



The future of transport

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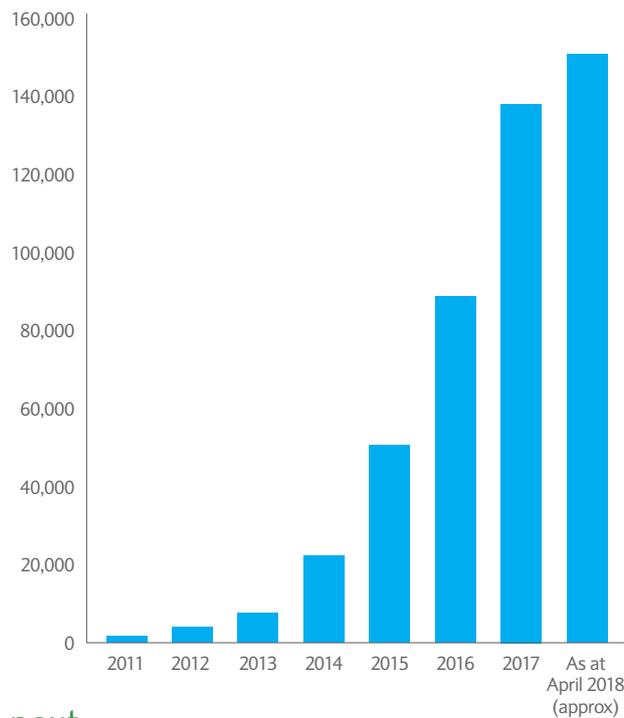
Electric vehicles are coming to a road near you. So what do you need to know about the 21st century's carriage of choice?

There is so much talk about electric vehicles right now that you would be forgiven for thinking that they are a recent phenomenon. In fact, they date back further than the light bulb. US blacksmith Thomas Davenport is credited with building the first practical electric vehicle back in 1835 and by 1900, electric vehicles accounted for a third of all vehicles on the road.<sup>1</sup> In 1908, the fortunes of electric vehicles took a downturn, however, when Henry Ford introduced the Model T car, which made petrol-powered cars widely available and affordable.

## By 1900, electric vehicles accounted for a third of all vehicles on the road.

Now, more than a century later, electric vehicles are enjoying a much-deserved revival, for various reasons. These include their environmental friendliness (they emit far fewer greenhouse gases over their lifetimes than conventional vehicles<sup>2</sup>), cost-effectiveness and low maintenance requirements. In the UK, the explosion of interest in electric cars also owes much to government policy. The government has stated its desire to end the sale of new conventional petrol and diesel cars by 2040 and wants almost every car and van to emit zero emissions by 2050.

Cumulative year-on-year electric car registrations (UK) 2012–2017



next greencar™

Source: Next Green Car, April 2018.

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## Types of electric vehicle

More than 145,000 electric vehicles were registered in the UK by April 2018, according to car guide Next Green Car,<sup>3</sup> up from a mere 3,500 registrations in 2013. Broadly speaking, the vehicles fall into four different categories:

### Hybrid Electric Vehicle (HEV)

This is a vehicle powered by an internal combustion engine and an electric battery, which achieves better fuel economy and lower emissions than a conventional vehicle. The battery is charged using excess energy from the engine, as well as by reclaiming the car's kinetic energy when it brakes. The most popular model in the UK is the Toyota Prius.

<sup>1</sup><https://www.energy.gov/articles/history-electric-car>

<sup>2</sup><https://www.ft.com/content/a22ff86e-ba37-11e7-9bfb-4a9c83ffa852>

<sup>3</sup><http://www.nextgreencar.com/electric-cars/statistics>

### Plug-in Hybrid Electric Vehicle (PHEV)

Similar to a HEV, but the battery can be charged from an external power source. At any time, it can run on the battery alone, on the engine alone, or on a combination of the two. Its electric-only range is 10–40 miles, but its total range is similar to a conventional car. The most popular model in the UK is the Mitsubishi Outlander PHEV.

This category also includes 'extended range' versions of BEVs, such as the BMW i3 REx. These are BEVs fitted with a small petrol engine to generate electricity when the battery's charge is too low. The i3's range extender increases its range on a single charge from 125 to 206 miles.

### Battery Electric Vehicle (BEV)

This is a vehicle powered entirely by an electric battery that is charged from an external power source. It is cheap to run but has a limited range – typically 100 to 250 miles. The most popular model in the UK is the Nissan LEAF.

### Hydrogen Fuel Cell Vehicle (FCEV)

This is an electric vehicle that uses a hydrogen fuel cell, instead of a battery, to generate electricity. It produces zero tailpipe emissions – only water vapour. It generally has a greater range than a BEV, but it needs to be refuelled at a hydrogen refuelling station. This takes less than five minutes, but there are very few refuelling stations in the UK. The Toyota Mirai is currently the only FCEV model available in the UK and has a range of about 300 miles.

Please note: Amounts shown are general indications only.

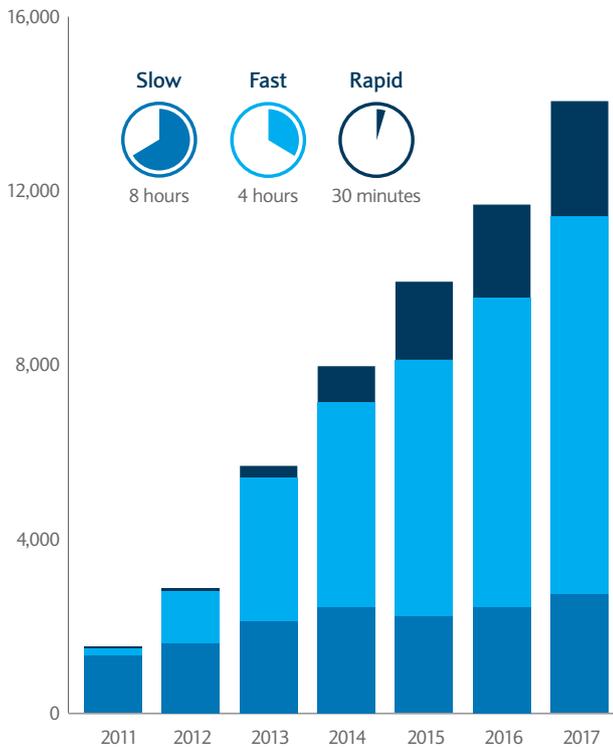
### At a glance

	Sources of Energy	Power	Emissions
 Conventional			
 Hybrid (HEV)			
 Plug-in hybrid (PHEV)			
 All-electric (BEV)			
 Hydrogen fuel cell (FCEV)			

### Three categories of car-charging infrastructure

There are three categories of charging infrastructure for electric cars – slow (takes up to eight hours to charge a car and is best suited to overnight charging), fast (takes up to four hours) and rapid (takes 30 minutes or less to provide an 80% charge). Charging an electric car at home costs around £3.64 for a full charge,<sup>4</sup> while charging at a rapid charge point at a motorway service station typically costs £6.50 for a 30-minute charge.

### Charging connectors by type



Source: Zap-Map 2018.

### Benefits of electric vehicles

Although the upfront cost of an electric vehicle can be higher than that of a petrol- or diesel-powered car, this cost is offset by the lower running costs of the vehicle over the course of its lifetime.

### Average cost to drive 100 miles



According to the Energy Saving Trust,<sup>5</sup> a full charge, costing £3 to £5, will give an electric vehicle a range of around 100 miles. In contrast, driving 100 miles in a petrol or diesel car will usually consume between £11 and £16 in fuel. Also, electric vehicles tend to have fewer component parts than traditional vehicles, reducing servicing and maintenance costs, while pure electric vehicles that cost no more than £40,000 incur a zero rate of vehicle excise duty.

You can find out how much a plug-in car could save you on your everyday journeys (compared to a conventional fossil fuel car) using the [Go Ultra Low campaign's journey calculator](#).<sup>6</sup>

Further benefits include discounts on the London Congestion Charge and on charges relating to the Clean Air Zones around the UK and the Ultra-Low Emission Zone in London. As well as being environmentally friendly, electric vehicles reduce noise pollution because they are quieter than their petrol and diesel counterparts.

### Barriers to purchasing an electric vehicle

Since electric vehicles bring many benefits to both individual drivers and fleets, and car manufacturers are investing heavily in them, they will almost undoubtedly be the preferred transport choice of the future. The Committee on Climate Change envisages that electric vehicles will account for 60% of Britain's new car and van sales by 2030.<sup>7</sup>

Nevertheless, there are some obstacles to mass take-up at present. Clearly, the most significant barrier is the limited charging infrastructure that exists today.

According to Zap Map, an information site for the electric vehicle community, there were 5,347 public charging locations across the UK as of 6 March 2018, with 15,304 connectors between them. The Committee on Climate Change says that nearly 29,000 charging points are needed across Great Britain by 2030 to meet the future charging needs of electric vehicles, with 85% of these being fast or rapid chargers.

Furthermore, around a third of British people do not have off-street parking, according to the government,<sup>8</sup> which makes it extremely difficult for them to charge their electric vehicles overnight. On top of that, National Grid has warned that the UK's domestic electricity infrastructure might need to be rebuilt to ensure that someone who boils a kettle at the same time as charging an electric car with a fast charger at home doesn't blow a main fuse in their house.<sup>9</sup>

<sup>4</sup><https://pod-point.com/landing-pages/cost-of-charging-electric-car>

<sup>5</sup><http://www.energysavingtrust.org.uk/transport-travel/electric-vehicles>

<sup>6</sup><https://www.goultralow.com/electric-car-savings/journey-cost-savings-calculator/>

<sup>7</sup><https://www.theccc.org.uk/publication/plugging-gap-assessment-future-demand-britains-electric-vehicle-public-charging-network/>

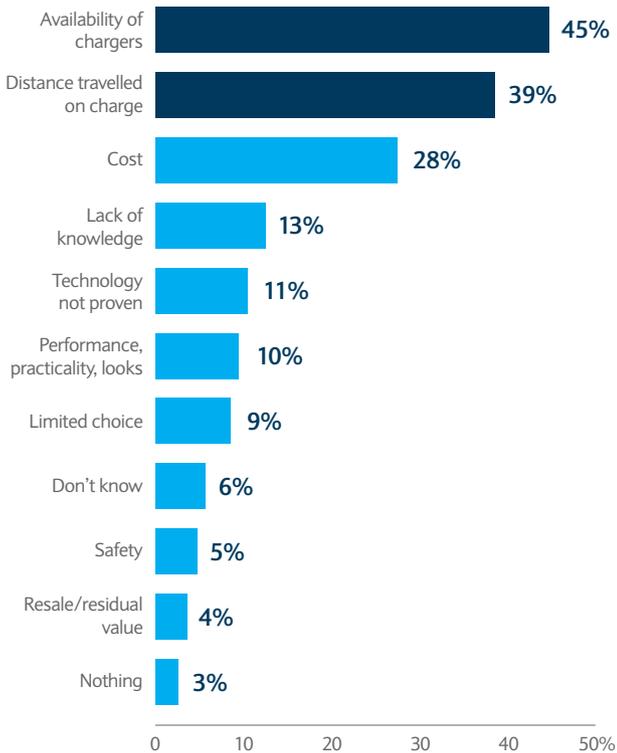
<sup>8</sup><https://www.gov.uk/government/news/funding-for-thousands-of-electric-car-charge-points-unused-by-councils>

<sup>9</sup><https://www.ft.com/content/852dbb54-8411-11e7-a4ce-15b2513cb3ff>

Research by the Department for Transport found that the availability of chargers was consumers' biggest reason for not purchasing an electric vehicle, cited by 45%, followed by distance travelled on the charge, given by 39%. Other concerns were around cost, a lack of knowledge about electric vehicles and a feeling that the technology was not proven.

### Reason for not purchasing an EV

(multiple selections possible)



Source: Department for Transport.

### Overcoming the barriers

The government, along with automotive manufacturers and oil companies, is working to overcome the barriers that exist. Already, charge points, including rapid chargers, can be found at most service stations on the UK's motorways and main routes, and the number of charging points at UK petrol stations is set to rise as the large oil companies increase their investment in charging infrastructure.<sup>10</sup>

In October 2017, the Transport Minister, John Hayes, announced the Automated and Electric Vehicles Bill, which is intended to increase the access and availability of charge points for electric cars, while also giving the government powers to make it compulsory for charge points to be installed across the country and enabling drivers of automated cars to be insured on UK roads. Furthermore, the Office for Low Emission Vehicles is providing funding for local authorities that increase the availability of on-street charging points in residential streets where off-street parking is not available.<sup>11</sup>

### The number of charging points at UK petrol stations is set to rise as the large oil companies increase their investment in charging infrastructure.

Since electric vehicles tend to cost more upfront than their petrol or diesel equivalents, the government has introduced a number of incentives to encourage uptake, including the plug-in car grant, which covers 35% of the cost of the car, up to a maximum of either £2,500 or £4,500, depending on the model.

It has also launched the Electric Vehicle Homecharge Scheme whereby individuals who are the registered keeper, or have primary use of an electric vehicle, may receive up to 75% of the total capital cost of the charge point and associated installation costs (capped at £500).

Meanwhile, businesses that buy electric vehicles can write down 100% of the purchase price against their corporation tax liability (provided the vehicle emits no more than 50g/km CO<sub>2</sub>) and company car drivers can benefit from significantly reduced benefit-in-kind (BIK) taxation. You can compare BIK rates and tax payable by make/model using [Next Green Car's online calculator](https://www.nextgreencar.com/company-car-tax/calculator/).<sup>12</sup>



<sup>10</sup><https://www.theguardian.com/environment/2018/jan/30/bp-charging-points-electric-cars-uk-petrol-stations>

<sup>11</sup><https://www.gov.uk/government/publications/grants-for-local-authorities-to-provide-residential-on-street-chargepoints>

<sup>12</sup><http://www.nextgreencar.com/company-car-tax/calculator/>

## Key barriers the Government is tackling



### Upfront costs

Electric vehicles tend to cost more upfront than petrol or diesel equivalents. However, prices are coming down as sales increase.



### Range and recharging

Ongoing improvements in range and recharging/refuelling infrastructure will help ease the public's transition to electric vehicles.



### Energy system

The extra electricity demand from uptake of electric vehicles could require some increased generating capacity and upgrades to local electricity connections.



### Supply of vehicles from manufacturers

A regulatory framework helps encourage manufacturers to clean up their vehicles and bring electric vehicles to market.



### Technology development

Continued investment is needed to accelerate performance improvements and prepare electric vehicles for the mass market. Government research support, and investment in the industry, encourage this technology development.



### Public misconceptions

Consumer concerns do not always reflect reality. The Government's Go Ultra Low campaign aims to address common misconceptions.



### Other vehicles

Taxis, buses and commercial vehicles significantly impact on urban air quality, but have particular challenges for electrification.

Source: Office for Low Emission Vehicles.

## Conclusion

While the 21st-century revival of the electric vehicle is still in its early stages, there is no doubt that the concept has caught the imagination of policymakers, businesses, entrepreneurs and the public alike. Such is the enthusiasm for the vehicles that unexpected competitors are even popping up to challenge the hegemony of traditional carmakers.

**The future of transport is certainly electric, and will probably include self-driving vehicles.**

For example, British inventor James Dyson, the man who revolutionised the vacuum cleaner, is coming up with his own electric car concept, which he promises will be “radically different” from current models.<sup>13</sup> The future of transport is certainly electric, and will probably include self-driving vehicles, but what will that future look like? Nobody knows just yet.

<sup>13</sup><https://www.theguardian.com/technology/2017/sep/26/james-dyson-electric-car-2020>

## Further reading

For general reading on electric vehicles, see:

<http://www.energysavingtrust.org.uk/sites/default/files/reports/A%20guide%20to%20ultra%20low%20emission%20vehicles%20for%20Fleet%20Managers.pdf>

For general reading on electric vehicles or to find out more about the Government's Go Ultra Low campaign, see:

<https://www.gov.uk/government/organisations/office-for-low-emission-vehicles>

For more on the history of electric vehicles, see:

<https://www.energy.gov/articles/history-electric-car>

For National Grid's views on the electric revolution, see:

<http://fes.nationalgrid.com/insights/forecourt-thoughts-mass-fast-charging-of-electric-vehicles>

To find out which vehicles are eligible for a plug-in grant, see:

<https://www.gov.uk/plug-in-car-van-grants>

For more on the tax benefits of electric vehicles, see:

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/670515/ultra-low-emission-vehicles-tax-benefits.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/670515/ultra-low-emission-vehicles-tax-benefits.pdf)

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