsidies such as one-time bonus payments, discounts granted by national governments, and car manufacturers.
Base price	The vehicle's list price as provided by car manufacturers, exclusive of VAT, registration tax, and one-time subsidies.
Electric vehicle	A vehicle that uses an electric motor. In the scope of this report, we consider electric vehicles (EVs) to include battery electric vehicles (BEVs), fuel cell electric vehicles (FCEVs) and plug-in hybrid electric vehicles (PHEVs).
Zero-emission vehicle	A passenger vehicle that emits no exhaust emissions. In our report, we assume emissions of 0 grams carbon dioxide per kilometer (g CO ₂ /km) to be applicable for BEVs and FCEVs.
Low-emission vehicle	A passenger vehicle with tailpipe emissions of less than 95 g CO ₂ /km.

1. INTRODUCTION

A typical new Volkswagen Golf diesel vehicle costs about €47,000 in the Netherlands but €38,000 in Germany. Why? Mainly because of different vehicle taxes. Over an average holding period of four years, the owner of a Golf diesel vehicle in Germany pays about one-third the taxes of his or her Dutch neighbor.

Different taxation levels can have a strong influence on customers' vehicle purchase decisions. If designed appropriately, taxes can help to speed up the transition of vehicle fleets toward low-emission vehicles—that is, passenger vehicles with tailpipe emissions of less than 95 g CO₂/km.¹ This in turn will help to leverage vehicle emission² reduction efforts at the European level as well as at national levels.

Previous ICCT studies indicate that vehicle taxation policy can be a powerful instrument to address vehicle costs and motivate consumers to buy an electric vehicle (EV)—battery electric vehicle (BEV), fuel cell electric vehicle (FCEV), or plug-in hybrid electric vehicle (PHEV) (Mock and Yang, 2014; Tietge et al., 2016). This report builds on these studies. However, it does not focus solely on electric vehicles and the question of whether or how long tax incentives will be needed to make them cost-competitive with conventional gasoline and diesel cars (Slowik and Lutsey, 2016). Rather, we expand the view to all low-emission vehicles to illustrate the cost effects of taxation policy dependent on a vehicle's CO₂ emissions in general. We focus on new passenger cars, as they account for almost 90% of the new vehicle market in Europe (Mock, 2018a). We analyze the effects of taxation on vehicle costs, including new passenger cars in private ownership. We also investigate the cost effects for employees privately driving a company car, as company cars account for the majority of new car registrations in many countries in the European Union. In Germany, for example, 64% of new cars in 2017 were registered by companies; in France the proportion was 51%; and in the United Kingdom the market share of new fleet and business cars was 56% (KBA, 2018; Ministry of Ecological and Solidarity Transition, 2018; SMMT, 2018).

Our report provides an overview of vehicle taxation policy across Europe. Our aim is to inform how governments might induce consumers to buy low-emission vehicles to reduce CO₂ emissions. We start in section 2 with a general overview of vehicle taxes in Europe, followed by an in-depth view of vehicle taxation policy in five specific European countries to describe how various systems provide incentives for the purchase of vehicles with certain CO₂ emission levels. In section 3 we calculate the monetary effects of vehicle taxation policy on different vehicle types, including a gasoline and a diesel car, a PHEV, and a BEV. Based on this analysis, we use the results dependent on a vehicle's CO₂ emissions to compare the effects of the different taxation policies on ownership costs. The aim is to identify best-practice examples and systems that are most likely to encourage consumers to buy low-emission autos. We conclude with the key findings and recommendations on how governments might encourage low-emission car purchases via taxation policies.

1 This reflects the current regulation of the European Union that requires average CO₂ emissions of new cars to fall to 95 g/km by 2021.

2 All emissions mentioned in this report refer to CO₂ emissions rather than pollutant emissions, unless specifically indicated. CO₂ figures are stated as measured under the NEDC test.

2. OVERVIEW OF TAXES FOR PASSENGER CARS IN EUROPE

European countries in this study include the 28 member states of the European Union and the countries of the European Free Trade Association—Iceland, Liechtenstein, Norway, and Switzerland. These nations apply an inconsistent mix of vehicle taxation policies to new passenger cars. The following section provides an overview on how individuals across Europe are taxed on car acquisition, ownership, and energy consumption, as well as how they are charged for using road infrastructure. In addition, we show how employees are taxed for using a company car for private purposes. Depending on the scheme and design, vehicle-related taxes in combination with benefits for low-emission vehicles can help foster their uptake. These tax benefits can include exemptions on VAT, lower upfront costs when first registering a vehicle, lower regularly payable ownership costs, lower costs for consuming electricity compared with gasoline and diesel fuel, and exemptions from paying road charges.

2.1. VEHICLE TAXES IN GENERAL

New-car buyers in Europe usually have to pay VAT as well as a registration tax or fee. For ownership, motor vehicle tax³ is due e.g. annually, bi-annually, or quarterly. In addition, motorists are taxed for consumption when refueling or recharging vehicles and pay for using road infrastructure via road charges (Figure 1). Employees using a company car provided by their employer for private purposes have to pay income tax for the private use as a benefit in kind. We assume that work-related expenses such as fuel and electricity costs and road charges are paid by the employer while the same expenses if privately incurring are paid by the auto owner. Thus, the additional costs do not change the income tax burden of an employee.

Some countries offer incentives for low-emission vehicles such as one-time subsidies on car purchase involving cost reimbursements. In addition, there are tax exemptions on acquisition, ownership, or usage aimed at stimulating sales.

³ We refer to ownership tax as “motor vehicle tax,” acknowledging that actual wording differs among countries.

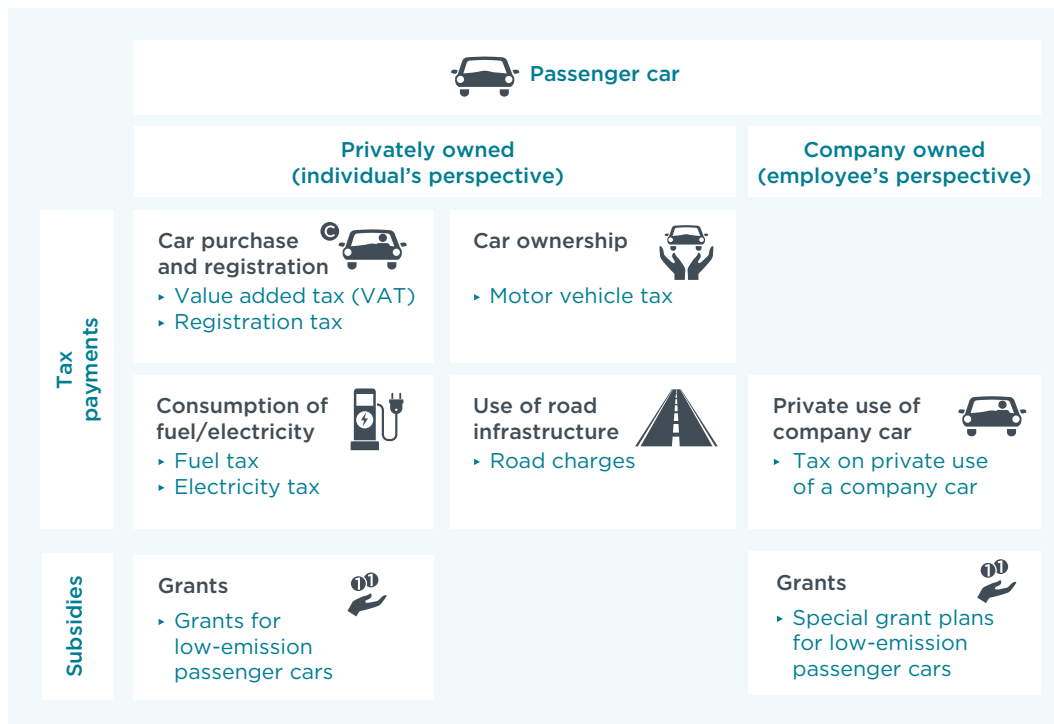


Figure 1. Key types of vehicle taxes and fees to be paid as well as key subsidies received by owners of a passenger car in Europe.

Taxes on vehicle acquisition and ownership

Figure 2 gives an overview of taxes on acquisition and ownership of a passenger car as well as subsidies and tax benefits for EVs as applied in the EU and EFTA countries. The green boxes indicate that these countries levy taxes on registration or ownership based on emissions such as CO₂ and nitrogen oxides (NO_x), Euro Emission Limits⁴, or fuel consumption (ACEA, 2018a, 2018b; Landesverwaltung Fürstentum Liechtenstein, 2018).

The new-car VAT is proportional to the price. In European countries, VAT on vehicle purchase ranges from 17% in Luxembourg to 27% in Hungary. In countries like Norway and Iceland, zero-emission vehicles are fully or partly exempt from VAT.

Twenty-five of the 32 European countries we consider levy some form of one-time registration tax⁵ upon the purchase of a new car. Of those, 15 offer tax benefits in the form of lower rates or exemptions for low-emission vehicles. Almost all countries providing benefits for low-emission vehicles on registration, except Slovakia, charge registration tax depending on a car's emissions level. This can include CO₂ and NO_x emissions, Euro Emission Limits, or fuel consumption.

Of the 32 European nations considered, 26 levy taxes on owning a passenger car. Sixteen of those provide tax benefits for owners of a low-emission vehicle.

⁴ 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.

⁵ A clear differentiation is not always possible. The Czech Republic does not levy tax on registration, but it imposes a surcharge which can be considered as a tax. Some countries, such as Poland and the United Kingdom, impose excise duty upon registration, which strictly speaking is a tax and therefore is included in Figure 2. Slovakia imposes registration charges that are also considered a registration tax in our overview table. Benefits for low-emission vehicles listed in the table usually refer to the national level. In some cases, such as Spain and Switzerland where national taxes do not exist, regional benefits are listed.

	Subsidies	Taxes on acquisition and ownership and respective tax benefits for low-emission vehicles		
Country	Subsidies for low-emission vehicles	VAT (benefits for low-emission vehicles in parentheses)	Registration tax (benefits for low-emission vehicles in parentheses)	Ownership tax (benefits for low-emission vehicles in parentheses)
Austria	X	X	X (✓)	X (✓)
Belgium	X	X	X (✓)	X
Bulgaria		X	X	X (✓)
Croatia		X	X	X
Cyprus		X	X (✓)	X
Czech Republic		X	X	
Denmark		X	X (✓)	X
Estonia		X		
Finland		X	X (✓)	X
France	X	X	X (✓)	X
Germany	X	X		X (✓)
Greece		X	X (✓)	X (✓)
Hungary		X	X (✓)	X (✓)
Iceland		X (✓)	X	X
Ireland	X	X	X (✓)	X (✓)
Italy		X	X	X (✓)
Latvia		X		X
Liechtenstein		X		X (✓)
Lithuania		X		
Luxembourg	X	X		X (✓)
Malta		X	X (✓)	X
Netherlands		X	X (✓)	X (✓)
Norway		X (✓)	X (✓)	
Poland		X	X	
Portugal		X	X (✓)	X
Romania	X	X		X (✓)
Slovakia		X	X (✓)	
Slovenia	X	X	X	X (✓)
Spain		X	X	X (✓)
Sweden	X	X	X	X (✓)
Switzerland		X	X	X (✓)
United Kingdom	X	X	X (✓)	X (✓)

Figure 2. Taxes on acquisition and ownership of a vehicle as well as subsidies and tax benefits for low-emission vehicles in the EU and EFTA countries. Green boxes indicate that these countries levy taxes on registration or ownership based on emissions (ACEA, 2018a, 2018b; Landesverwaltung Fürstentum Liechtenstein, 2018).

Taxes on consuming fuel and electricity

Figure 3 illustrates the consumer end prices for gasoline and diesel fuel and for household electricity.⁶ In the case of electricity, we consider yearly household consumption of between 5,000 and 15,000 kilowatt hours (kWh) per year. Assuming that an EV consumes 30 kWh/100 km and is driven 13,000 km per year, it would use 3,900 kWh of household electricity in a year (see section 3.1). The figure also shows the relevant tax ratios in the consumer price for gasoline, diesel, and electricity.

Different taxation levels are mostly what influence consumer end prices. Figure 3 illustrates that for gasoline all over Europe, at least half of the total pump price is taxes and duties (as of May 21, 2018; EC, 2018a, 2018b, 2018c). Ratios range between 50% for Bulgaria and Romania and 65% for Norway. For diesel, the share starts at 44% in Luxembourg and goes up to 61% in the United Kingdom. The United Kingdom has among the highest tax rates on both fuel types and treats them equally, resulting in almost identical tax ratios in the end consumer price—63% for gasoline and 61% for diesel. Norway also levies high taxes on gasoline and diesel. But in most countries, such as Germany, owners of a diesel car profit from lower taxes compared with gasoline. Unlike motor fuel taxes, electricity tax rates vary widely (Eurostat, 2018). In Malta, the tax share is just 5% while in Denmark it is 63%. Germany ranks second-highest at 56%. Denmark is the only country levying higher taxes on household electricity than on motor fuels. In Germany and the Netherlands, taxes on electricity exceed taxes on diesel.

⁶ A detailed description of consumption costs and taxes on natural gas is outside the scope of this report.

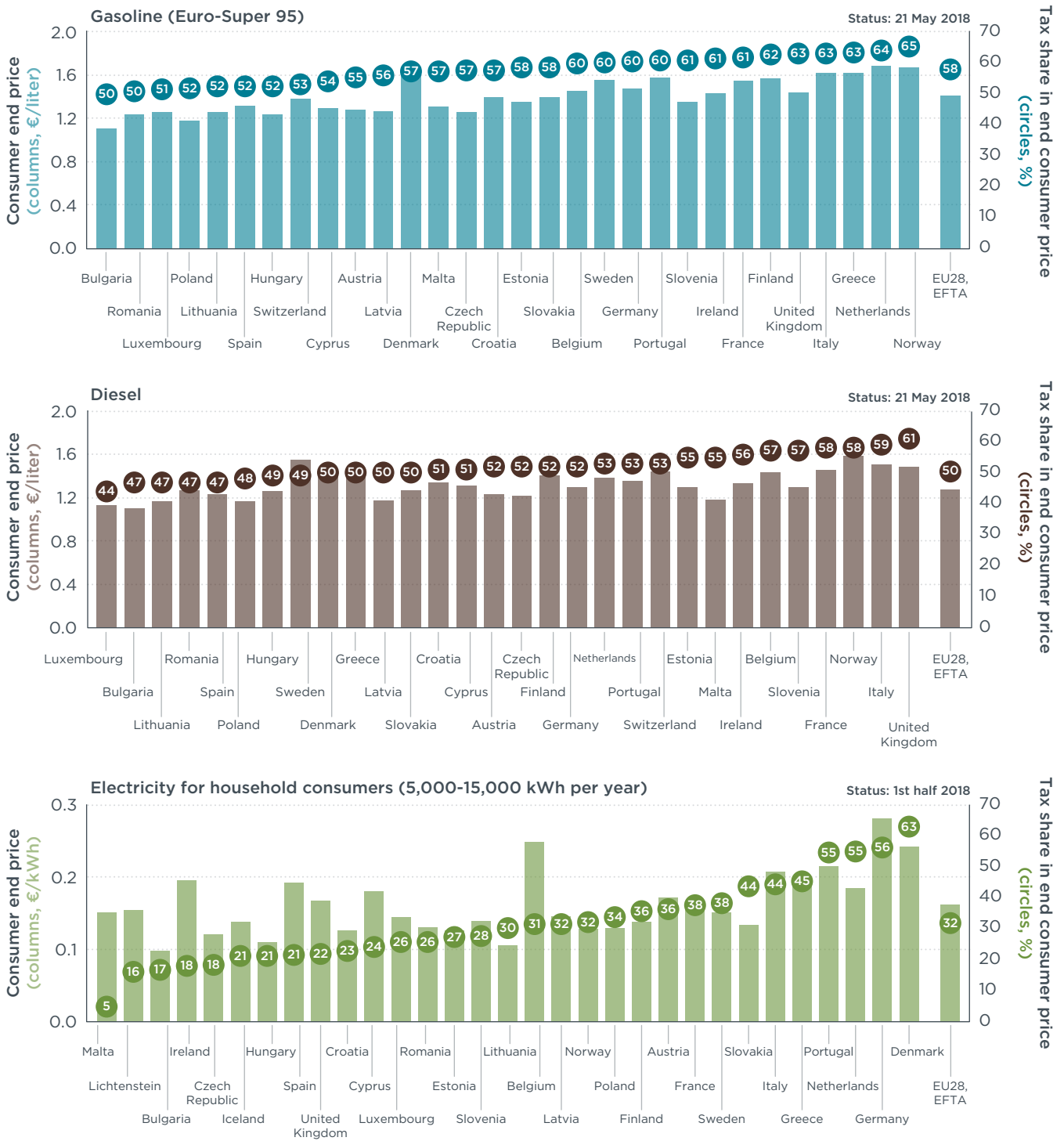


Figure 3. Consumer prices for gasoline, diesel, and household electricity with taxes by country as a percentage of the consumer end price (EC, 2018a, 2018b, 2018c; Eurostat, 2018). Tax ratios for gasoline and diesel are based on ACEA (2018a). Missing: data for Iceland and Liechtenstein (gasoline, diesel fuel) and Switzerland (energy prices) due to lack of comparable data. Data on electricity for household consumers in Liechtenstein is available only for the second quarter of 2017.

Taxes on use of road infrastructure

Another form of user tax is road charges—payments for use of public or private roads, tunnels, bridges, or ferries, including road tolls, fees, or congestion charges. They are collected by national governments, local authorities, or private organizations. Road charges for passenger cars are based on parameters such as distance traveled or a fixed rate for using road infrastructure (ACEA, 2017a). Road charges on national motorways are applied in about half of the 32 European countries. The remaining countries either do not charge for using road infrastructure in general—such as Liechtenstein or Luxembourg—or impose charges only on certain roads, tunnels, or bridges—such as Andorra, Denmark, Germany, Montenegro, and the Netherlands (ADAC, 2018). A few countries such as Norway and Ireland offer exemptions or reduced road charges for low-emission vehicles (AutoPASS, 2018; Transport Infrastructure Ireland, n.d).

Taxes on the private use of a company car

A company car is owned or leased by a business but can be provided as a benefit to employees for private use. The use of a company car is widespread in Europe, in part because of tax breaks for companies. In Germany, 64% of new car registrations in 2017 were company cars (KBA, 2018). The private use of a company car in most European countries is considered a benefit in kind for income taxes. Countries such as the Netherlands, Norway, and the United Kingdom provide special income tax reductions for zero- or low-emission vehicles (see sections 2.2.3, 2.2.4, and 2.2.5). In Germany, companies receive a specific reduction on the car's list price based on battery capacity (see section 2.2.2).

One-time subsidies for low-emission vehicles

In addition to tax benefits for low-emission vehicles, 10 of the 32 countries offer national one-time subsidies on car purchase, reducing vehicle costs at the point of purchase (see Figure 2). Depending on the country, these are financed by car manufacturers; car dealers; local, regional, and national governments; or a combination. Recipients include individuals and private households, associations, foundations, and companies. We focus on purchase incentives provided by national governments aimed at privately and company owned cars. There are also special schemes for low-emission company cars, reducing the initial price of the vehicle as in Germany (see section 2.2.2).

2.2. VEHICLE TAXES FOR SPECIFIC SELECTED COUNTRIES

For deeper insight into specific vehicle taxation systems, we select five specific countries, based on the following criteria:

- » **Top vehicle markets.** Taxation schemes in top vehicle markets are likely to strongly influence the product strategy of vehicle manufacturers and to have spillover effects for smaller markets. Germany, France, and the United Kingdom are the largest car markets, consuming more than 50% of all European new passenger car production in 2016.
- » **Top electric vehicle markets.** A high proportion of new EV sales often can be traced to policies such as vehicle taxation favoring low-emission vehicles (Tietge et al., 2016; Mock and Yang, 2014). The largest electric vehicle market in Europe is Norway, where 39% of all newly registered cars in 2017 were EVs.
- » **Most progressive taxation schemes.** High taxation of combustion-engine vehicles with relatively high emission levels and low taxation or exemptions for low-emission

vehicles can act as a buying incentive for consumers. In countries such as France, the Netherlands, and Norway, taxation for high emission cars is significantly higher than for low-emission cars, while tax differences are not as substantial in countries such as Germany and the United Kingdom.

Based on these criteria, we include France, Germany, the Netherlands, Norway, and the United Kingdom in our analysis. They are analyzed in alphabetical order. The country-specific review includes a description of the vehicle tax system as applied as of May 2018.

2.2.1. France

Figure 4 illustrates key facts about the French new passenger car market in 2017 and vehicle taxation in 2018. The average new car in France emitted about 111 g CO₂/km in 2017 based on the New European Driving Cycle (NEDC). That is 8 g below the EU average of 119 g CO₂/km. The share of diesel cars in France at 47% was slightly above the EU average of 44%, having dropped significantly from 73% in 2012. EVs accounted for 1.7% (Mock 2018a). France levies taxes on vehicle acquisition, including 20% VAT and registration tax; ownership in the form of a motor vehicle tax; consumption through taxes on fuel and electricity; private use of a company car; and infrastructure use through road charges. A bonus-malus tax system encourages low-emission vehicles and penalizes cars with high emissions.

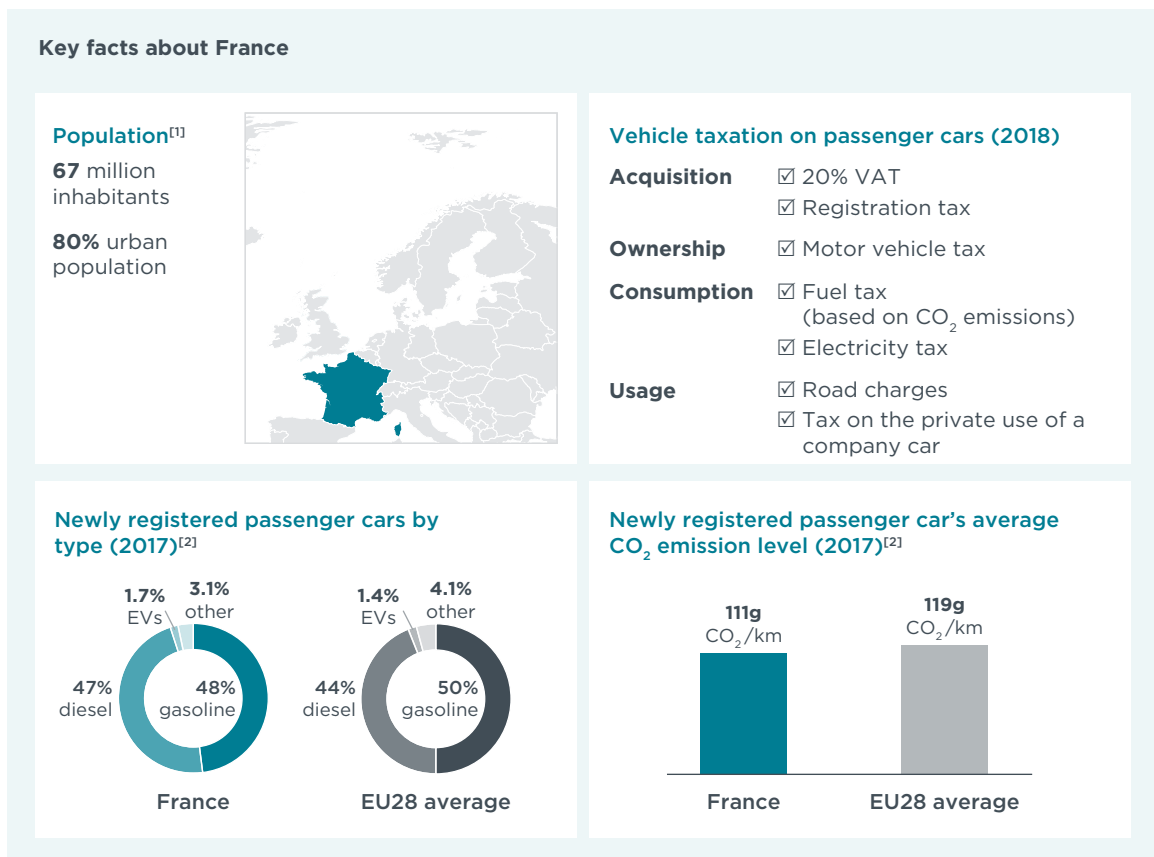


Figure 4. Key facts about France (^[1] CIA, 2018; ^[2] Mock, 2018a).

Figure 5 plots French one-time taxes and subsidies on vehicle acquisition and registration, as well as annual taxes on ownership. Upon **registration**, cars emitting more than 119 g CO₂/km pay a penalty (a so-called malus) starting at €50. The rates increase progressively to a maximum of €10,500 for vehicles emitting more than 184 g CO₂/km. Cars emitting between 21 g CO₂/km and 119 g CO₂/km are exempt from registration tax. In addition to the national amount, a regional tax plus fees are payable when registering a new vehicle for the first time. The regional tax varies between €27 in Corsica and €51.20 in Provence-Alpes-Côte d’Azur per taxable horsepower. Therefore, the amount payable on registration can exceed 10,500. In contrast to conventional gasoline and diesel cars, low-emission vehicles are exempt from the regional tax in almost all French regions (Directorate of Legal and Administrative Information, 2018a, 2018b). Part of the registration tax design is a **one-time subsidy**. Purchasers of a vehicle emitting 20 g CO₂/km or less receive a maximum grant of €6,000 including VAT, though the grant amount cannot exceed 27% of the vehicle’s purchase price including VAT and, if applicable, battery leasing cost. The grant is either deducted from the vehicle’s list price by the car dealer or refunded after purchase upon request (Directorate of Legal and Administrative Information, 2018c).

Private car owners also have to pay **tax on ownership** at a flat rate of €160 per year. However, this amount is payable only if a vehicle emits more than 190 g CO₂/km (see Figure 5). Vehicles below this threshold are exempt from ownership tax (ACEA, 2018).

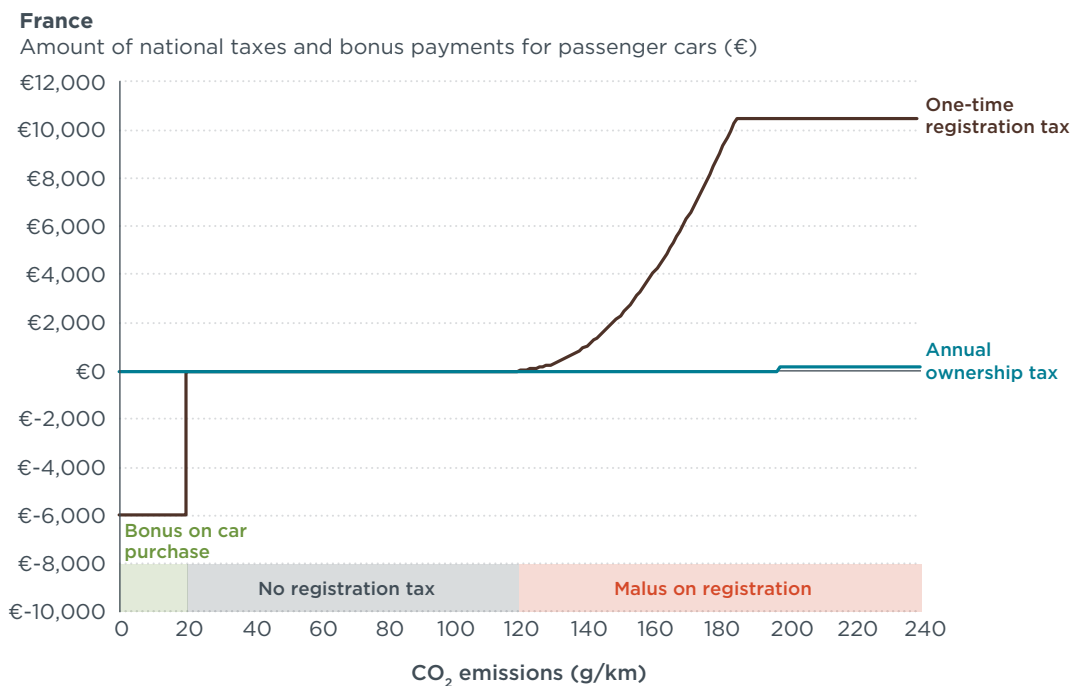


Figure 5. Overview of national one-time taxes and subsidies on vehicle acquisition and registration as well as annual taxes on ownership in France, as of May 2018.

The **fuel tax** in France is based on the energy excise tax and is calculated in proportion to weight or volume. Tariffs are set by parliament and may vary over the year depending on the oil price. Since April 2014, the tax includes a CO₂ component. In 2018, the rate is €44.60 per ton (t) of CO₂ and will be raised yearly up to a rate of €86.20/t CO₂ in 2022. In 2016, the French government initiated a gradual alignment of gasoline and

diesel taxes. Taxes for diesel will be raised until 2022—in addition to the increase of the CO₂ tax—without a tax decrease for gasoline. As of May 21, 2018, the excise tax for gasoline was €0.6629 per liter (L) and for diesel €0.5940/L, excluding regional surcharges. The total tax share accounted for 61% of the €1.543/L gasoline fuel price at the pump and 58% of the €1.461/L diesel pump price (EC, 2018a, 2018b, 2018c; Sénat, 2018). As for **electricity**, the taxation share of household electricity cost—assuming a private household consuming between 5,000 kWh and 15,000 kWh per year—was 38% in the first half of 2018; the household end consumer price was on average €0.161/kWh (Eurostat 2018).

Road charges in the form of tolls are payable by passenger cars on most motorways in France; some bridges and tunnels also collect tolls. The French road charging network is the largest in Europe with an overall length of more than 9,000 km. Tolls are payable for each use and are usually due when exiting a motorway. The majority of these roads are managed by operating companies on the basis of concessions granted by the government. There are no reduced rates for low-emission vehicles (DGCCRF, 2013; APRR, 2018; ASECAP, 2018).

The **private use of a company car** by an employee is subject to social contributions and income tax. There are two methods to calculate the benefit in kind of a company car, both depending on whether the car has been purchased or leased, and in the case of a purchase, also the age of the car. The first method is based on a fixed percentage of the car's list price—defined as the price provided by car manufacturers, including VAT and registration tax. If the employer pays for fuel for private use, the taxable benefit for the employee is 12% of the car's list price. If the employee pays for the fuel, the taxable amount declines to 9%. The second calculation method is based on real expenses including annual depreciation from the vehicle's purchase price including VAT, insurance and maintenance costs, and fuel costs for private use (Ministère de l'Action et des Comptes publics, 2018).

2.2.2. Germany

Figure 6 provides an overview of facts on new passenger cars and taxes in Germany. New cars in Germany emit about 7 g more CO₂/km than the average European new car, or 126 g CO₂/km versus 119 g CO₂/km, based on the NEDC. The diesel share of the market has dropped significantly and is well below the European average, 39% versus 44% (Mock, 2018a). The German government levies a 19% VAT on acquisition, a motor vehicle tax, taxes on fuel and electricity, and taxes on the private use of a company car.

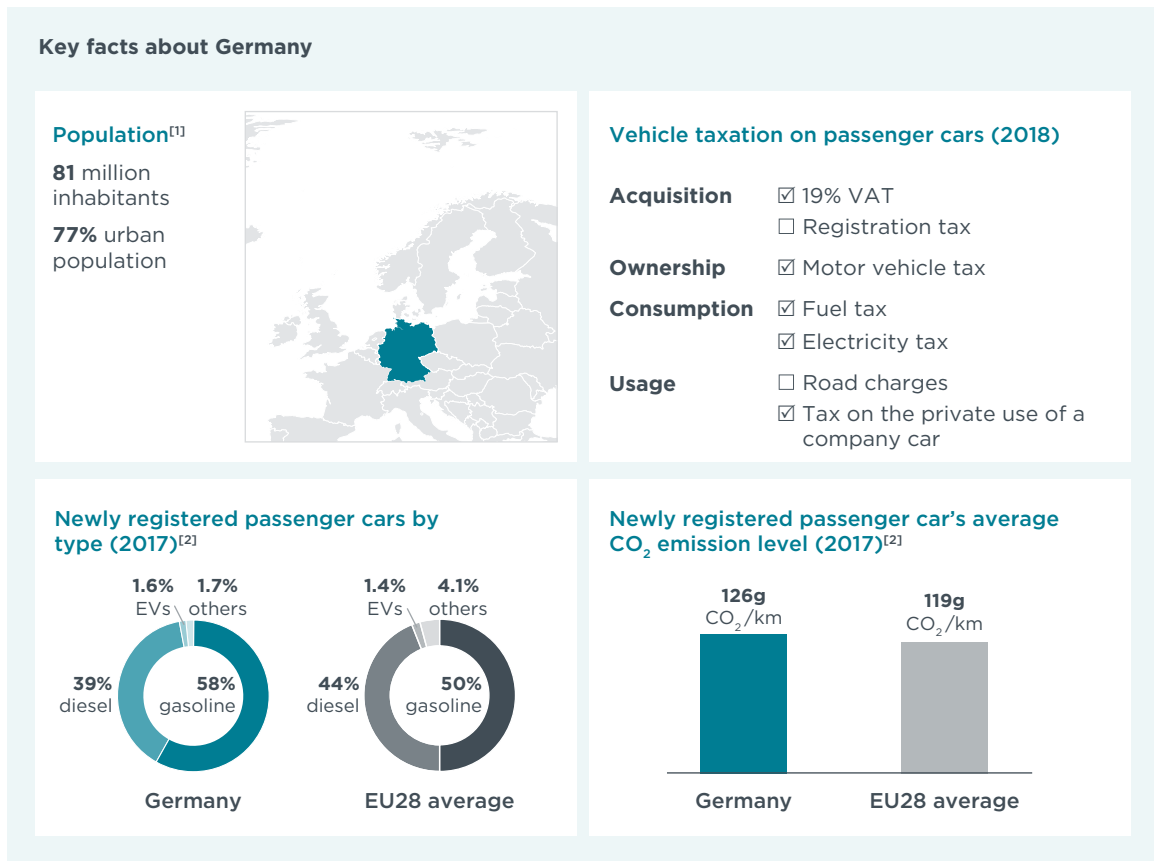


Figure 6. Key facts about Germany (^[1] CIA, 2018; ^[2] Mock, 2018a).

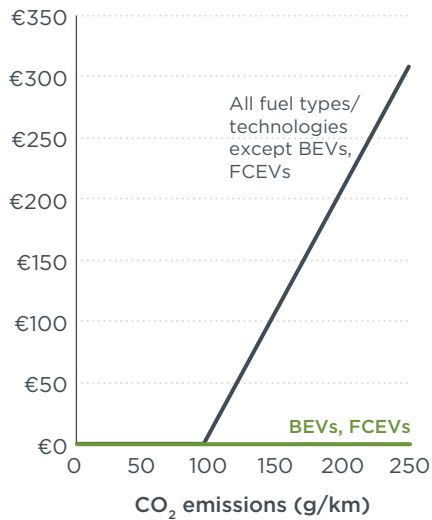
Figure 7 illustrates national **annual tax rates on ownership** in Germany. Unlike most European countries, the German government does not levy registration taxes on car purchases but imposes a one-time registration fee of about €26 on initial registration (ACEA, 2018a; STVA, 2018). German car owners pay an annual motor vehicle tax based on the sum of levies on CO₂ emissions and cylinder capacity (BMJV, 2017a):

1. CO₂: Cars emitting 95 g CO₂/km or less are exempt from CO₂ tax. Above that, emissions are taxed at a rate of €2 per g CO₂/km.
2. Cylinder capacity: Step tax rates on cylinder capacity are based on fuel type, with gasoline cars paying a lower rate of €2/100 cubic centimeters (cm³) and diesel cars paying €9.50/100 cm³.

Zero-emission vehicles are exempt from motor vehicle tax for 10 years. After that, annual taxes are based on vehicle weight (BMF, 2016; BMJV, 2017a).

Germany

Amount of national annual ownership tax - CO₂ component (€)



+

Amount of national annual ownership tax - cylinder capacity component (€)

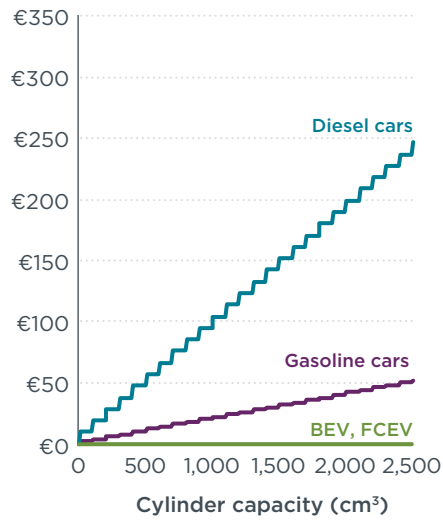


Figure 7. Overview of annual ownership tax rates in Germany as of May 2018.

The pump price of fuel in Germany includes VAT and energy tax. Energy tax on fuels, which falls in the scope of **excise tax on gasoline and diesel**, amounts to 0.6545/L for gasoline and €0.4704/L for diesel (BMJV, 2006). Taxes on gasoline account for 60% of the €1.474/L pump price and for diesel, 52% of the €1.293/L pump price, as of May 21, 2018. **Taxes on electricity** total as much as 56%, even higher than the proportion for diesel, assuming yearly consumption of 5,000–15,000 kWh. At this consumption rate, households in Germany paid on average €0.280/kWh in the first half of 2018, the highest rate in Europe (Eurostat, 2018).

Passenger car owners currently pay **no road charges** in Germany except for selected private roads. A road charging system for passenger cars is expected to go into effect at the latest by 2021 with the mandatory payment of an annual infrastructure fee for domestic drivers using German motorways and federal roads. Owners of a vehicle not registered in Germany would only pay for the actual use, limited to German motorways. According to the current plan, the amount payable for domestic drivers will depend on fuel type, with lower rates for gasoline than diesel; engine size; and pollutant class, based on Euro Emission Limits. Electric cars will be exempt from road charges (BMVI, 2018; BMF, 2017; Deutscher Bundestag, 2018a).

Germany uses two methods for taxing the **private use of a company car**. The first is the 1% method, in which the monthly benefit in kind is set at 1% of the new car’s list price, totaling 12% per year. A monthly surcharge of 0.03%—based on the vehicle’s list price times the one-way distance between home and workplace—is added if the company car is also used for trips between home and workplace. The result is the taxable amount to be declared by the employee as part of income tax. Electric company cars benefit from a special bonus plan introduced by the German government in 2013. The bonus amount is calculated per kWh of the battery capacity. For example, electric company cars bought in 2018 receive a flat-rate reduction of €250/kWh of battery capacity with a maximum of €7,500. As a result of the bonus, the new car’s list price is reduced and

thereby the amount payable through income tax.⁷ An alternative to the 1% method is the logbook-method, in which the tax amount is calculated based on total actual vehicle costs including depreciation, fuel, insurance, and maintenance.

German EV purchasers benefit from a one-time **subsidy** upon purchase of a BEV, FCEV, or PHEV. The policy was introduced in July 2016. The federal government's share of the environmental grant is €2,000 for BEVs and FCEVs emitting 0 g CO₂/km and €1,500 for PHEVs emitting less than 50 g CO₂/km. The national subsidy "will only be granted if the car manufacturers grants the buyer at least the same share of the net list price of the base model ... as a discount" (BAFA, 2018). Thus, manufacturers and the government each contribute €2,000 or €1,500. The manufacturer and government subsidies count once toward the vehicle's gross price and once toward the net price. In total, the environmental grant for BEVs and FCEVs is limited to €4,380 including VAT, and for PHEVs, to €3,285 including VAT. Vehicles eligible for a grant may not exceed a net list price of €60,000. Individuals, companies, foundations, corporations, and associations can apply. The program is supposed to end as soon as the €6 million government appropriation for its share is exhausted, or by the end of 2019 at the latest (BAFA, 2018).

2.2.3. The Netherlands

New passenger cars in the Netherlands on average emit about 10 g CO₂/km less than the EU level, or 109 g CO₂/km compared with 119 g CO₂/km, based on the NEDC (see Figure 8). Today the Netherlands is one of the EU member states with the lowest new-car CO₂ levels, whereas until 2009 it had one of the highest rates. The diesel market share dropped significantly from 29% in 2015 to 18% in 2017, the lowest in the EU (Mock, 2018a). The number of EV registrations dropped from 10% in 2015 to 2.2% in 2017 as the government cut PHEV tax subsidies and focused incentives on fully electric vehicles. At the same time, the share of BEVs has grown steadily, making the Netherlands one of the frontrunners in Europe (Mock, 2018a; RAI Vereniging, 2018). The Dutch government levies taxes on acquisition, including 21% VAT and a registration tax; ownership, in the form of a motor vehicle tax; consumption, as taxes on fuel and electricity; and private use of a company car.

⁷ This will be changed beginning January 1, 2019. Under new legislation, BEVs, FCEVs, and PHEVs will pay a reduced rate of 6% per year, while the special bonus plan for electric vehicles, initially to be ended by the end of 2022, will be dropped (Deutscher Bundestag, 2018b; Bundesrat, 2018).

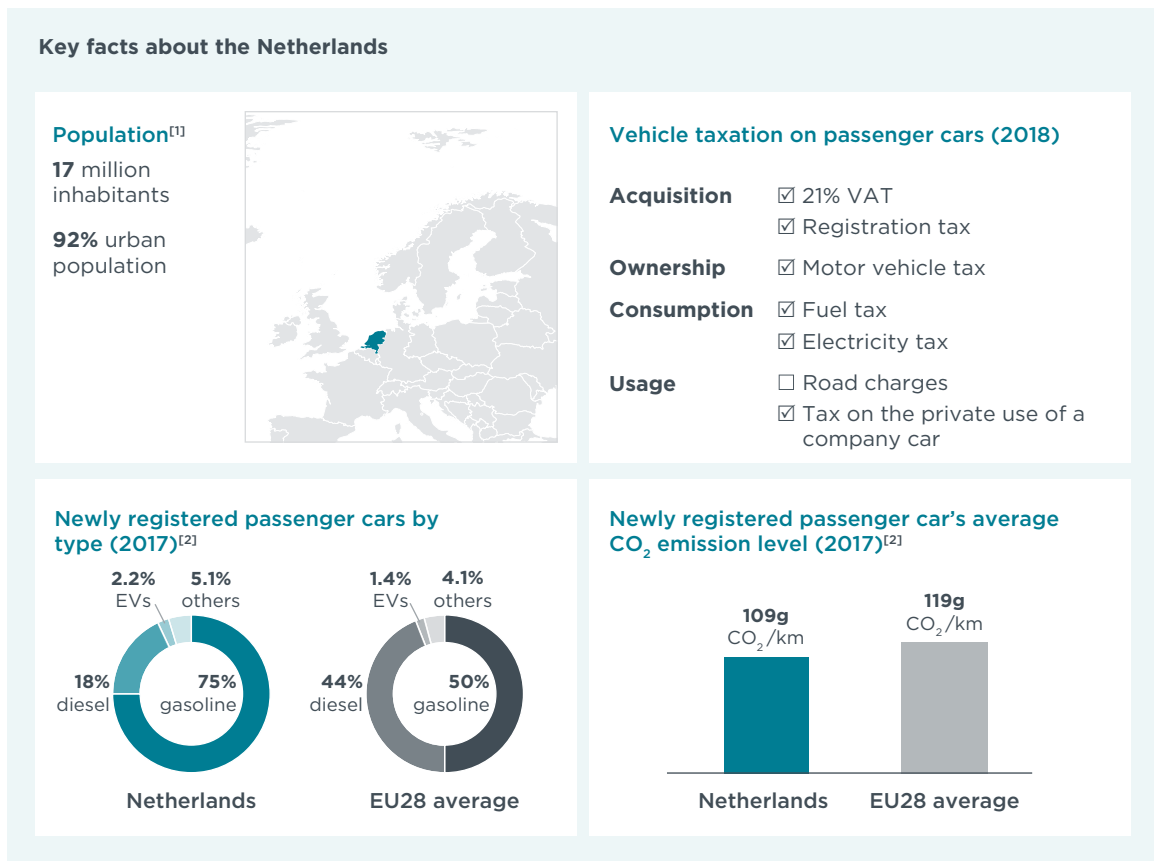


Figure 8. Key facts about the Netherlands (^[1] CIA, 2018; ^[2] Mock, 2018a).

Figure 9 summarizes national **taxes on registration** in the Netherlands. The one-time registration tax on acquisition is determined by the CO₂ emission level of a vehicle (Tax and Customs Administration, n.d):

- » For gasoline and diesel cars, the payable amount consists of an initial basic fee of €356 plus a fixed rate per g CO₂/km. The CO₂-based rates are divided into five bands and start at €2 for each emitted gram between 1 g CO₂/km and 73 g CO₂/km and increase progressively up to €458 for each gram above 162 g CO₂/km. Cars with a diesel engine pay a surcharge of €87.38 per gram CO₂/km starting at 63 g CO₂/km.
- » PHEVs are subject to different rates, also based on CO₂ emissions, divided into three bands: 1-30 g CO₂/km, 31-50 g CO₂/km, and more than 50 g CO₂/km. The levies start at €19 for each g CO₂/km for the first band and rise linearly to a maximum of €289 for each gram above 50 g CO₂/km. There is no initial surcharge of €356 as for gasoline and diesel cars.
- » BEVs and FCEVs in the Netherlands are exempt from one-time registration tax.

Netherlands

Amount of national one-time registration tax for new passenger cars (€)

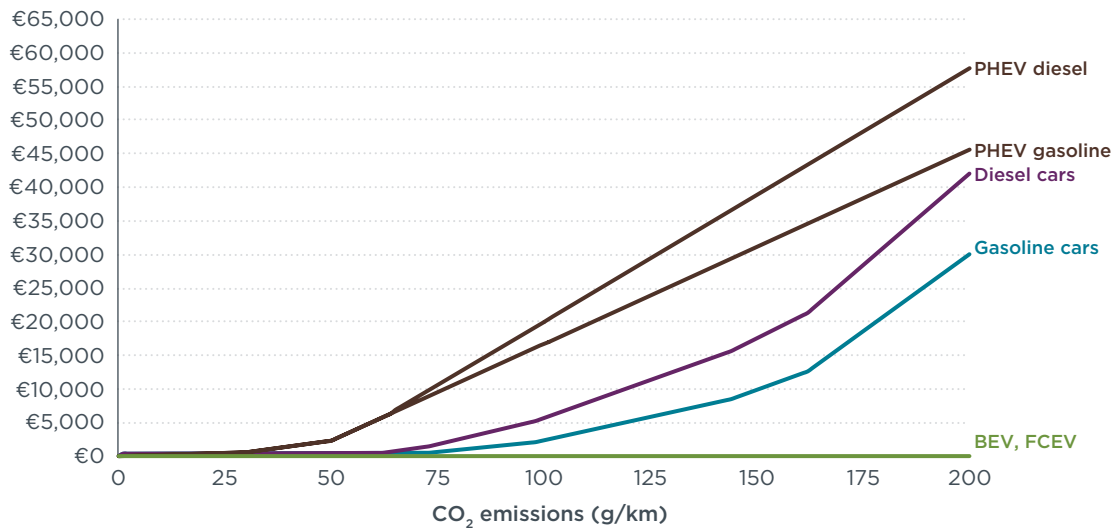


Figure 9. Overview of national one-time tax on vehicle registration as of May 2018.

Motor vehicle tax in the Netherlands is a stepwise function. The annual amount payable is the sum of four factors: CO₂ emissions, the weight of the car including battery, the fuel type, and an additional provincial-level surcharge.⁸ Zero-emission vehicles are exempt from motor vehicle tax, and PHEVs emitting 1–50 g CO₂/km pay half the tariff of a conventional car until 2020. Gasoline and diesel cars as well as non plug-in hybrids pay the full amount. Based on the four factors, the tax can be calculated via the Dutch tax authority website. As an example: The owner of a typical VW Golf diesel, registered in the region of Drenthe where the regional tax is highest, pays about €1,500 in 2018. The tax on the comparable gasoline variant would be 700, and the PHEV Golf, €500, while the BEV version would be exempt (Centraal Bureau voor de Statistiek, 2018; Belastingdienst, 2018a).

On **fuel** consumption, car owners in the Netherlands pay an **excise tax** on gasoline at a rate of €0.780/L; the corresponding rate for diesel is €0.495/L (Belastingdienst, 2018b). Taxes account for 64% of the gasoline pump price and 53% for diesel. The price at the pump is €1.688/L for gasoline and €1.381/L for diesel, as of May 21, 2018 (EC, 2018a, 2018b, 2018c). The corresponding rate for **taxes on electricity** is 55%, or about as high as for diesel—assuming a consumption rate between 5,000 kWh and 15,000 kWh per year. Households with this level of consumption paid on average €0.185/kWh in the first quarter of 2018 (Eurostat, 2018).

Road charges are not collected in the Netherlands. There are two toll tunnels where drivers are charged per use (ASECAP, 2017).

Calculation of the **taxable benefit in kind** for the private use of a company car is based on the Dutch catalogue price of a car inclusive of VAT and registration tax. A tax is payable only if private use exceeds 500 km per calendar year. In 2018, the rate is 22% for

⁸ Provincial rates in the 12 provinces varied between €67.90 for North Holland and €92 for Drenthe in 2018 for a period of three months.

cars emitting more than 0 g CO₂/km. Zero-emission vehicles are subject to a reduced tax rate of 4% (Royal Dutch Touring Club, 2018; Belastingdienst, 2018c).

There are no national one-time **subsidies** granted by the Dutch government on the acquisition of a low-emission car similar to those in Germany.

2.2.4. Norway

New passenger cars in Norway on average emit about 37 g CO₂/km less than the average new car in the EU, or 82 g CO₂/km versus 119 g CO₂/km, based on the NEDC (see Figure 10). Diesel cars made up 23% of new car registrations in 2017, significantly below the EU average of 44%. Norway has the highest share of electric vehicles in the world, with 39% of all new car registrations in 2017 (Mock, 2018a;). Norway levies taxes on the acquisition of a new car, including 25% VAT plus registration tax; ownership in the form of motor vehicle tax; consumption, as taxes on fuel and electricity; private use of a company car; and infrastructure use in the form of road tolls.

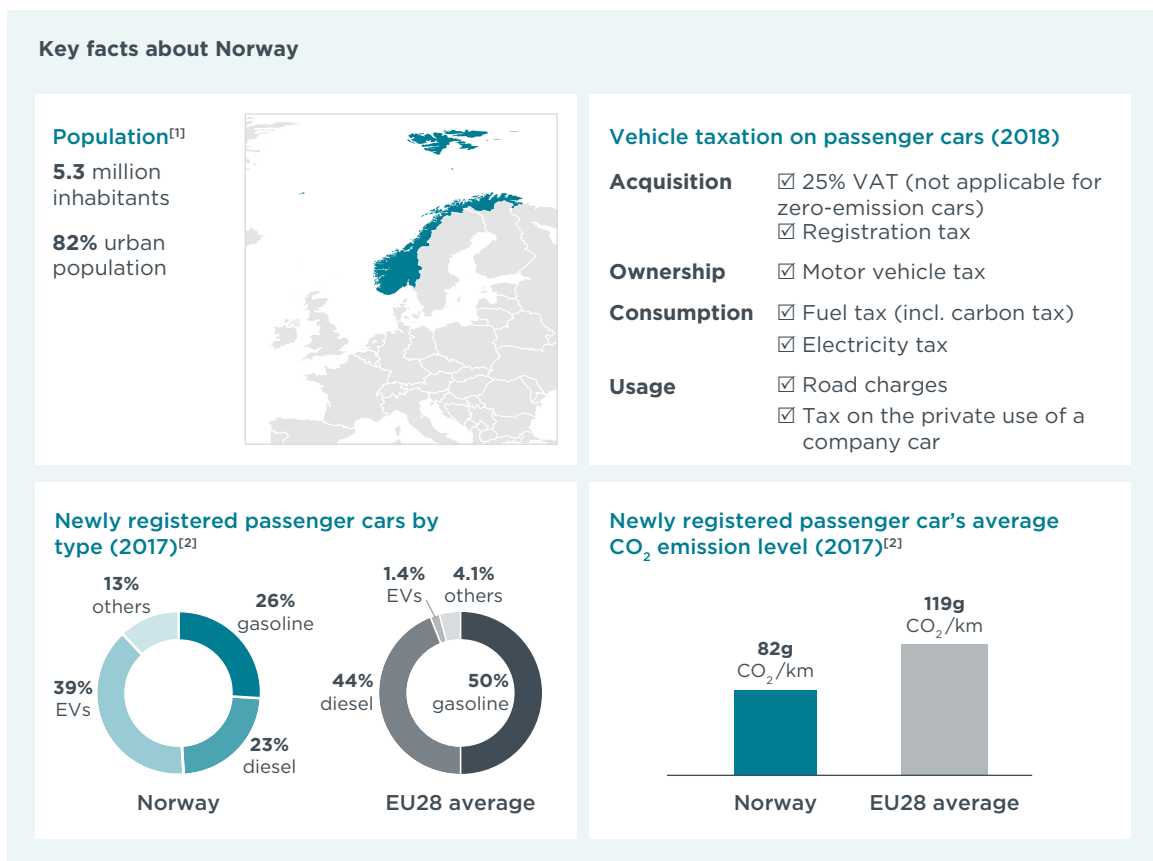


Figure 10. Key facts about Norway (^[1] CIA, 2018; ^[2] Mock, 2018a).

In Norway, a 25% **VAT** is payable on the vehicle's base price, or the list price as provided by car manufacturers. Zero-emission vehicles are exempt from paying 25% VAT. The **registration tax** (see Figure 11) is based on the sum of tax components related to CO₂ emissions, NO_x emissions, and vehicle weight (Ministry of Finance, 2018):

1. CO_2 : The amount payable is based on six bands. Cars emitting between 71 g CO_2/km and 95 g CO_2/km pay 929 Norwegian kroner (NOK),⁹ or €97, for each gram. Maximum rates start above 195 g CO_2/km at 3,505 NOK, or €366, per gram. Two bands provide tax reductions for vehicles emitting less than 71 g CO_2/km , resulting in a negative tax value: Between 0 g CO_2/km and 39 g CO_2/km , the deduction is 1,120.29 NOK, or €117, per gram, and between 40 g CO_2/km and 70 g CO_2/km , the deduction is 952.20 NOK, or €99, per gram.
2. NO_x : The amount to be paid is a fixed linear rate of 72.06 NOK, or €7.50, per milligram (mg)/km.
3. Vehicle curb weight: The amount payable depends on five classes with rates applying per kilogram. Cars with a curb weight of 500 kg or less are tax exempt; between 501 kg and 1,200 kg, the payable amount is 25.04 NOK, or €2.61, per kilogram. The maximum rate applies for vehicles weighing more than 1,500 kg, with a tax of 226.83 NOK, or €23.68, per kilogram, rising linearly.

Even though the sum of the three components can result in a negative amount for cars emitting less than 71 g CO_2/km , there are no tax refunds if the value is less than zero.

Norway

Amount of national one-time registration tax for new passenger cars (€)

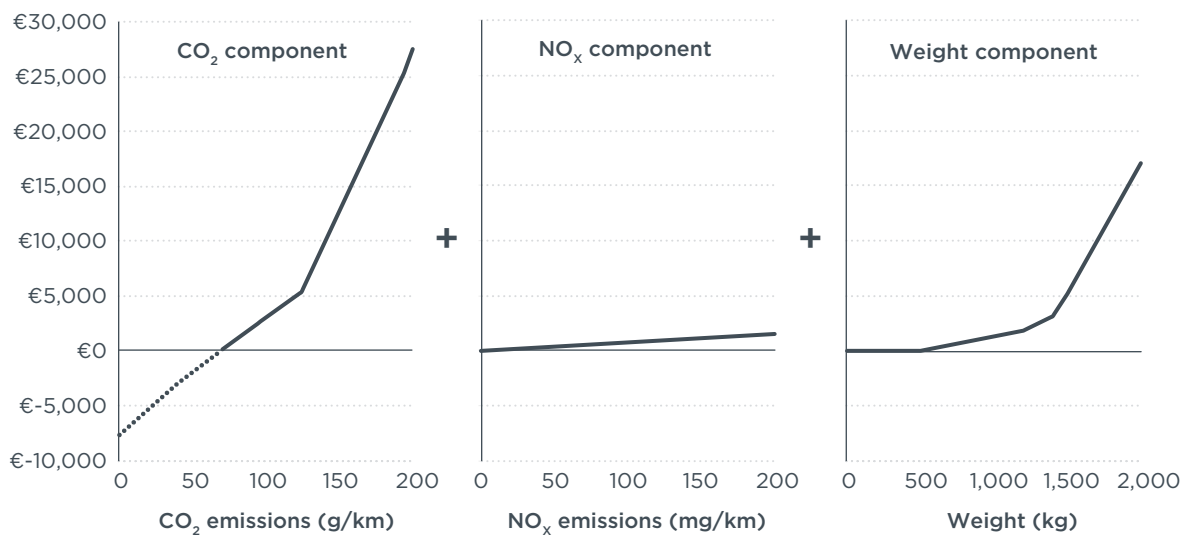


Figure 11. Overview of national one-time taxes on vehicle registration as of May 2018. Exchange rate €1 = 9.578 NOK. Dotted line indicates that consumers do not benefit from tax rebates or subsidies.

In 2018, the annual **motor vehicle tax** was replaced by a traffic insurance fee payable as part of the car insurance. The fee is collected by insurance companies which, in turn, pay the fee to the government. The amount payable is calculated per day. Assuming 365 insurance days a year, the owner of a diesel vehicle without particulate filter pays 3,327 NOK, or €347, in 2018. The owner of a gasoline car, a diesel car with particulate filter, or a PHEV pays 2,855 NOK, or €298, and owners of BEVs and FCEVs pay no fee (Statens vegvesen, 2018a; Trafikkforsikringsforeningen, n.d.).

⁹ Exchange rate €1 = 9.578 NOK as of May 14, 2018.

Fuel in Norway is **taxed** at 6.33 NOK/L, or €0.6609/L, in the case of gasoline, including a CO₂ tax of 1.16 NOK/L, or €0.1211/L. The corresponding rate for diesel is 5.08 NOK/L, or €0.5304/L, including a CO₂ tax of 1.33 NOK/L, or €0.1389/L. The total fuel price at the pump amounts to €1.665/L for gasoline and €1.583/L for diesel. Of the gasoline pump price, taxes are 65%, the highest share in Europe, and for diesel, 58%, as of May 2018 (Ministry of Finance, 2018). Households paid on average €0.128/kWh for **electricity** in the first half of 2018, with a **tax** share of 32%, assuming yearly household consumption between 5,000 kWh and 15,000 kWh (Eurostat, 2018).

Norway has a **road tolling** network including highways, city toll rings, bridges, and tunnels, with a total length of about 900 km. In addition, charges are payable on ferries. Cities like Oslo and Trondheim levy specific city-related tolls for access to their city centers. Tariffs are not related to distance driven but are a flat rate for using certain road sections. BEVs and FCEVs, previously exempt from national road tolls, pay half of the regular rate on some toll roads since 2018 (Statens vegvesen, 2018b; AutoPASS, 2018).

In Norway, the taxable in-kind benefit for the **private use of a company** car depends on the vehicle price and fuel type. If the vehicle costs 303,900 NOK, or €31,700, or less, the employee has to tax 30% of the vehicle's list price as benefit in kind. If the list price is higher than 303,900 NOK, the percentage to be added for the remaining amount of the list price is 20%. For example, the yearly taxable benefit in kind for a vehicle costing 660,000 NOK, or €68,900, is 162,390 NOK, or €17,000: (303,900 NOK * 30%) + (356,100 NOK * 20%). For zero-emission vehicles, the calculation base for the taxable in-kind benefit is 60% of the vehicle's list price rather than 100%. For example, the list price of an electric car costing 660,000 NOK is reduced by 40%, leaving 396,000 NOK as the calculation base. The yearly taxable benefit in kind would be 109,590 NOK, or €11,400: (303,900 NOK * 30%) + (92,100 NOK * 20%). In cases where an employee drives a nonelectric car more than 40,000 km per year, the calculation base is reduced from 100% to 75% of the car's list price. Alternatively, employees can pay tax based on expenditures actually incurred (Skatteetaten, 2018).

In Norway, the government does not provide national one-time **subsidies** for the purchase of a low-emission vehicle similar to those of Germany.

2.2.5. United Kingdom

In the United Kingdom, the average CO₂ emissions for new cars are about 2 g CO₂/km higher than the EU level, or 121 g CO₂/km versus 119 g CO₂/km, based on the NEDC (Mock, 2018a) (see Figure 12). The shares of gasoline, diesel, and electric vehicles are similar to the EU averages. The United Kingdom taxes vehicles on acquisition, including 20% VAT plus registration; ownership in the form of motor vehicle tax; consumption as taxes on fuel and electricity; private use of a company car; and road charges.

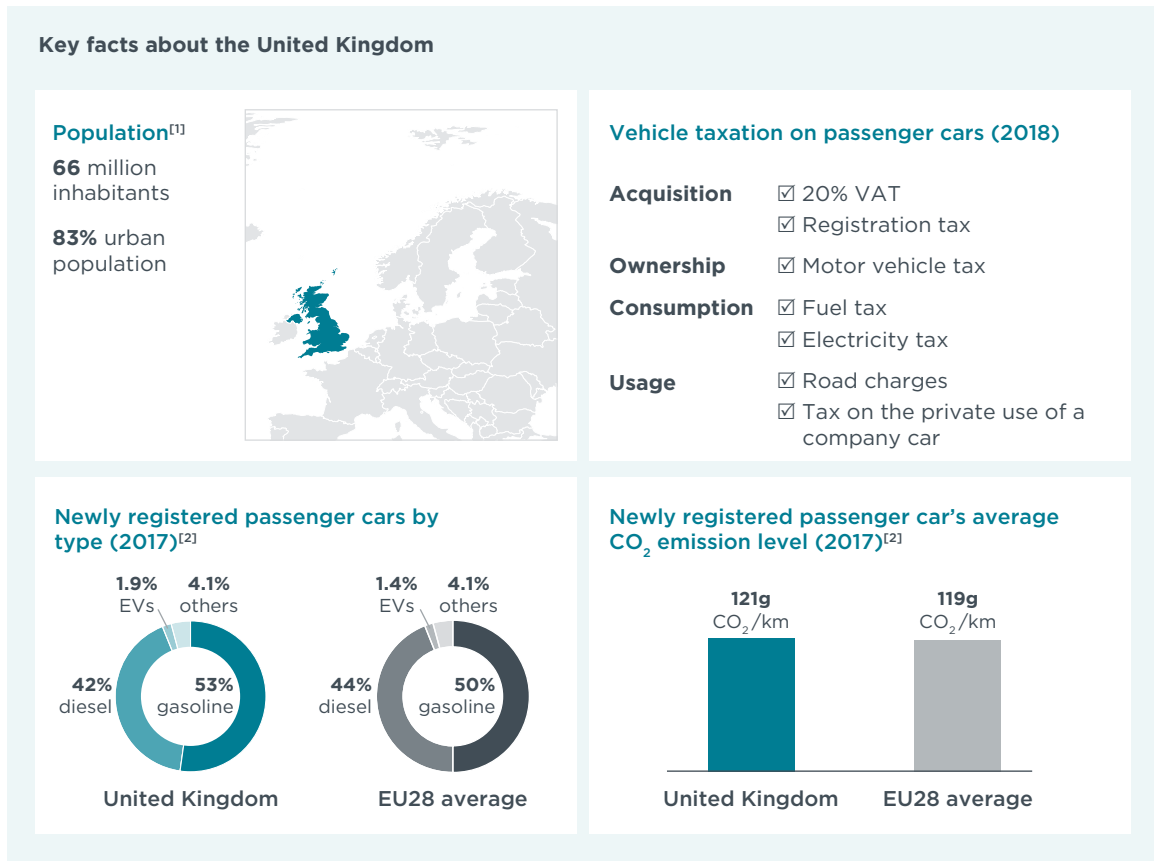


Figure 12. Key facts about the United Kingdom (^[1] CIA, 2018; ^[2] Mock, 2018a).

Figure 13 gives an overview of national taxes on vehicle acquisition and ownership. Purchasers of a new car pay a so-called excise duty on registration, which is strictly speaking a form of registration tax.¹⁰ It is based on the car's CO₂ emissions. There are 13 bands with different rates defined for (1) diesel cars that comply with the Real Driving Emissions 2 (RDE2) standard¹¹ and gasoline cars, (2) all other diesel cars, and (3) alternative-fuel cars (including PHEVs). Rates for gasoline and diesel cars that fulfil the RDE2 standard start at £10, or €11¹² if emitting between 1 g CO₂/km and 50 g CO₂/km and increase by CO₂ band up to a maximum of £2,070, or €2,350, for cars emitting more than 255 g CO₂/km. All other diesel cars pay £25, or €28, if emitting between 1 g CO₂/km and 50 g CO₂/km, also capped at €2,350 if emissions exceed 255 g CO₂/km. Rates for alternative-fuel cars are slightly lower, being exempt up to 50 g CO₂/km and starting at €16 for cars emitting between 51 g CO₂/km and 75 g CO₂/km, with a maximum of €2,250 if emitting more than 255 g CO₂/km. BEVs and FCEVs are exempt.

10 Excise duty on registration is the first-year rate of ownership tax; however, it is considered as registration tax in this report.
 11 RDE2 standard will not become mandatory for all vehicles until 2021. The standard allows limits on NO_x to be exceeded under real driving conditions with a factor 1.43. The valid RDE1 standard allows a deviation by a factor of 2.1 (Mock, 2018b).
 12 Exchange rate €1 = £0.88 as of May 15, 2018.

United Kingdom

Amount of national one-time registration tax for new passenger cars (€)

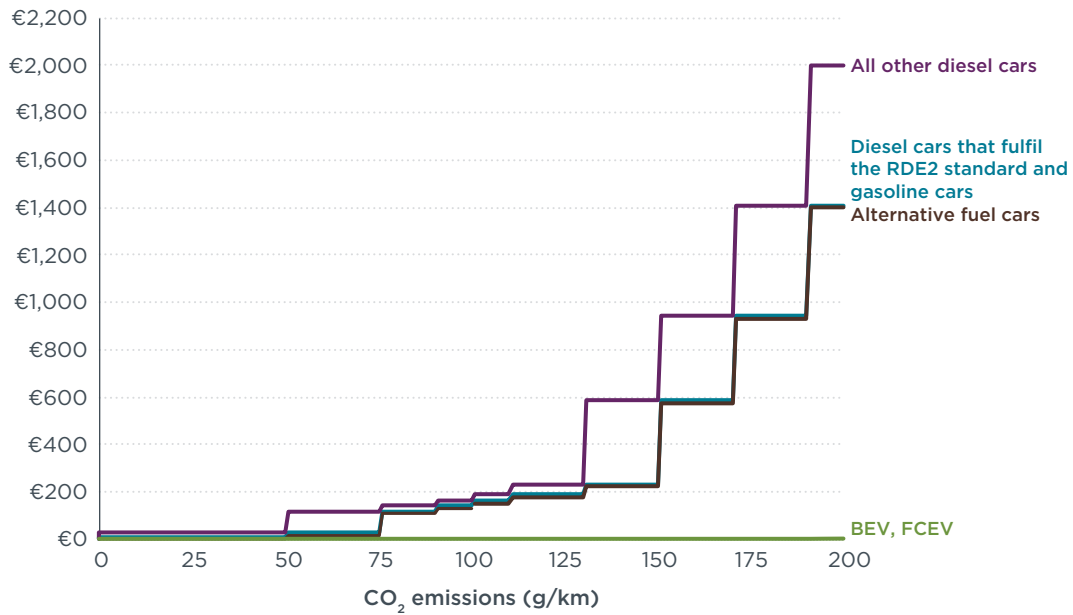


Figure 13. Overview of national one-time tax on vehicle registration in the United Kingdom as of May 2018. €1 = £0.88 as of May 15, 2018.

Owning a vehicle in the United Kingdom is taxed starting with the second year of ownership, based on the list price of the vehicle (Government Digital Service, 2018a):

- » Vehicle list price up to £40,000, or €45,500: The standard annual motor vehicle tax rate for gasoline and diesel vehicles is a fixed £140, or €159. Alternative-fuel vehicles are subject to a slightly lower yearly rate of £130, or €148. Zero-emission vehicles are exempt.
- » Vehicle list price above £40,000, or €45,500: All cars are subject to an additional rate on top of the standard annual motor vehicle tax rate of £310, or €350, a year for five years. After five years, car owners pay the standard annual motor vehicle tax rate as in the first bullet point.

Consumption of gasoline and diesel is taxed on an equal basis at £0.5795/L, or €0.6585/L. Similarly, the tax share in the end consumer fuel price is about the same—63% for gasoline and 61% for diesel. This also applies to the pump price of €1.437/L for gasoline and €1.484/L for diesel, as of May 21, 2018 (Government Digital Service, 2018b; EC, 2018a, 2018b, 2018c). Household **electricity** averaged €0.168/kWh in the first half of 2018, taxed at a rate of 22% and assuming yearly household consumption between 5,000 kWh and 15,000 kWh (Eurostat, 2018).

Road charges apply to more than 20 roads in the United Kingdom, including motorways, bridges, and tunnels. Rates for passenger cars include fixed rates for one-time use, seasonal tags, or fixed rates depending on time of day. There are no exemptions for low-emission vehicles. In addition to these charges, there are congestion charging schemes in London and Durham for inner-city areas during peak times. In London, cars that emit 75 g CO₂/km or less and meet Euro 5 qualify for a 100% discount on congestion charges (Government Digital Service, 2018c; Transport for London, 2018).

The **private use of a company car** is taxed based on the vehicle's list price including VAT, excise duty on registration, and delivery charges. Taxes are based on CO₂ emissions and fuel type. For CO₂, there are 29 bands with rates starting at 13% of the vehicle's price for diesel cars that fulfill the RDE2 standard, gasoline cars, electric, and hybrid cars. Rates for other diesel cars start at 17%. The percentage value goes up to a maximum of 37% of the list price for all vehicle types. Users of a zero-emission car or a car emitting between 1 g CO₂/km and 50 g CO₂/km pay a rate of 13%; for other diesel cars the rate for the same bands is 17%. The rates for all vehicles types will gradually increase until 2020 (Government Digital Service, 2018d).

The government of the United Kingdom provides financial support for private and business customers for purchasing low-emission vehicles. Car dealerships and manufacturers have access to **grants** to reduce the price of the vehicle; the value of the grant is included in the vehicle's price by the dealer. The grant applies to the recommended retail price and covers 35% of the base purchase price including registration tax, VAT, and license plates and excluding optional equipment and first-registration fee. Before November 2018, the maximum grant amount was either £2,500 or £4,500—€2,800 or €5,100. There were three categories depending on a car's CO₂ emissions and all-electric drive range (Government Digital Service, 2018e):

- » Category 1: Cars emitting less than 50 g CO₂/km with an all-electric travel range of at least 112 km received a grant of as much as €5,100. There was no price cap.
- » Category 2: Cars emitting less than 50 g CO₂/km with an all-electric range of 16 km received a maximum of €2,800. Vehicles costing more than €60,000, or €68,000, were excluded.
- » Category 3: Cars emitting between 50 g CO₂/km and 75 g CO₂/km with an all-electric range of at least 32 km got a maximum grant of €2,800. Vehicles costing more than €60,000, or €68,000, were excluded.

Starting in November 2018, the grant scheme was adapted. Vehicles of category 1 now receive a reduced one-time grant of £3,500, or €4,000. Purchasers of a category 2 or 3 vehicle no longer receive financial support by the British government (Government Digital Service 2018f).

2.2.6. Overview of vehicle taxation policy

Our review of the various tax systems reveals an inconsistent and complex taxation policy for passenger cars in the five markets. Types of taxation, timing of taxation, tax bases, and tariffs vary widely. Table 1 summarizes the essential factors in Germany, France, the Netherlands, Norway, and the United Kingdom and highlights the complexity and differentiation.

Table 1. Overview of important national vehicle taxes for passenger cars for the tax year 2018 (starting April 2018).

		France	Germany	Netherlands	Norway	United Kingdom
Tax payments						
Purchase and registration of a new vehicle (one-time)	VAT	20% for all fuel types	19% for all fuel types	21% for all fuel types	25% for all fuel types, 0% for zero-emission vehicles	20% for all fuel types
	Registration tax	Yes , based on CO ₂ emissions	No , only a registration fee	Yes , based on CO ₂ emissions and fuel type	Yes , based on CO ₂ emissions, NO _x emissions, and vehicle weight	Yes , based on CO ₂ emissions and fuel type
Ownership of a vehicle (in regular intervals)	Motor vehicle tax	Yes , based on CO ₂ emissions (> 190 g CO ₂ /km)	Yes , based on CO ₂ emissions, cylinder capacity, and fuel type	Yes , based on vehicle weight and fuel type	No , in 2018 replaced by a traffic insurance fee	Yes , based on CO ₂ emissions and fuel type
Consumption of fuel and electricity	Tax share of gasoline (end price)^[i]	61% (€0.173/kWh)	60% (€0.166/kWh)	64% (€0.190/kWh)	65% (€0.187/kWh)	63% (€0.161/kWh)
	Tax share diesel (end price)^[i]	58% (€0.149/kWh)	52% (€0.132/kWh)	53% (€0.141/kWh)	58% (€0.162/kWh)	61% (€0.151/kWh)
	Share of taxes and levies on electricity (end price)^[ii]	38% (€0.161/kWh)	56% (€0.280/kWh)	55% (€0.185/kWh)	32% (€0.128/kWh)	22% (€0.168/kWh)
Use of transport infrastructures	Road charges	Yes , national toll scheme	No , but infrastructure fee in planning	No , only for crossing two tunnels	Yes , national and city toll schemes; partial exemptions or reduced rates for zero-emission vehicles	No , only for about 20 road sections; some congestion charging schemes at city level
Private use of company car	Taxable benefit in kind per year^[iii]	9% or 12% for all fuel types	12% for all fuel types (starting January 1, 2019, 6% for BEV/FCEV and PHEV)	4% for zero-emission vehicles 22% for vehicles emitting > 0 g CO ₂ /km	30% of the list price up to €31,700, 20% of the rest of the car's list price for all fuel types; reduced list price (60%, instead of 100%) for zero-emission vehicles	13% for zero-emission vehicles 13%–37% for other fuel types including diesel cars with RDE2-standard (> 0 g CO ₂ /km), 17%–37% for other diesel cars (> 0 g CO ₂ /km)
Refunds						
Subsidies	Grants	Yes , maximum of €6,000 for cars between 0 g CO ₂ /km and 20 g CO ₂ /km	Yes , maximum of €4,380 for zero-emission vehicles, maximum of €3,285 for PHEV (< 50 g CO ₂ /km); price cap at €60,000	No national grants for low-emission vehicles	No national grants for low-emission vehicles	Yes , maximum of €5,100 or €2,800, depending on CO ₂ -emissions and all-electric range; partial price cap at €68,000 (until November 2018)

^[i] Tax share of the end consumer price (%) and consumer end price in parentheses (€/kWh) as of May 21, 2018. To convert fuel end price to kWh, we use the heat value of 8.9 kWh/L for gasoline and 9.8 kWh/L for diesel.

^[ii] Tax share of the end consumer price for the first half of 2018. Exemplary for a household consuming 5,000–15,000 kWh of electricity per year.

^[iii] Based on the full list price in the case of France, Germany, Norway, and the United Kingdom; in the Netherlands, based on the taxable value.

3. QUANTITATIVE ANALYSIS OF TAXATION LEVELS

While 24 of 32 European countries impose some form of emission-based registration or ownership tax on passenger cars, our country-specific overview of tax systems indicates that the emission-based tax approaches vary widely in terms of constituent elements such as CO₂ emissions, NO_x emissions, Euro Emission Limits, and fuel consumption. They also differ on timing, such as at acquisition or during ownership, as well as thresholds. To quantify the financial impact of the taxation systems from a vehicle user's perspective, we determine the total vehicle costs for different configurations of the same VW Golf model for the selected markets. Based on these findings, we evaluate the relative cost-benefit ratio in terms of CO₂ output.

3.1. METHODOLOGY

This analysis is based on four comparable VW Golf variants. Out of 10 vehicle segment classifications, the lower-medium segment accounted for the second largest market share in 2017 with almost 30%. The VW Golf was the top-selling passenger car in Europe (Mock, 2018a). For our sample, we select conventional gasoline and diesel models, comparing ownership costs with those for electrically-driven counterparts, the VW e-Golf, a BEV, and the VW Golf GTE, a PHEV. We select vehicle configurations with comparable specifications that are available in each country. Table 2 below provides an overview of the vehicle variants selected for our analysis and their specifications in terms of engine power, CO₂ emissions based on the NEDC, and engine size.

Table 2 VW Golf variants selected for analysis.

Segment	Model	Model Year	Powertrain	Engine power (kW)	CO ₂ emissions (g/km)	Engine size (cm ³)
Lower medium	VW Golf 1.5 TSI	2017	Gasoline	110	112	1,498
	VW Golf 2.0 TDI	2017	Diesel	110	114	1,968
	VW e-Golf	2017	BEV	100	0	—
	VW Golf GTE	2017	PHEV gasoline	150	36	1,395

Note: Information based on German vehicle specifications (Volkswagen, 2018). Numbers might vary by country, as car manufacturers provide different figures for engine power, CO₂ emissions, or engine size. CO₂ emissions are based on NEDC.

To compare the tax liabilities of the four Golf variants, we analyze the impact on their relative purchase, ownership, and consumption costs. We also make some standard assumptions. For example, we assume that vehicles are purchased and operated on a private basis and are subject to an amortization period of four years. This is to reflect the expected timeframe an average customer takes into account when estimating cost of ownership. We also perform similar calculations for vehicles supplied as company cars, which are then subject to a holding period of three years. We use an annual discount rate of 6%. This methodology was used in similar ICCT studies (Mock and Yang, 2014; Tietge et al., 2016). In terms of current validity, we base our calculations on

13 Based on NEDC.

tax data for the 2018 financial year, more specifically starting April 2018 due to policy changes in the United Kingdom, and apply the relevant vehicle taxation policy for each national market.

The basis for the analyses is the manufacturer’s officially disclosed purchase price in each market before the application of initial one-time subsidies. It includes VAT and, in the case of the Netherlands and Norway, registration tax. For a better understanding and interpretation of the results, we first examine detailed pricing of the models in the five markets.

Figure 14 plots the list prices of the vehicle variants in each market. The BEV and PHEV variants are more expensive than the gasoline and diesel variants across most markets. The only exception is Norway, where both electric models are cheaper. That is because in Norway, zero-emission vehicles are exempt from the 25% VAT and the registration tax. The Golf PHEV, emitting less than 71 g CO₂/km, is also exempt from the registration tax. The differences in list prices among the vehicles in this study are also significant within each market. Consider the list price of the gasoline Golf and the e-Golf BEV. In France and the Netherlands, the cost of the e-Golf is about €7,300 higher than the gasoline variant. In the United Kingdom it is €7,000 higher, and Germany, €5,300 more. Therefore, if we consider only the list price of the vehicle at the time of purchase before the application of initial one-time subsidies, the e-Golf version turns out to be significantly more expensive than the gasoline version, with the exception of Norway.

VW Golf variants

List price (€)

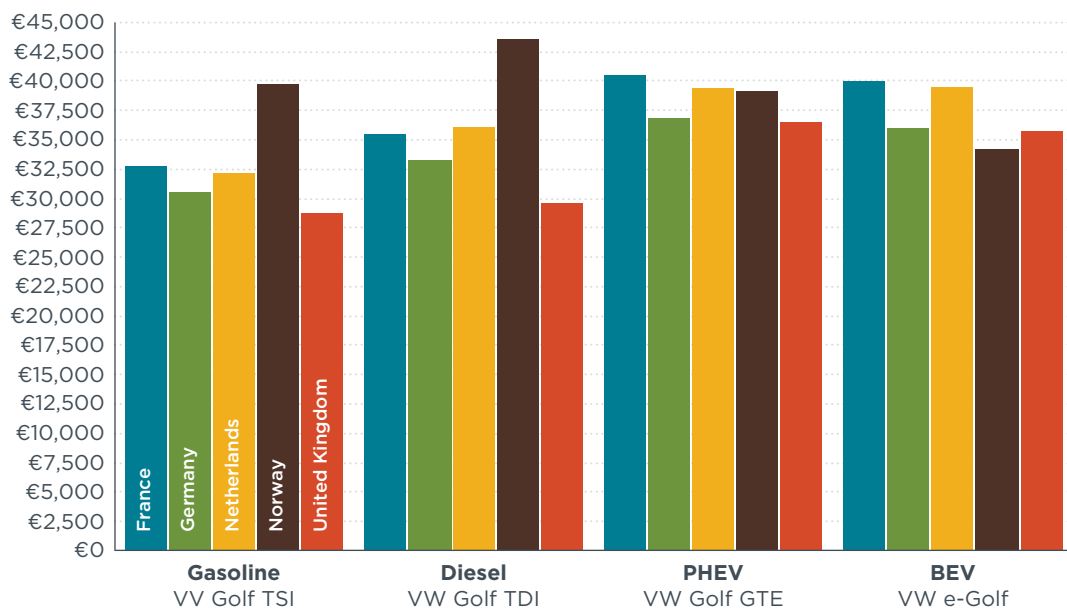


Figure 14. List prices including VAT as well as registration tax in the case of the Netherlands and Norway for the VW Golf vehicle variants selected for our analysis. Prices based on car manufacturers’ data, before the application of initial one-time subsidies.

We focus on the tax payments and credits applied directly at the point of purchase and throughout the assumed ownership period, disregarding any indirect values, costs, or benefits that may occur later, such as when selling the vehicle. That’s because resale values constantly fluctuate, especially for EVs.

The definition of “taxes” as part of our report includes **VAT**, which applies to the vehicle’s base price at purchase. Any **one-time subsidies for low-emission** vehicles are generally subtracted from the car’s base price plus VAT. In addition to VAT, we include **initial one-time registration tax** as applied mostly by national governments and regional registration taxes where applicable, such as in France. Registration fees that apply on top of registration tax are not considered as the amounts are negligible. We also take into account **periodic motor vehicle tax** for owning a car, projected at yearly intervals. Where there exist, regional motor vehicle taxes are also included, such as for the Netherlands. Finally, in addition to **taxes and pre-tax prices on fuel and electricity**, we factor in **road charges**. In the case of France, we use the estimated average level of highway tolls; for Oslo and London we analyze charges for access to city centers. Road charges are not counted for the other countries as they relate only to specific roads.

It is necessary to make a number of assumptions on fuel and electricity costs. Generally, all fuel consumption and electricity usage figures are stated based on the NEDC test procedure. We differentiate between pre-tax and tax costs to better reflect total consumption costs. For gasoline cars we apply an adjustment factor of 1.37, and for diesel, 1.45 to the NEDC fuel consumption and energy consumption values, to reflect real-world fuel consumption for medium-sized vehicles (Tietge et al., 2016).¹⁴ Fuel prices and relevant tax ratios within the consumer fuel end prices are for May 2018 (EC, 2018a, 2018b, 2018c; Ministry of Finance, 2018). The assessment of PHEV fuel and energy consumption is more complicated, as these vehicles combine an electric drivetrain with a conventional one and data on real-world driving and usage patterns is limited. For our analysis, we assume that PHEVs are driven using only electricity for 30% of total distance, with the rest of the distance using gasoline. We apply an adjustment factor of 1.37 on gasoline fuel and 1.50 on electricity to reflect real-world fuel and electricity use (Riemersma and Mock, 2017; Plötz, Funke, and Jochem, 2017). In the case of BEVs, we use an adjustment factor of 1.50 to reflect real-world electricity use. Electricity rates are based on prices for private households.¹⁵ We choose a range of annual household electricity consumption between 5,000 kWh and 15,000 kWh, acknowledging that charging an electric car at home requires about 3,900 additional kWh per year, assuming a car uses 30 kWh per 100 km and drives 13,000 km per year. Electricity prices and tax ratios are based on figures for the first half of 2018 (Eurostat, 2018). For the calculation of fuel and electricity costs, we consider a car to be driven 13,000 km a year, representing the average annual distance driven by passenger cars in Europe (ACEA, 2017b).

Further costs, such as expenses for insurance, repairs, extra fees, or maintenance are not included, as the focus of our report is the impact of taxation.

Although not technically part of four-year ownership costs, one-time subsidies at car purchase are also illustrated to show their effects on costs to the private consumer.

In the case of the **private use of a company car**, the relevant cost value is defined as the taxable benefit in kind an employee has to pay as a part of income tax. The actual amount payable depends on the employee’s income tax rate, which usually varies according to salary. Table 3 shows the methods, reference values, and assumptions made for each country to calculate the taxable amount payable as part of income tax over an assumed

¹⁴ Assumptions are based on various analyses carried out by the ICCT on this issue before 2016.

¹⁵ We assume that electric vehicles are charged at home where household electricity prices apply. In reality, charging is done at different places, so costs can differ. For example, industrial electricity prices are usually lower than for households. As a result, consumption costs for BEVs and PHEVs in our analysis represent comparably high values.

three-year holding period. The reference value is the vehicle's list price and, in the case of the Netherlands, the so-called tax value. We assume that allowances and discounts in the form of one-time subsidies by the retailers and governments are usually not taken into consideration when calculating the benefit in kind. We do however, subtract the special bonus for electric company cars as provided by the German government. For consistency, we base calculations on the marginal income tax rate for each country, taking into account that company cars are a benefit generally offered to employees with relatively higher status and income. In addition, we assume that additional costs for private use, such as for fuel or electricity or road charges, are paid by the employee, so no further benefits need to be taxed. This report aims to focus on the employee's perspective and costs for the private use of a company car. Costs incurred by the employer, which ultimately owns the vehicle, are not considered in this analysis.

Table 3. Methods and assumptions used to calculate the tax on the private use of a company car, for tax year 2018 (starting April 2018).

Country	Method	Reference value	Maximum marginal income tax rate	Taxable benefit in kind for the private use of a company car by an employee, as a percentage of the list price
France	Flat-rate method	Vehicle list price including VAT	45%	<ul style="list-style-type: none"> • 9% per year, based on the vehicle's list price, all vehicle types and technologies • Expenses such as fuel or electricity costs and road charges for the private use paid by employee • Allowances and discounts in the form of grants by the car dealer or government are not included in the assessment of the company car cost calculations
Germany	1%-method	Vehicle list price including VAT, minus special bonus for electric company cars	45%	<ul style="list-style-type: none"> • 12% per year, based on the vehicle's list price, all vehicle types/technologies • Expenses such as fuel/electricity costs and road charges for the private use paid by employee • Trips between work and home are not considered, only the use of the vehicle • Allowances and discounts in the form of grants by the car dealer/government are not included in the assessment of the company car cost calculations
Netherlands	Flat-rate method	Vehicle tax value including VAT and registration tax	51.95%	<ul style="list-style-type: none"> • 4% per year, based on the vehicle's tax value if the private use of the company car exceeds 500 km per year for zero-emission vehicles • 22% per year, based on the vehicle's tax value if the private use of the company car exceeds 500 km per year for all vehicle types and technologies except zero-emission vehicles • Expenses such as fuel and electricity costs and road charges for the private use paid by employee
Norway	Flat-rate method	Vehicle list price including VAT and scrapping fee	46.6%	<ul style="list-style-type: none"> • 30% or 20% of the vehicle's list price (reduced list price of 60% for zero-emission vehicles) for all vehicle types and technologies • Expenses such as fuel and electricity costs and road charges for the private use paid by employee
United Kingdom	Flat-rate method	Vehicle list price including VAT, registration tax, and delivery charges	45%	<ul style="list-style-type: none"> • 13% of the vehicle's list price for zero-emission vehicles • 13%-37% of the vehicle's list price for all vehicle types including diesel cars that fulfill the RDE2 standard, emitting > 0 g CO₂/km • 17%-37% of the vehicle's list price for diesel cars that do not fulfill the RDE2 standard, emitting > 0 g CO₂/km • Expenses such as fuel and electricity costs and road charges for the private use paid by employee • Allowances and discounts in the form of grants by the car dealer or government are not included in the assessment of the company car cost calculations

3.2. COUNTRY-SPECIFIC ANALYSIS

The following country-specific analysis illustrates the effects of vehicle taxation on the ownership costs of individual consumers over four years of vehicle usage. In addition, the costs related to the company car benefit—or the taxable amount for income tax on the private use of a company car by an employee—are plotted for a three-year holding period.

France

In France, subsidies for low-emission vehicles as well as exemption from registration taxes and relatively low electricity costs significantly reduce the four-year vehicle expense of privately owned BEVs, making them cost-competitive with gasoline and diesel autos and PHEVs (see Figure 15).

France

4-year consumer ownership costs including 3-years tax on company car benefit (€)

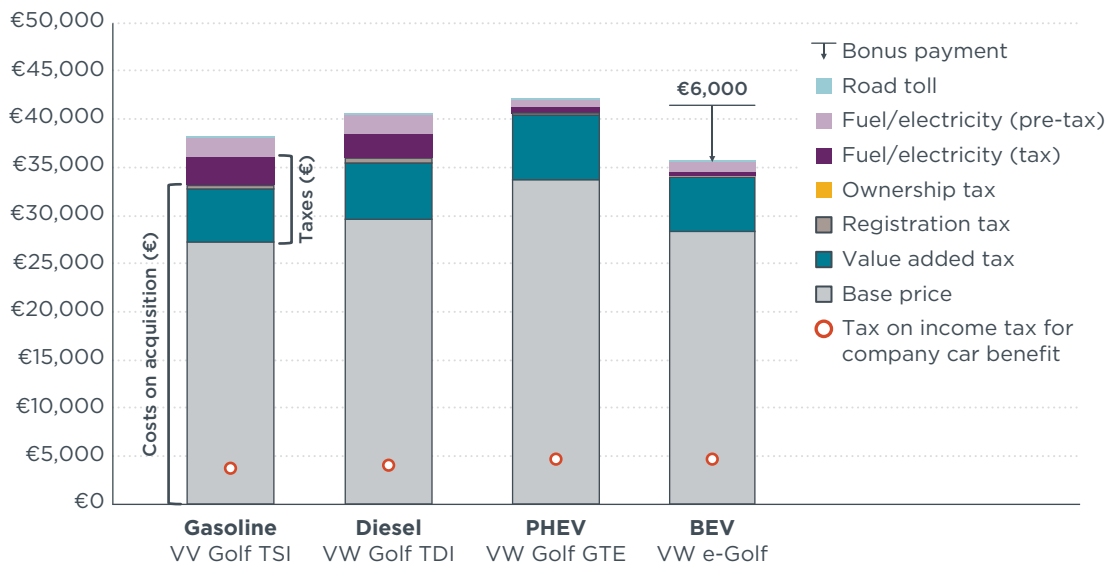


Figure 15. Four-year consumer ownership costs including three-year tax on company car benefit. Regional share of registration tax based on the Region Provence-Alpes-Côte d’Azur, which has the highest regional tax. Subsidy values have been subtracted from the list price in the case of privately owned cars.

The base price—excluding VAT and subsidies—accounts for the largest share of ownership costs, with significant differences between individual vehicle models. Take, for example, the gasoline Golf TSI with a base price of about €27,300. The comparable PHEV model costs almost €34,000 on acquisition, or €6,700 more. For cars emitting less than 21 g CO₂/km—the BEV version—the €6,000 one-time French government subsidy helps to offset the higher cost of acquisition. Thus, a BEV buyer pays a base price of €28,400 instead of €33,400.

The exemption from registration tax provides another notable incentive for EV buyers. For example, buyers of gasoline and diesel Golfs pay a one-time registration tax of just over €400, reflecting the regional levy as both vehicles fall below the 119 g CO₂/km threshold for the national registration fee. Meanwhile, buyers of the BEV and PHEV versions pay zero registration tax. Ownership taxes do not apply to any of the Golf models as they all emit less than 191 g CO₂/km.

Other incentives for low-emission vehicles in France are the relatively low net prices of electricity and a low electricity tax. About one-third of the consumer end price of electricity is taxes, whereas for gasoline and diesel the tax is about two-thirds of the pump price. In combination with the lower energy consumption per kilometer driven for electric vehicles, total expenses for electricity for the BEV and PHEV Golfs are less than one-third of the fuel cost for the gasoline Golf.

Road charges account for only a small proportion of vehicle costs, assuming average expenses of €0.35/km and an average distance traveled on motorways of 58.5 km. In this case, average four-year road charges add up to about €80 (ASFA, 2018).

Overall, from the perspective of a private consumer in France, the BEV benefits the most from the fiscal incentives provided by the government. It generates the lowest costs in terms of total tax expenses as well as total costs over four years. On acquisition, including base price, VAT, and registration tax, however, the gasoline car has a slight cost advantage over the BEV model.

In the case of the private use of a company car, the taxable amount payable by an employee as part of income tax is based on the vehicle’s list price. If not considering the subsidy for low-emission vehicles, the selected EVs have no competitive advantage over the comparable gasoline and diesel vehicles over three years.

Germany

In Germany, reflecting one-time subsidies by the government and manufacturers, no ownership tax, and lower total costs on consumption compared with gasoline and diesel, the BEV secures a slight competitive advantage over four years (see Figure 16). The same applies for employees privately using the BEV as a company car.

Germany

4-year consumer ownership costs including 3-years tax on company car benefit (€)

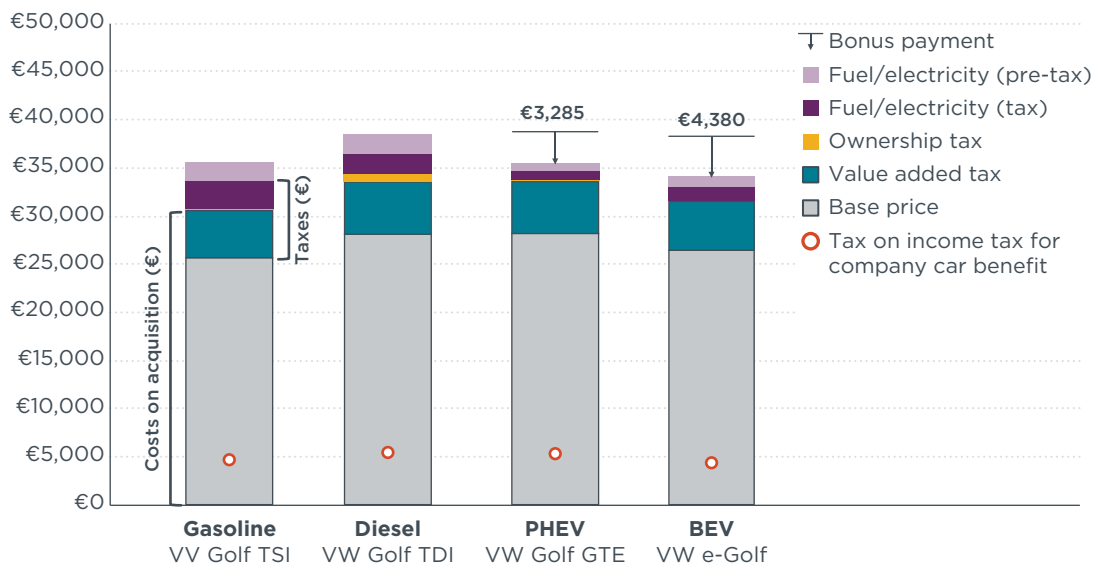


Figure 16. Four-year consumer ownership costs including three-year tax on company car benefit. Subsidy values have been subtracted from the list price or base price in the case of privately owned cars.

A significant difference compared with France are the one-time subsidies, which in Germany are lower for zero-emission vehicles at €4,380 including VAT than in France at €6,000 including VAT, valid for cars emitting up to 20 g CO₂/km. In contrast to France, Germany also offers grants of €3,285 including VAT for vehicles up to 49 g CO₂/km. However, the subsidies are not sufficient to make both electric Golf variants cost-competitive with the gasoline or diesel autos on acquisition. In the case of the BEV, the base price is still €800 higher than the gasoline version.

Annual ownership taxes vary by fuel type, engine displacement, and CO₂ emissions and can differ significantly. The Golf diesel is subject to more than €800 of ownership tax over four years; the gasoline model, to nearly €250; the PHEV, to €100; and the BEV is exempt from ownership tax.

Electricity prices and corresponding tax rates for private consumers in Germany were the highest across Europe as of the first half of 2018. Paired with minimal cost advantages over fuel prices, total consumption costs for the owner of the Golf BEV add up to just over €2,500, whereas the owner of the diesel variant pays about one-third more over four years, or almost €4,000. The owner of the BEV pays almost €800 more than a PHEV owner, mainly due to the high electricity prices in Germany.

Overall, the BEV turns out to be the least costly option for a private consumer in Germany over four years. It secures a competitive advantage of just over €1,400 compared with the PHEV and gasoline Golf, and a €4,000 advantage over the diesel Golf.

For private use of a company car, EVs benefit from an additional bonus based on the capacity of the vehicle's battery. This is most notable for the BEV as the amount payable in income tax by an employee is the lowest at €4,300 over three years. That amounts to an advantage of €300 to almost €1,000 compared with the other variants.

The Netherlands

In the Netherlands, registration and ownership taxes are relatively high for gasoline vehicles and even higher for diesel vehicles, while EVs benefit from lower tax rates or from exemptions. These benefits make the BEV the least costly option over four years. Employees privately using a BEV company car also benefit from significant tax benefits (see Figure 17).

Netherlands

4-year consumer ownership costs including 3-years tax on company car benefit (€)

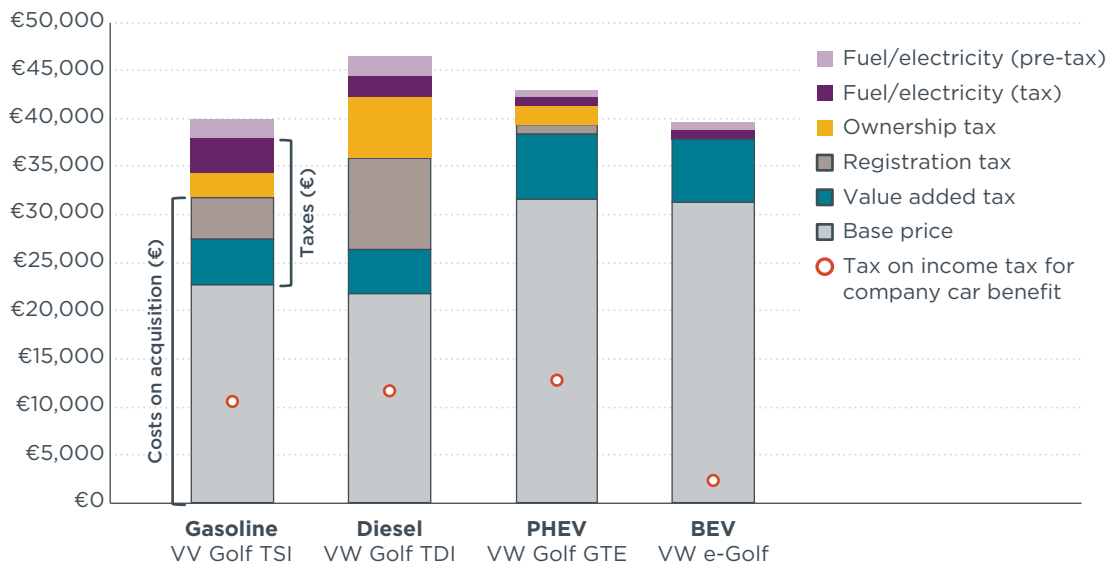


Figure 17. Four-year consumer ownership costs including three-year tax on company car benefit. Ownership tax includes a regional component, based on the Dutch Region of Drenthe, most expensive regional tax.

Registration and ownership taxes are comparatively high. A gasoline Golf is subject to €4,300 of registration tax; the diesel, €9,500; and the PHEV, almost €1,100. The BEV variant is completely exempt. For the ownership tax, the gasoline model is subject to €2,600 over four years while the tax on the diesel is more than twice as high at almost €6,300. For the PHEV, the ownership tax is more than €1,800, and the BEV is entirely exempt.

Total electricity prices for household consumers in the Netherlands amount to €0.185/kWh, slightly below the European average, assuming yearly consumption of 5,000 kWh to 15,000 kWh. As a result, total consumption costs over four years for the BEV are about one-third of the fuel costs for the gasoline variant. The cost advantage for the PHEV is almost identical.

Overall, the BEV turns out to have the lowest cost of ownership over four years and is competitive with the gasoline, diesel, and PHEV variants. However, this advantage takes effect only after a certain holding period. Upon acquisition, the BEV and the PHEV are much more expensive than the comparable conventional models because of significantly higher base prices and corresponding VAT. Even exemptions on registration tax cannot balance out the higher purchase costs.

For private use of a company car, income tax for benefit in kind is lowest for the BEV. This because the tax calculation basis is 4% for BEVs, compared with 22% for the other variants. Consequently, the taxable amount for the user of a Golf diesel amounts to more than €11,600 over three years, while the income tax amount for the BEV is just over €2,300.

Norway

In Oslo, road charges account for a high share of overall vehicle costs, with BEVs typically exempt. In addition, BEVs benefit from exemptions on VAT and registration taxes.

As a result, the BEV Golf is by far the least costly option over four years as well as at acquisition, a major distinction with the other markets. The PHEV pays no registration tax, also resulting in cost advantages over the gasoline and diesel variants (see Figure 18).

Norway

4-year consumer ownership costs including 3-years tax on company car benefit (€)

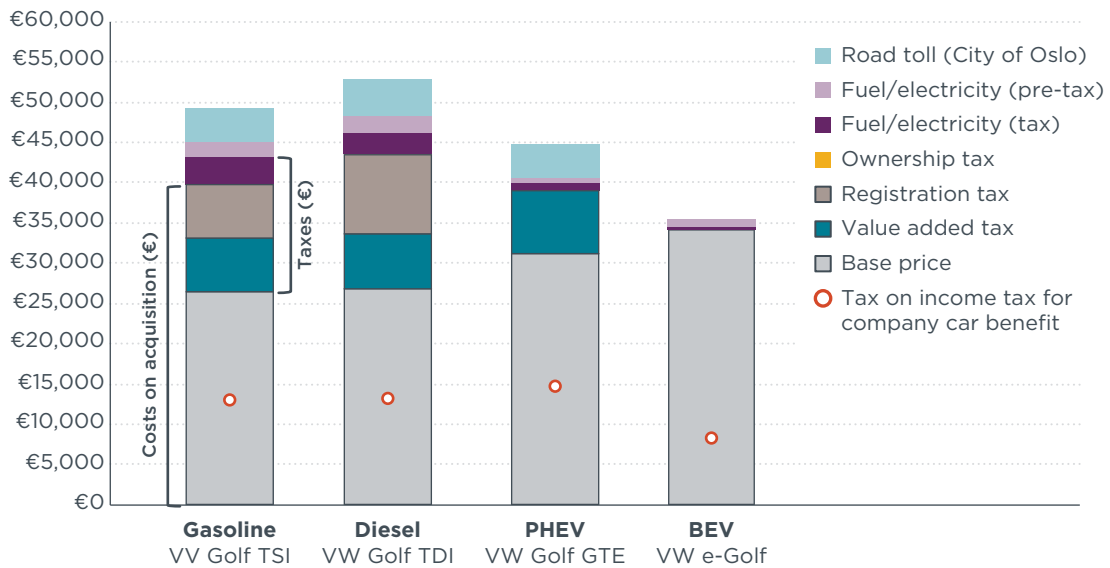


Figure 18. Four-year consumer ownership costs including three-year tax on company car benefit (€1 = 9.578 NOK, as of May 14, 2018).

VAT and registration tax exemptions help to balance out the higher initial base price of the BEV and make its acquisition costs significantly lower compared with the gasoline, diesel, and PHEV variants. Ownership taxes are not payable since 2018; instead, an insurance fee must be paid.

Household electricity prices in Norway at €0.128/kWh, with yearly consumption of 5,000 kWh to 15,000 kWh, are well below the European average. Reflecting some of the highest prices for gasoline and diesel in Europe, Norway owners of the BEV pay about one-fifth as much for fuel as gasoline variant owners.

We assume the road charges for a commuter entering Oslo during rush hours on 220 days a year. We also assume that drivers use a special tag providing a 10% discount (Fjellinjen, 2018). Owners of a gasoline or PHEV Golf pay around €4,200 over four years while owners of a diesel pay almost €4,600. In contrast, the driver of the BEV model pays no roads charges in Oslo.

The BEV is the best choice for private consumers based on cost, both upon acquisition and over four years, followed by the PHEV.

A BEV is also the best choice for a company car from the employee’s perspective. As a result of a reduced rate for BEVs in determining income taxes for private use of a company car, the taxable sum over three years is significantly lower than for the diesel,

gasoline, and PHEV variants. The user of the BEV variant would pay about €8,200 in income tax over three years; owners of the three other cars pay more than €4,800.

United Kingdom

As a proportion of vehicle operating costs, road pricing in London and other capital cities such as Oslo is notably high. Vehicles emitting less than 76 g CO₂/km in London are typically exempt from road charges. However, even disregarding these savings, both Golf EV variants are still the most cost-effective cars. This is mainly because of initial subsidies for BEVs and PHEVs paid by the government at the point of purchase (Figure 19).

United Kingdom

4-year consumer ownership costs including 3-years tax on company car benefit (€)

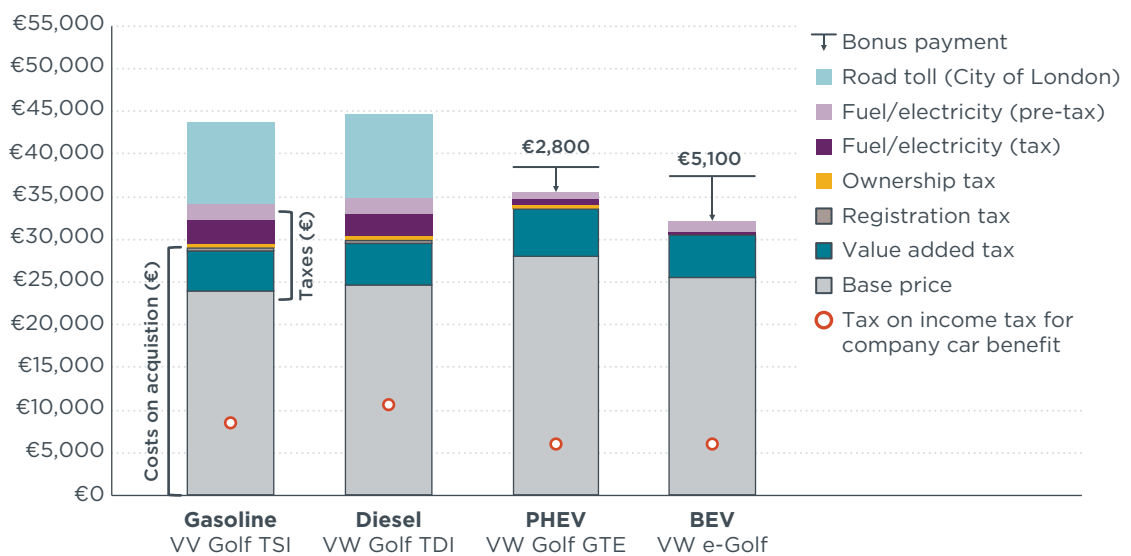


Figure 19. Four-year consumer ownership costs including three-year tax on company car benefit (€1 = £0.88, as of May 15, 2018). Subsidy values have been subtracted from the list price in the case of privately owned cars.

Government subsidies for BEVs of about €5,100 including VAT and for PHEVs of about €2,800 including VAT significantly reduce base prices.¹⁶ Such alternative-fuel vehicles emitting less than 51 g CO₂/km are also exempt from registration tax. However, the registration costs of the gasoline and diesel Golfs account for a very small fraction of vehicle-related taxes in the United Kingdom—about €190 for the gasoline and €230 for the diesel models.

Ownership taxes in the United Kingdom for new cars are based on CO₂ emissions, fuel type, list price, and tax year. The Golf BEV is exempt, while owners of the gasoline and diesel models are subject to an ownership tax of almost €600 over four years. Owners of a PHEV qualify for a slightly reduced rate of €550.

Consumer electricity prices in the United Kingdom at €0.168/kWh are below the European average for households consuming 5,000 kWh to 15,000 kWh a year. Combined with high fuel costs, this means that total consumption costs for owners of the BEV and the PHEV variants are only about one-third of the fuel costs of the gasoline and diesel versions.

¹⁶ The analysis refers to the UK grant scheme applicable until the beginning of November 2018.

To understand the real-world impact of road charges, consider a person commuting into London's congestion charging zone between 7 a.m. and 6 p.m. on weekdays 220 days a year. The system offers a reduced daily rate of £10.50, or €11.40, if users are registered for the automated payment system (Transport for London, 2018). Under these assumptions, all gasoline and diesel cars would incur almost €10,000 in congestion charges over four years. Meanwhile, as vehicles that emit 75 g CO₂/km or less, BEVs and PHEVs are exempt.

Even without counting the road charges, the BEV Golf offers the lowest cost of ownership for private motorists in the United Kingdom over four years. However, both EVs are still more expensive at purchase than the gasoline and diesel versions, despite grants provided at the time of acquisition.

Employees in the United Kingdom driving low-emission company cars benefit from lower taxable amounts payable as part of income tax, as lower tax rates apply to the cars' list prices. Users of the Golf BEV and PHEV pay about €6,000 as part of income tax over three years, while users of the gasoline variant pay €8,000 and diesel owners, €10,000.

3.3. INTER-COUNTRY COMPARISON OF COSTS AND TAX LEVELS OF VEHICLE OWNERSHIP

Figure 20 collates the results of the ownership cost analysis for the five selected markets. The four-year costs do not take into account the resale value of a car, which would effectively reduce the acquisition cost and as a consequence, the overall four-year ownership costs.

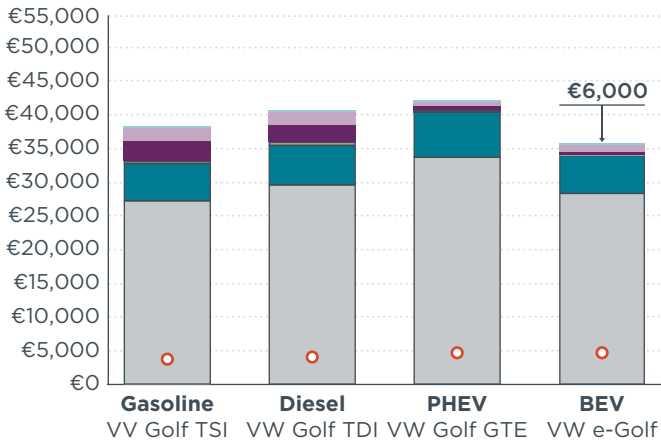
The comparison shows that the Golf BEV variant is the most-affordable choice across all five markets based on ownership costs over four years. The cost-benefit of the BEV model compared with the gasoline version is most pronounced in Norway, at almost €10,000 excluding road charges, and least distinct in the Netherlands at just €400 and Germany at €1,500. The diesel variant incurs the highest costs in Germany, the Netherlands, and Norway. In Germany, this is a combined result of a higher base price and taxes compared with the three other versions. In the Netherlands and Norway, despite a lower base price, this is attributable to significantly higher taxes. In France and the United Kingdom, the Golf PHEV is the most expensive option as a result of a higher base price compared with the three other models. National road charges, such as in France, do not significantly contribute to ownership costs. In our analysis, only city charges as in London and Oslo—both exempting low-emission vehicles—can make a significant difference in costs for low- versus high-emission vehicles.

However, based only on acquisition costs, the gasoline variant turns out to be the most affordable option in France, Germany, the Netherlands, and the United Kingdom. Norway is the only country where the Golf BEV is already significantly less expensive at acquisition. This is despite having the highest base price compared with the three other variants and is because Norway waives VAT and registration tax for zero-emission vehicles.

For those using a company car for private reasons, the benefit in kind to be paid by an employee through income tax is the lowest for a user of a BEV in the Netherlands, Norway, and the United Kingdom, assuming a three-year holding period. Employees in the United Kingdom driving a PHEV with emissions of 50 g CO₂/km or less benefit from the same tax breaks as apply to zero-emission vehicles. Conversely, Germany and France do not provide notable tax benefits for low- versus high-emission vehicles.

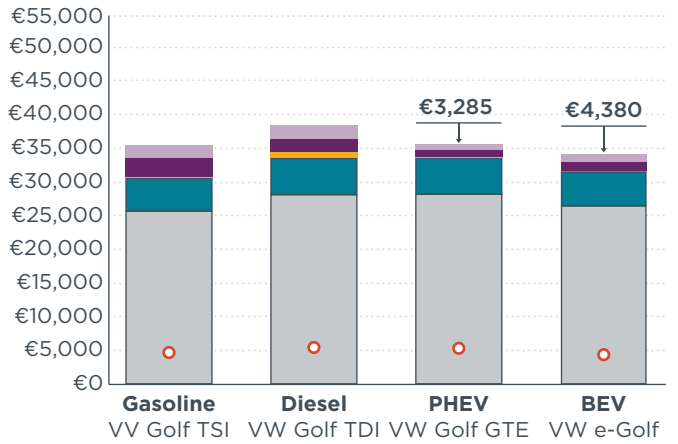
France

4-year consumer ownership costs including 3-years tax on company car benefit (€)



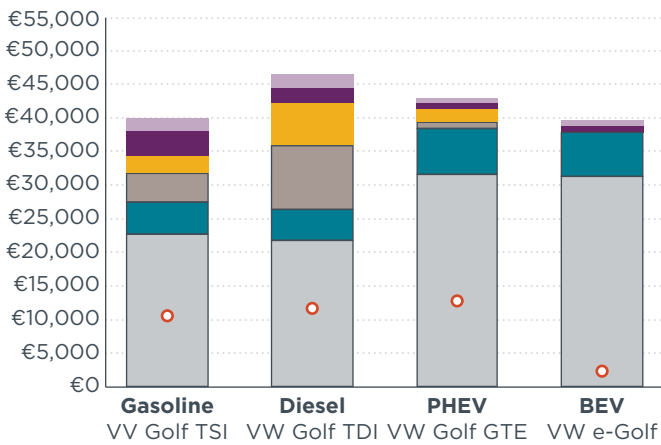
Germany

4-year consumer ownership costs including 3-years tax on company car benefit (€)



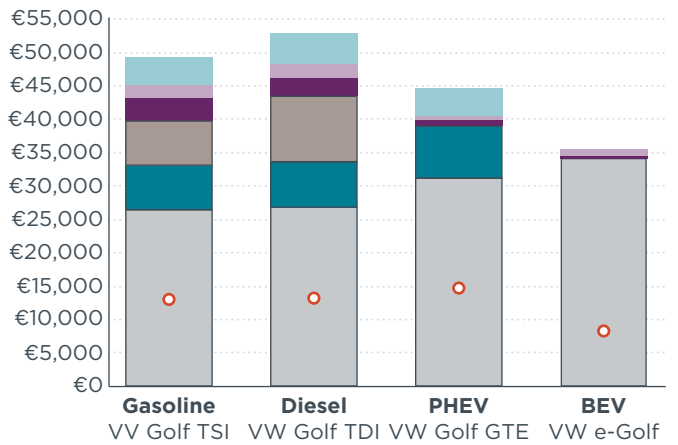
Netherlands

4-year consumer ownership costs including 3-years tax on company car benefit (€)



Norway

4-year consumer ownership costs including 3-years tax on company car benefit (€)



United Kingdom

4-year consumer ownership costs including 3-years tax on company car benefit (€)

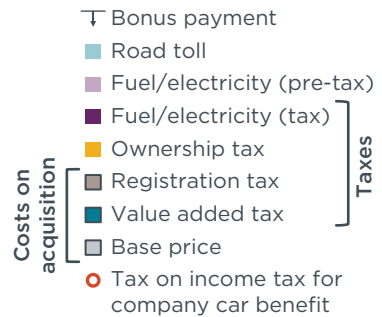
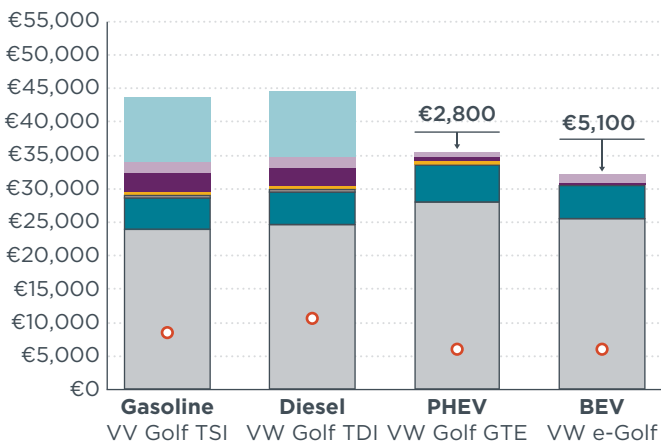


Figure 20. Comparison of four-year consumer ownership costs and three-year tax on company car benefit.

To compare vehicle taxation policies, we aggregate our findings and plot the four-year tax costs minus bonus payments as a function of CO₂ emission levels. Pre-tax fuel and electricity costs as well as road charges are not considered. Specifically, we seek to illustrate the effect of a car's CO₂ emissions on a consumer's tax liability. We use the vehicle specifications of the VW e-Golf, a BEV; the Golf GTE, a PHEV; and the Golf TSI gasoline car. We apply the tax regulations for three CO₂ bands: 0 g CO₂/km, 1-49 g CO₂/km, and > 49 g CO₂/km. We provide a similar analysis for the company car benefits over a three-year holding period.

Figure 21 shows the tax payment curves for cars in private ownership. Markets such as Germany and the United Kingdom offer consumers relatively minor tax benefits for low- versus high-emission vehicles in the 0-200 g CO₂/km emission range as selected for our analysis. The tax payment curve is relatively balanced in these two markets, with negligible cost increases for a car emitting more than 50 g CO₂/km in the United Kingdom or 95 g CO₂/km in Germany. The variation in the tax payment curve is more dynamic in France, exponentially increasing as cars emit more than 119 g CO₂/km, with the maximum tax payments starting at 191 g CO₂/km. The Netherlands and Norway show the most dynamic variations in their tax payment curves. In the Netherlands, the four-year tax payment is piecewise linear in the 1-49 g CO₂/km band and above 50 g CO₂/km. Between 50 g CO₂/km and 78 g CO₂/km, taxes for a gasoline car are lower than for a PHEV emitting 49 g CO₂/km. In Norway, the tax payment curve is a step-wise function up to 70 g CO₂/km, linearly steepening starting at 126 g CO₂/km.

Zero-emission cars are the cheapest alternative across all five markets over four years. In France, the tax cost adds up to about €200; in Germany, €2,500; and in the United Kingdom, €300. Subsidies help to significantly reduce the four-year tax liability. In Norway, the comparable tax costs amount to about €370, mainly reflecting exemption from VAT and registration tax. In the Netherlands, BEVs have the highest tax cost at €7,500 compared with the four other markets because of no subsidies or notable tax advantages on purchase, paired with a significantly higher base price and VAT amount payable.

Comparing the four-year taxes for a zero-emission vehicle with those for a car emitting 200 g CO₂/km, we find the strongest difference for Norway, where the owner of a BEV pays almost €40,000 less in taxes. The tax break is similarly pronounced in the Netherlands with a savings of more than €33,000 and in France with €19,000. Differences are least significant in the United Kingdom, with BEV-owning consumers paying about €9,300 less than owners of gasoline cars emitting 200 g CO₂/km, and in Germany, at just over €6,000 less.

Privately owned car

Tax costs minus bonus payments over a four-year holding period (€)

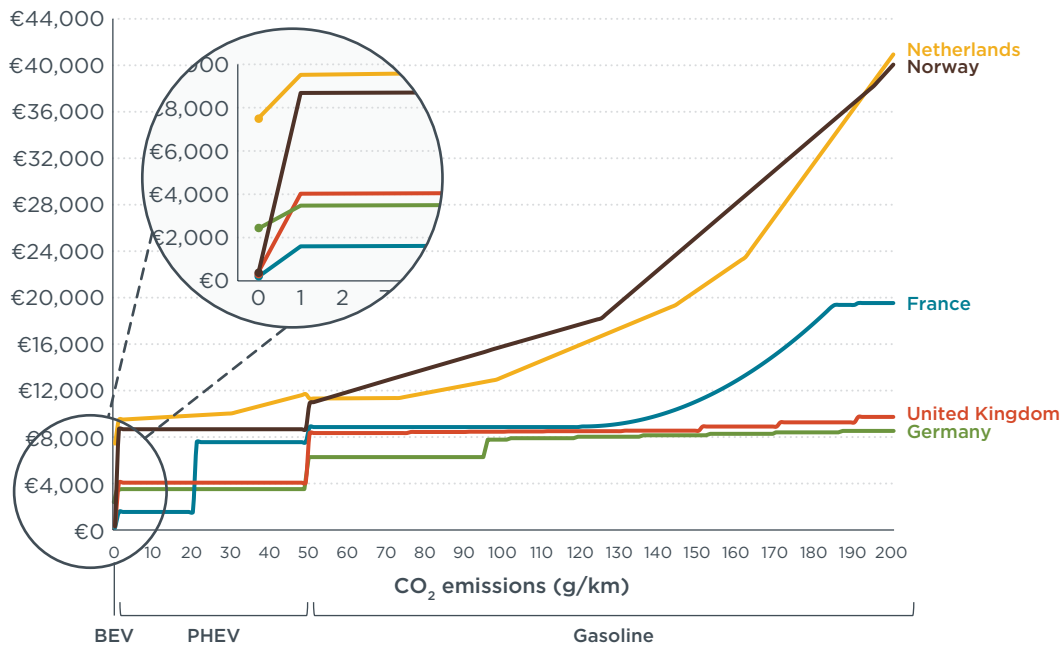


Figure 21. Comparison of vehicle taxation policy over four years for cars in private ownership based on CO₂ emissions, applicable for the tax year 2018 (starting April 2018).

Figure 22 provides a similar illustration of income tax due for the private use of a company car over three years. Variations in taxation policy are less distinct than for taxes related to private cars. In France, Germany, the Netherlands, and Norway the tax rate is largely constant, irrespective of the emission level of the vehicle. The same is true for the United Kingdom for cars emitting 49 g CO₂/km or less. For vehicles with 50 g CO₂/km or more, the United Kingdom then applies a step-wise function, taxing the benefit in kind for the private use of a company cars based on 29 CO₂ bands.

In the case of BEV company cars, employees in the Netherlands have the largest advantage, paying annual income tax on only 4% of the vehicle’s list price, compared with 9% in France, 12% in Germany, 13% in the United Kingdom, and 30% or 20% based on a 40% reduced list price in Norway.

The difference in taxation between cars emitting 0 g CO₂/km and 200 g CO₂/km are least pronounced in Germany and France over three years and assuming a maximum marginal income tax rate. The BEV user in France pays an even greater amount of income tax than the user of a gasoline car. The advantage for a BEV driver in Germany is about €300. Because of a significantly lower taxation base for zero-emission company cars, the advantage is significantly higher in the Netherlands at €8,100 and in Norway at €7,500. In the United Kingdom, tax breaks are similarly high—€7,600 for a car emitting 0 g CO₂/km versus one emitting 200 g CO₂/km. However, larger tax variations exist in the 50 g CO₂/km to 200 g CO₂/km emission range because of a differentiated approach to taxing CO₂ emissions of company cars.

Company owned car

Taxable amount by an employee for the private use of a company car over a three-year holding period (€)

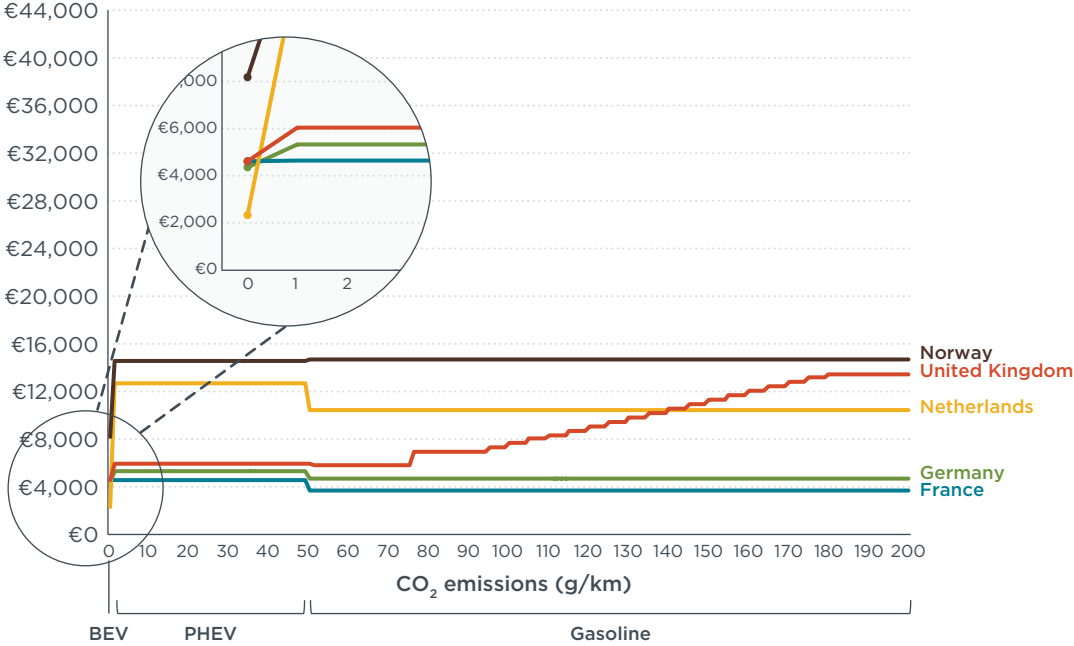


Figure 22. Comparison of vehicle taxation policy over a car’s three-year holding period for cars in company ownership based on CO₂ emissions, applicable for the tax year 2018 (starting April 2018).

4. CONCLUSIONS

Our report principally provides an overview of vehicle taxes across Europe and illustrates how much tax schemes differ by country. We further show how strongly taxation systems affect a vehicle's four-year costs for private owners as well as income taxes over three years on employees for the private use of a company car.

We focus on low-emission vehicles, or autos with tailpipe emissions of less than 95 g CO₂/km. Most electric and hybrid vehicles fall within this range, including the specific BEV and PHEV variants of the VW Golf that we analyze. At the same time, we expand the analysis to all low-emission vehicles to show the effects of tax policies based on CO₂ emissions. We do not address whether or how long tax incentives may be needed to make EVs cost-competitive with gasoline and diesel cars as this has been assessed in previous ICCT studies (e.g. Slowik and Lutsey, 2016).

Most European countries have adopted vehicle taxation schemes that provide an incentive for consumers to buy zero- and low-emission vehicles while sanctioning the use of vehicles with higher emissions, we find.

Consumer ownership costs for BEVs are lower than those of comparable gasoline and diesel cars and PHEVs across the five markets we study, assuming a four-year holding period and focusing on variants of the top-selling VW Golf. This corresponds with subsidies or tax breaks for BEVs, most pronouncedly in Norway. For three years of tax on company car benefit, BEVs have the highest cost-benefit in the Netherlands, Norway, and the United Kingdom. Depending on the market, PHEVs turn out to be either more expensive, comparable, or less expensive over a four- or three-year period. However, the cost advantages of certain electric vehicles over comparable gasoline and diesel cars is not always reflected in national EV sales (Mock, 2018a). To address possible consumer barriers, incentives in the form of tax benefits or subsidies need to be complemented by strong regulations to ensure model availability, sufficient charging infrastructure to address consumer convenience, and consumer campaigns to raise awareness (Slowik and Lutsey, 2017, 2018).

Based only on purchase price—including VAT and registration tax and excluding one-time subsidies—BEVs and PHEVs are price-competitive only in Norway and only with significant cost advantages on acquisition. If including subsidies, BEVs in particular become comparable. However, price advantages of the EVs over gasoline and diesel cars are not as pronounced elsewhere as in Norway. This lack of significant price benefits at the point of purchase might be a hurdle to increased sales of BEVs and PHEVs. To offset this, solutions could include stronger incentives at the point of purchase and better information to raise consumer awareness (Slowik and Lutsey, 2018; Slowik and Lutsey, 2017; Yang et al., 2016).

In some countries, the tax difference between low-CO₂ and high-CO₂ vehicles is quite low over four years. This is the case in France, Germany, and the United Kingdom. Conversely, the Netherlands and Norway provide stronger four-year tax breaks. For company cars, the user of a zero-emission car benefits from lower income tax rates in the Netherlands and Norway. However, it is really only the United Kingdom that differentiates between CO₂ emission levels for a large portion of the company car fleet. To raise the share of low-emission vehicles in private ownership and in company car fleets, other countries could follow the examples of the Netherlands and Norway for

private consumers and the United Kingdom for private use of company cars, while also introducing a stronger differentiation for CO₂ emissions.

This could then offer a solution for the challenge of ensuring longer-term sustainability of the tax system by providing a means for better balancing out revenues. Policy makers could ensure that tax breaks for low-emission vehicles are paid for by tax revenue from high-emission vehicles. The potential effects on revenue and uptake of low-emission vehicles should be studied in more detail as part of a future analysis.

Based on our findings, we recommend that governments encourage the purchase of low-emission passenger cars through these tax policies:

- » **Create significant tax advantages for low-emission vehicles at the point of purchase.** Tax payments or tax advantages at the point of purchase have a stronger influence on consumer choice than annual tax payments. This plays an important role in influencing consumer behavior. In Norway and the Netherlands, private buyers of low-emission cars benefit from significant tax breaks upon registration, and purchasers of higher emitting cars pay higher taxes. In France, the government has implemented a bonus-malus scheme, providing incentives for purchasers of low-emission vehicles in the form of one-time bonus payments while at the same time penalizing the purchase of a high-emission vehicle on registration with higher rates. Both approaches increase the cost difference and reduce the initial cost of vehicles with low CO₂ emissions. The same effect can be achieved by exempting vehicles with low emissions from value added tax (VAT). In Norway, for example, zero-emission vehicles are exempt from a 25% VAT, reducing the initial vehicle costs by a significant margin and providing an incentive for consumers to buy low-emission vehicles.
- » **Ensure continued tax benefits for low-emission vehicles during their use.** Lower taxes and lower total costs for consuming electricity compared with higher taxes and total price at the pump for gasoline and diesel fuel can serve as an incentive for consumers to opt for a car with an electric drive train. The differential between total costs for consuming electricity compared with gasoline and diesel is most significant in Norway, due primarily to variation in taxes. The French government progressively adjusts and increases taxes on gasoline and diesel, serving as a disincentive for diesel cars and a further incentive for electrified vehicles. By contrast, high taxes on electricity and fuel, combined with marginal differences between total end prices as in Germany, do not provide notable cost advantages to consumption for electric vehicles from the consumer standpoint. In addition to taxes on fuel or electricity consumption, road charges that provide exemptions or reduced rates for zero-emission vehicles as in Norway or vehicles with certain CO₂ emission levels as in London can serve as a supplementary incentive for consumers to drive low-emission vehicles.
- » **Account for the emissions of a vehicle as part of the company-car tax system.** Company cars play an important role in Europe as they make up the highest proportion of new-car registrations in markets such as France, Germany, and the United Kingdom. In Germany and France, the tax advantages for users of a company car with low emissions are negligible as the percentage tax base is the same for all vehicle types and technologies. Conversely, employees in the Netherlands and Norway privately using a zero-emission company car benefit from significant income tax advantages due to lower percentages applied when

calculating the benefit in kind. Moreover, in the United Kingdom, employees using vehicles emitting 50 g CO₂/km or less profit from distinct tax relief. These cost advantages for a low-emission vehicle provide an incentive for an employee to decide in favor of a low-CO₂ company car.

- » **Balance and regularly re-adjust the tax system to be self-sustaining.** In Norway, notable and differentiated tax breaks for private buyers of a BEV or PHEV in combination with increased taxes for conventional gasoline and diesel cars are sufficient to make BEVs and PHEVs significantly less expensive than comparable gasoline or diesel cars. In Germany and the United Kingdom, tax benefits for BEVs or PHEVs are insufficient to provide significant cost advantages over gasoline or diesel cars. As a consequence, these countries rely on subsidies in the form of one-time payments to consumers when purchasing a vehicle with a certain CO₂ emission level. However, this kind of mechanism should be considered only as a transitional measure for the market. To ensure a self-sustaining tax system, vehicle-related taxes need to take into consideration all vehicles, ensure that high-emission vehicles generate the tax revenue to provide tax breaks for low-emission vehicles, and be adapted annually or every two years to account for changes in market structure—similar to the bonus-malus system adopted by the French government.

By implementing these recommendations, national governments can provide significant consumer incentives to encourage zero- and low-emission car purchase or use. In parallel, it is important to encourage manufacturers to provide the required vehicle technologies to the market by setting sufficiently ambitious emission targets for new passenger vehicles (Mock, 2018c). In combination with adequate charging infrastructure fed with renewable energy and consumer information campaigns to raise awareness (Slowik and Lutsey, 2017, 2018), the penetration of low-emission vehicles will then help to leverage efforts to reduce vehicle emissions at the European and national levels.

REFERENCES

- ACEA - European Automobile Manufacturers Association. (2017a). *Road Charging*. <http://www.acea.be/industry-topics/tag/category/road-charging>.
- ACEA - European Automobile Manufacturers Association. (2017b). *Fact sheet: cars*. Retrieved from <https://www.acea.be/publications/article/fact-sheet-cars>. Retrieved 20 October 2018.
- ACEA - European Automobile Manufacturers Association. (2018a) *ACEA Tax Guide 2018*. Retrieved from https://www.acea.be/uploads/news_documents/ACEA_Tax_Guide_2018.pdf.
- ACEA - European Automobile Manufacturers Association. (2018b). *Overview on tax incentives for electric vehicles in the EU*. Retrieved from http://www.acea.be/uploads/publications/EV_incentives_overview_2018.pdf.
- ADAC - Allgemeiner Deutscher Automobil-Club e.V. (2018). *Toll in Europe*. Retrieved from https://www.adac.de/reise_freizeit/maut/.
- APRR - Autoroutes Paris-Rhin-Rhône. (2018). *Toll rates*. Retrieved from http://www.aprr.fr/fr/preparation_au_voyage/itineraires/tarifs.
- ASECAP - Association Européenne des Concessionnaires d'Autoroutes et d'Ouvrages à Péage. (2018). *Statistical Bulletin 2018*. Retrieved from <http://www.asecap.com/images/News/PDF/ASECAPStatisticalBulletinStatistique2018v8.pdf>.
- ASFA - French Motorway Companies Association. (2018). *Key figures 2018*. Retrieved from [http://www.autoroutes.fr/FCKeditor/UserFiles/File/ASFA_Chiffres_Cles18\(2\).pdf](http://www.autoroutes.fr/FCKeditor/UserFiles/File/ASFA_Chiffres_Cles18(2).pdf).
- AutoPASS. (2018). *Zero-emission vehicles*. Retrieved from <http://www.autopass.no/en/payment/zeroemissionsvehicles>.
- BAFA - Bundesamt für Wirtschaft und Ausfuhrkontrolle. (2018). *Electromobility (Environmental bonus)*. Retrieved from http://www.bafa.de/DE/Energie/Energieeffizienz/Elektromobilitaet/elektromobilitaet_node.html.
- Belastingdienst. (2018a). *How much motor vehicle tax do I have to pay?* Retrieved from <https://www.belastingdienst.nl/wps/wcm/connect/nl/auto-en-vervoer/content/hulpmiddel-motorrijtuigenbelasting-berekenen>.
- Belastingdienst. (2018b). *Tables rates for environmental taxes*. Retrieved from https://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/zakelijk/overige_belastingen/belastingen_op_milieugrondslag/tarieven_milieubelastingen/tabellen_tarieven_milieubelastingen.
- Belastingdienst. (2018c). *Bijtelling privégebruik auto 2018 (Addition to private use car 2018)*. Retrieved from <https://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/zakelijk/winst/inkomstenbelasting/veranderingen-inkomstenbelasting-2018/bijtelling-privégebruik-auto-2018>.
- BMF - Bundesministerium der Finanzen. (2016). *Gesetz zur steuerlichen Förderung von Elektromobilität im Straßenverkehr (Law on tax incentives for electric mobility in road traffic)*. Retrieved from http://www.bundesfinanzministerium.de/Content/DE/Downloads/Gesetze/2016-11-16-G-stl-Foerderung-Elektromobilitaet.pdf;jsessionid=5E0189DF8D0DA40A307F91BB56A05EDE?__blob=publicationFile&v=4.

- BMF - Bundesministerium der Finanzen. (2017). *Bundeskabinett beschließt Änderungen bei der Kraftfahrzeugsteuer (Federal cabinet decides changes in the motor vehicle tax)*. Retrieved from <http://www.bundesfinanzministerium.de/Content/DE/Pressemitteilungen/Finanzpolitik/2017/01/2017-01-25-pm05-kfz-steuer.html>.
- BMJV - Bundesministerium der Justiz und für Verbraucherschutz. (2006). *Energiesteuergesetz (Energy tax act)*. Retrieved from <http://www.gesetze-im-internet.de/energiestg/EnergieStG.pdf>.
- BMJV - Bundesministerium der Justiz und fuer Verbraucherschutz. (2017a). *Kraftfahrzeugsteuergesetz (Motor vehicle tax act)*. Retrieved from <https://www.gesetze-im-internet.de/kraftstg/BJNR005090927.html>.
- BMJV - Bundesministerium der Justiz und für Verbraucherschutz. (2017b). *Stromsteuergesetz (Electricity tax act)*. Retrieved from <https://www.gesetze-im-internet.de/stromstg/>.
- BMVI - Bundesministerium für Verkehr und digitale Infrastruktur. (2018). *Infrastrukturabgabe (Infrastructure charges)*. Retrieved from <https://www.bmvi.de/SharedDocs/DE/Artikel/StV/Infrastrukturabgabe/infrastrukturabgabe.html>.
- Bundesrat. (2018). *Steuertentlastung für E-Dienstwagen und Jobtickets kommt (Tax relief for e-company cars and job tickets are coming)*. Retrieved from <https://www.bundesrat.de/DE/plenum/bundesrat-kompakt/18/972/972-pk.html?nn=4352766#top-5>.
- Centraal Bureau voor de Statstiek. (2018). *Provinces; surcharges vehicle tax rates*. Retrieved from <http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=80889NED&D1=0&D2=a&D3=a&HD=110830-1633&HDR=T%2cG2&STB=G1>.
- CIA - Central Intelligence Agency. (2018). *The world factbook*. Retrieved from <https://www.cia.gov/library/publications/the-world-factbook/>.
- Deutscher Bundestag. (2018a). *Bundesregierung hält an Pkw-Maut fest (Federal government sticks to infrastructure charges)*. Retrieved from <https://www.bundestag.de/presse/hib/-/569316>.
- Deutscher Bundestag. (2018b). *Geplante Steuervergünstigung für Privatnutzung von E-Autos strittig bewertet (Planned tax deduction for private use of electric cars disputed)*. Retrieved from <https://www.bundestag.de/dokumente/textarchiv/2018/kw42-pa-finanzen-onlinehandel/572528>.
- DGCCRF - Direction générale de la concurrence, de la consommation et de la répression des frauds. (2013). *Mes Vacances 2013 (My holidays 2013)*. Retrieved from https://www.economie.gouv.fr/files/directions_services/dgccrf/documentation/ete_2013/Vacances_Ete2013revu.pdf.
- Directorate of Legal and Administrative Information. (2018a). *Malus et taxe CO₂ pour un véhicule polluant (Malus and CO₂ tax for the most polluting vehicles)*. Retrieved from <https://www.service-public.fr/particuliers/vosdroits/F19911>.
- Directorate of Legal and Administrative Information. (2018b). *Coût de la carte grise (certificate d'immatriculation) (Cost of registration (certificate of registration))*. Retrieved from <https://www.service-public.fr/particuliers/vosdroits/F19211>.

- Directorate of Legal and Administrative Information. (2018c). *Bonus écologique pour un véhicule électrique (voiture, scooter, moto, vélo, ...)* (Ecological bonus for an electric vehicle (car, scooter, motorcycle, bike, ...)). Retrieved from <https://www.service-public.fr/particuliers/vosdroits/F34014>.
- EC - European Commission. (2018a). *Consumer prices for petroleum products inclusive of duties and taxes*. Retrieved on 21 May 2018 from http://ec.europa.eu/energy/observatory/reports/latest_prices_with_taxes.pdf.
- EC - European Commission. (2018b). *Consumer prices for petroleum products net of duties and taxes. (Prices in force on 21 May 2018)*. Retrieved from http://ec.europa.eu/energy/observatory/reports/latest_prices_without_taxes.pdf.
- EC - European Commission. (2018c). *Total taxation share in the end consumer price for Euro-Super 95 and diesel oil*. Retrieved on 21 May 2018 from http://ec.europa.eu/energy/maps/maps_weekly_oil_bulletin/latest_taxation_oil_prices.pdf.
- Eurostat. (2018). *Electricity prices for household consumers – bi-annual data (from 2007. Onwards)*. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_price_statistics.
- Fjellinjen. (2018). *Rates*. Retrieved from <https://www.fjellinjen.no/private/prices/>.
- Government Digital Service. (2018a). *Vehicle tax rates*. Retrieved from <https://www.gov.uk/vehicle-tax-rate-tables>.
- Government Digital Service. (2018b). *Tax on shopping and services – fuel tax*. Retrieved from <https://www.gov.uk/tax-on-shopping/fuel-duty>.
- Government Digital Service. (2018c). *Toll road charges*. Retrieved from <https://www.gov.uk/uk-toll-roads>.
- Government Digital Service. (2018d). *Taxable benefits in kind and expenses payments*. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/684687/tc2b.pdf.
- Government Digital Service. (2018e). *Low-emissions vehicles eligible for a plug-in grant*. Retrieved from <https://www.gov.uk/plug-in-car-van-grants>.
- Government Digital Service. (2018f). *Reformed Plug-in Grant extended into next decade*. Retrieved from <https://www.gov.uk/government/news/reformed-plug-in-car-grant-extended-into-next-decade>.
- KBA - Kraftfahrt-Bundesamt. (2018). *Jahresbilanz der Neuzulassungen 2017 (Annual balance sheet of new registrations in 2017)*. Retrieved from https://www.kba.de/DE/Statistik/Fahrzeuge/Neuzulassungen/n_jahresbilanz.html?nn=644522.
- Landesverwaltung Fürstentum Liechtenstein. (2018). *Gesetz vom 14. September 1994 über die Motorfahrzeugsteuer (Motor vehicle tax act from 14th September 1994)*. Retrieved from <https://www.gesetze.li/konso/1994078000>.
- Ministère de l'Action et des Comptes publics. (2018). *Evaluation of the benefit resulting from the private use of a vehicle made available to the employee*. Retrieved from <http://bofip.impots.gouv.fr/bofip/2469-PGP.html>.
- Ministry of Ecological and Solidarity Transition. (2018). *Registrations of new and used vehicles in 2017*. Retrieved from http://www.statistiques.developpement-durable.gouv.fr/transports/r/vehicules-routiers-immatriculations.html?tx_ttnews%5Btt_news%5D=25507&cHash=73b29c942b12dbc2f52ad551f26429d9.

- Ministry of Finance. (2018). *Tax rates in 2017*. Retrieved from <https://www.regjeringen.no/no/tema/okonomi-og-budsjett/skatter-og-avgifter/avgiftssatser-2017/id2514838/>.
- Mock, P. (ed.) (2018a). *European Vehicle Market Statistics. Pocketbook 2018/2019*. Retrieved from the International Council on Clean Transportation https://www.theicct.org/sites/default/files/publications/ICCT_Pocketbook_2017_Web.pdf.
- Mock, P. (2018b). *Changes to the motor vehicle type-approval system in the European Union. (Policy update)*. Retrieved from the International Council on Clean Transportation https://www.theicct.org/sites/default/files/publications/EU-Type-Approval-System_ICCT-Policy-Update_20180529_vF.pdf.
- Mock, P. (2018c). *The role of standards in reducing CO₂ emissions of passenger cars in the EU*. Retrieved from the International Council on Clean Transportation <https://www.theicct.org/publications/role-standards-reducing-co2-emissions-passenger-cars-eu>. Retrieved 29 May 2018.
- Mock, P., Yang, Z. (2014). *Driving electrification: A global comparison of fiscal policy for electric vehicles*. Retrieved from the International Council on Clean Transportation http://www.theicct.org/sites/default/files/publications/ICCT_EV-fiscal-incentives_20140506.pdf.
- Plötz, P., Funke, S., Jochem, P. (2017). Empirical Fuel Consumption and CO₂ Emissions of Plug-In Hybrid Electric Vehicles. *Journal of Industrial Ecology*, 22 (4), 773-784. Retrieved from <https://onlinelibrary.wiley.com/doi/full/10.1111/jiec.12623>.
- RAI Vereniging. (2018). *Rapportage over Nieuwe voertuigen 2017 (Report on new vehicles 2017)*. Retrieved from <https://www.bovag.nl/BovagWebsite/media/BovagMediaFiles/Cijfers/2017/Verkoop-personenautos-maart-2017.pdf?ext=.pdf>.
- Riemersma, I., Mock, P. (2017). *Too low to be true? How to measure fuel consumption and CO₂ emissions of plug-in hybrid vehicles, today and in the future* (ICCT briefing paper). Retrieved from the International Council on Clean Transportation http://theicct.org/sites/default/files/publications/EU-PHEV_ICCT-Briefing-Paper_280717_vF.pdf.
- Royal Dutch Touring Club. (2018). *Addition. Paying for private use of a company car*. Retrieved from <https://www.anwb.nl/auto/autobelastingen/bijtelling>.
- Sénat. (2018). *Projet de loi de finances pour 2018: Fiscalité de la transition écologique (Draft budget law for 2018: Taxation of the ecological transition)*. Retrieved from <http://www.senat.fr/rap/a17-113-1/a17-113-14.html>.
- Skatteetaten. (2018). *Car rates - Company car*. Retrieved from <https://www.skatteetaten.no/nn/tabellar-og-satsar/bilsatser---firmabil/>.
- Slowik, P., Lutsey, N. (2016). *Evolution of incentives to sustain the transition to a global electric vehicle fleet*. Retrieved from the International Council on Clean Transportation https://www.theicct.org/sites/default/files/publications/EV%20Evolving%20Incentives_white-paper_ICCT_nov2016.pdf.
- Slowik, P., Lutsey, N. (2017). *Expanding the electric vehicle market in U.S. cities*. Retrieved from the International Council on Clean Transportation https://www.theicct.org/sites/default/files/publications/US-Cities-EVs_ICCT-White-Paper_25072017_vF.pdf.
- Slowik, P., Lutsey, N. (2018). *The continued transition to electric vehicles in U.S. cities*. Retrieved from the International Council on Clean Transportation <https://www.theicct.org/publications/continued-EV-transition-us-cities-2018>.

- SMMT – The Society of Motor Manufacturers and Traders. (2018). *Car registrations* [Viewed 13 September 2018]. Retrieved from <https://www.smmt.co.uk/vehicle-data/car-registrations/>.
- Statens vegvesen. (2018a). *Deregistration*. Retrieved from <https://www.vegvesen.no/en/vehicles/own-and-maintain/number-plates/deregistration>.
- Statens vegvesen. (2018b). *Toll roads*. Retrieved from <https://www.vegvesen.no/en/vehicles/professional-transport/road-financing>.
- STVA - Service Portal für Kraftfahrtwesen. (2018). *KFZ-Behörden Gebühren (Car authorities fees)*. Retrieved from <http://www.strassenverkehrsamt.de/artikel/kfz-behoerden-gebuehren>.
- Tax and Customs Administration. (n.d). *Tariffs list. Bpm tariffs (from 1993)*. Retrieved from https://download.belastingdienst.nl/belastingdienst/docs/bpm_forms_bpm651z5fdeng.pdf.
- Tietge, U., Díaz, S., Mock, P., German, J., Bandivadekar, A., Ligterink, N. (2016). *From laboratory to road – A 2016 update of official and ‘real-world’ fuel consumption and CO₂ values for passenger cars in Europe*. Retrieved from the International Council on Clean Transportation https://www.theicct.org/sites/default/files/publications/ICCT_LaboratoryToRoad_2016.pdf.
- Tietge, U., Mock, P., Lutsey, N., Campestrini, A. (2016). *Comparison of leading electric vehicle policy and deployment in Europe*. Retrieved from the International Council on Clean Transportation https://www.theicct.org/sites/default/files/publications/ICCT_EVpolicies-Europe-201605.pdf.
- Trafikkforsikringsforeningen. (n.d). *Traffic Insurance Fee*. Retrieved from <https://www.tff.no/informasjon/trafikkforsikringsavgift/>.
- Transport for London. (n.d). *Discounts & exemption*. Retrieved from <https://tfl.gov.uk/modes/driving/congestion-charge/discounts-and-exemptions?intcmp=2133>.
- Transport Infrastructure Ireland. (n.d). *Tolling Information*. Retrieved from <http://www.tii.ie/roads-tolling/tolling-information/>.
- Volkswagen. (2018). Dialog Center. Infomaterial bestellen (*Order information material*). Retrieved from <https://www.volkswagen.de/de/dialog-center/infomaterial-bestellen.html>.
- Yang, Z, Slowik, P., Lutsey, N., Searle, S. (2016). *Principles for effective electric vehicle incentive design*. Retrieved from the International Council on Clean Transportation <https://www.theicct.org/publications/principles-effective-electric-vehicle-incentive-design>.
- Yang, Z. (2018). *Practical lessons in vehicle efficiency policy: The 10-year evolution of France’s CO₂-based bonus-malus (feebate) system*. Retrieved from the International Council on Clean Transportation <https://www.theicct.org/blog/staff/practical-lessons-vehicle-efficiency-policy-10-year-evolution-frances-co2-based-bonus>.



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