



Electric and smart vehicles

Moving to ultra-low emission vehicles



Preface

Reducing energy use makes perfect business sense; it saves money, enhances corporate reputation and helps everyone in the fight against climate change.

The Carbon Trust provides simple, effective advice to help businesses take action to reduce carbon emissions; the easiest ways to do this is to use energy more efficiently.

This overview of electric and smart vehicles introduces the main technologies available for ultra-low emissions to help businesses invest in low carbon transport and move away from petrol or diesel-fuelled vehicles in a cost-effective way.

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Introduction

Benefit from lower emission, cost effective transport solutions

The use of ULEVs (Ultra-low emission vehicles) in the UK has been increasing rapidly over the past five years, and now there are nearly 200,000 ULEVs on the road¹. This has been facilitated by ever improving battery technology, expansion of charging infrastructure, and continued government support. For businesses, however, the switch to ULEVs is driven by seeing real cost savings, while improving service offerings and reducing the environmental impact of their business.

Who is this publication for?

The advice in this publication is relevant to businesses of all sizes and useful for members of staff across your business. This publication may be of use to fleet managers looking to optimise existing vehicles, finance controllers evaluating cost saving opportunities, or employees looking to purchase their own personal ULEV.

This overview will help you decide if electric vehicles and smart vehicles are suitable for your business and demonstrate best practice to realise the greatest savings from employing this technology. Investing in new technology can also be expensive, so this publication will outline how to build a suitable business case, as well as provide information on existing government incentives for ULEVs.

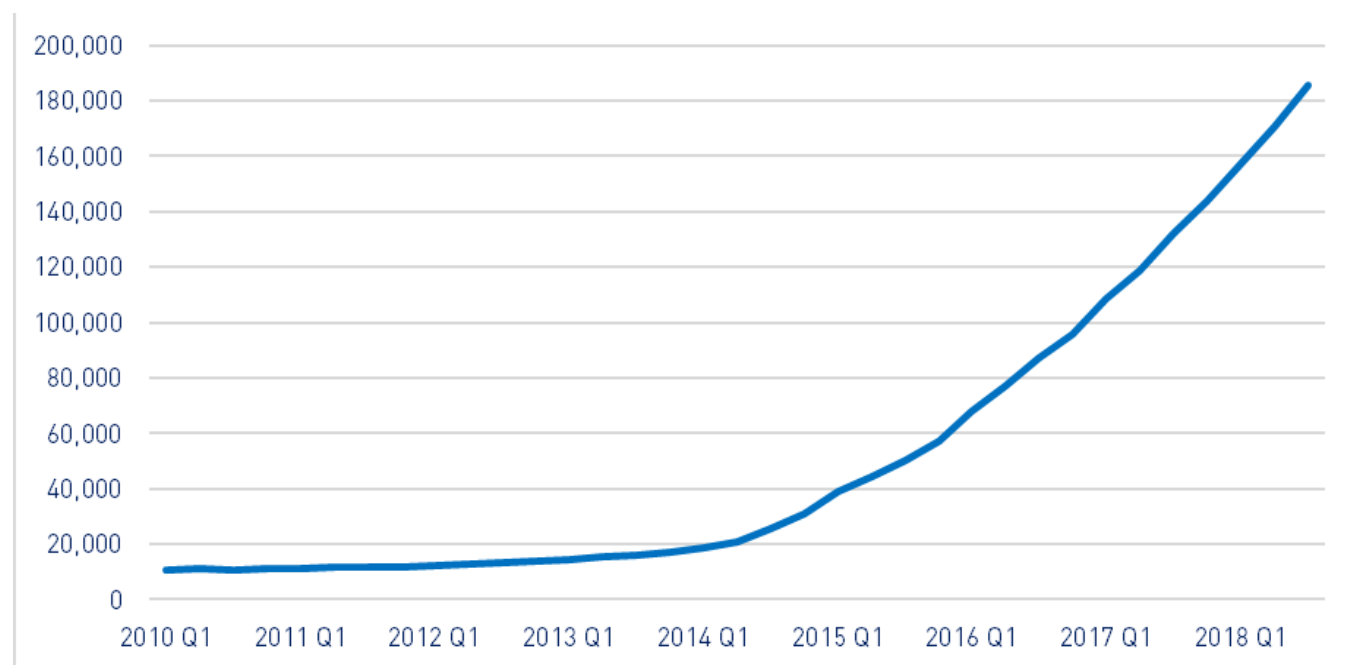


Figure 1: Ultra-low emission vehicles licensed in the UK

Department for Transport Statistics - No. of ULEVs licensed in the UK

¹ EDfT – Transport Statistics, Great Britain 2018

What are electric and smart vehicles?

Understanding the main technology options

Electric vehicles

Electric vehicle (EV) technology is constantly evolving, and most major manufacturers are developing and releasing their own models onto the market. However, ULEVs can be broadly grouped into four classifications:

- **Battery electric vehicle (BEV)** - wholly electric drivetrain charged by an external power source
- **Plug-in hybrid electric vehicle (PHEV)** - utilises an electric battery for slow speed driving, an internal combustion engine (ICE) for longer journeys, or both simultaneously
- **Extended range electric vehicle (E-REV)** - The drivetrain is always powered by electricity, and an ICE is used as a generator once the battery is depleted
- **Hydrogen fuel cell (FCEV)** - Powered by a hydrogen fuel cell, which generates electricity emitting only water.

Each classification has its own inherent advantages, and often business requirements will determine which type of ULEV is most suitable. It is also important to consider that mobile plant such as forklift trucks may be battery powered, as well as two-wheeled transport options.

Smart vehicles

'Smart' can be used in a variety of contexts and can describe many different aspects of vehicle usage. For the purpose of this publication, a smart vehicle is defined as a vehicle that utilises an internet connection to an external system in order to optimise driving performance or operations. Smart technology can be applied to any vehicle, not just ULEVs, and includes, but is not limited to autonomous vehicles.

An example of a typical smart vehicle is a commercial van that utilises an on-board telematics system to track real-time location and driver behaviour.



Why do electric vehicles make business sense?

Building the business case for investing in electric vehicles

More and more businesses are incorporating electric vehicles into their fleets, and readers of this publication may well be intending to do the same. There are a number of advantages to using EVs within your company's vehicle fleet.

Financial

Generally, purchase or lease costs for electric vehicles are higher than similar petrol or diesel fuelled vehicles, however these costs are more than offset when you look at the overall cost to the business over the vehicle's useful life. Mile for mile electric vehicles are cheaper than a similar sized typical diesel vehicle. The latest advisory fuel rates published by the UK Government state that the average electric vehicle has fuel costs of 4p per mile². Diesel in comparison costs between 9-13p per mile. These savings can add up significantly over a number of years and applying this whole lifecycle cost approach often results in the ULEV being more cost efficient than a traditionally fuelled vehicle over the same time period.

ULEVs are also exempt from certain tax mechanisms. Most ULEVs will be completely exempt from Vehicle Exercise Duty, and the cost of a low-emission vehicle can be written

down against corporate tax liability. ULEVs are also exempt from the London congestion charge; if your business makes frequent trips into London these avoided costs can be significant.

How to quantify and present this whole life cost business case for EVs is provided in a later section of this publication, along with details of sources of funding available to businesses that can reduce costs further.

Operational

If you choose to operate an EV fleet out of your place of work, then you will likely want to install EV charging points so that vehicles can be charged overnight or throughout the day when not in use. One advantage of this is that vehicles are ready and charged the next day, and do not need to travel to a separate charging site. Another is that some energy providers encourage users to charge vehicles at off-peak times, such as overnight, by providing lower cost tariffs at these times. A report by ChargePoint³ has also suggested that the provision of charging facilities on site can be a key incentive for some employees.

On-site charging may require additional load management to ensure that the energy supply can handle charging

multiple vehicles. You may also wish to make chargers available to members of the public, and there is also funding available if employees wish to install a charger at home.

Environmental

Operating ULEVs within your fleet can improve the sustainability credentials of your business, help to reduce your carbon footprint and meet environmental targets, and mitigate risk from future local air-pollution legislation.

Pure electric vehicles have zero tailpipe carbon emissions when in use, and the average gCO₂/km of hybrid models is much lower than even the most efficient diesel models. This means that when driving an EV using only the battery, the carbon emissions are zero. However, charging the vehicle will have some associated emissions depending on the grid electricity supply. This will still be much lower than the diesel fuel equivalent.

As well as no tailpipe carbon emissions, there are no emissions of harmful airborne particulates and pollutants. Nitrogen dioxide is one such pollutant, and this has been cited as one of the key contributors to poor air quality in urban areas.

² Gov.uk advisory fuel rates from March 2016

³ ChargePoint, An Employer's Guide to EV Charging in the Workplace 2018

These pollutants have significant health risks and are part of the reason that the UK has committed to phasing out diesel vehicles by 2040. It has also led many cities in the UK to look into implementing Clean Air Zones (CAZs). By operating ULEVs this reduces the risk of future costs or disruption when operating in urban areas, while also contributing to improved air quality.

As well as emission benefits, ULEVs are also quieter and result in less noise pollution. This can have social benefits in the local area and can allow commercial vehicles to operate overnight when there is reduced risk of collision with other vehicles or cyclists.

Maintenance and safety

An often-overlooked advantage to EV technology is that a battery and motor drivetrain has fewer components than a typical internal combustion engine. This has multiple advantages to your business. First, this reduces the likelihood of breakdown and incurring repair costs, which in itself makes driving safer for your employees. Second, expenditure on maintenance is likely to be reduced.



Understanding if EVs are suitable for your own fleet

Factors to consider

While there are significant benefits to operating Electric Vehicles in the fleet, it may not always be the best option for your business operations. You should consider the following when evaluating EVs for your fleet:

Charging and range

The biggest challenge to EV adoption is 'range anxiety' and the fear that the driver will be stranded unable to find a charge point. While these concerns are understandable, EV range is increasing with each new model of vehicle, and resources such as Zap-Map⁴ provide up to date maps of available public charging facilities across the UK. The UK Government has recently passed the Autonomous and Electric Vehicles Act⁵ to mandate that motorway service stations and large petrol stations install chargers, and to unify the types of charging plugs used.

However, if your drivers are carrying out over 100 miles a day, then EVs may not be a suitable option for your fleet.

The Carbon Trust's Green Business Directory provides a list of Accredited Suppliers and installers of energy efficiency and renewable energy technology in the UK.

Carbon Trust Accredited Suppliers have been independently assessed by the Carbon Trust and met or exceeded criteria designed to examine their capability and proven track record of delivering thoughtful, well-designed energy efficient and renewable energy systems.

Visit the directory now to find suitable suppliers of EV charging points.

Day-to-day business requirements

In addition to charging requirements, you must consider what kind of journeys drivers are carrying out and whether vehicles will be heavily loaded.

Motorway driving requires more power from the battery of an EV, thus shortens the maximum range possible on one charge. EVs are much more suited to urban driving routes of around 50-100 miles in between charges. If you carry out lots of rural driving or long-distance trips, EVs may not be suitable.

The load carried on board a vehicle will also impact maximum range. If your business operates a van fleet that carries heavy equipment all day over long distances, the EVs may not be well suited to these journeys. However, options such as the Nissan e-nv200 have proved popular with urban businesses, offering rapid charging features and a maximum load of 705kg⁶.

Staff engagement

Although businesses often look to integrate EVs following requests from staff, some staff may push back to operational changes, or may be apprehensive about driving an electric vehicle over a traditionally fuelled vehicle.

Driver training may be required to utilise vehicles optimally and to demonstrate the benefits; financial, environmental and safety – of EVs to members of staff. Staff will also need to be able to charge vehicles safely.

⁴ <https://www.zap-map.com/>

⁵ <http://www.legislation.gov.uk/ukpga/2018/18/contents/enacted>

⁶ https://www.nissan.co.uk/vehicles/new-vehicles/e-nv200/technical-information.html#capacity_capability

Ultra-Low Emissions Zones

From 8 April 2019 an Ultra-Low Emission Zone (ULEZ) will be in place in central London. This scheme aims to tackle dangerous levels of local air pollution in London by introducing a daily charge on vehicles that do not meet set emissions standards.

Transport emissions have been identified by the UK government as the largest source of harmful emission in London⁷, and this complements nationwide plans to ban the sale of new diesel and petrol vehicles by 2040.

The London ULEZ scheme will be expanded in October 2021, and it is likely that other urban areas around the UK will implement similar restrictions on vehicles. Switching to low emission and electric vehicles can future proof your business and ensure that it is able to operate in ULEZ areas without significant extra costs or disruption.

For more information about the scheme, and to see what vehicles are affected by the ULEZ please visit the TFL website: <https://tfl.gov.uk/modes/driving/ultra-low-emission-zone>



⁷ <https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/why-we-need-ulez?intcmp=54331>

Action Checklist

The first step in deciding whether EVs would be suitable for your fleet is to carry out an internal audit of your own operations and existing fleet.

Assess your fleet requirements by answering the following questions:	✓
1. Which employees are driving for business?	
2. What vehicles are currently used for business travel? Are they suitable?	
3. What is the vehicle fuel efficiency and emissions rating?	
4. How far are employees travelling per day, and how often?	
5. Are there special requirements for drivers or vehicles?	
6. Is the current vehicle the most efficient option for the employee?	
7. What is the current reimbursement structure?	
8. How much does the business currently spend on fuel?	

If it is difficult to answer these questions, you should assess whether current record keeping and mileage management is adequate. Good availability of fleet data is essential to support business decisions, such as procurement, driver training and operational efficiency.

How to Build the Business Case

When can switching to EV save your business money?

Whole Lifecycle Costing

The previous section on the financial benefits of ULEVs showed how considering whole life cycle costs results in ULEVs being more cost efficient to run than a diesel or petrol alternative. The following table shows how this can be shown in practice between an electric and a diesel vehicle. It is assumed all vehicles are leased for 3 years and drive 20,000 miles per year.

Presenting the information in this form may be helpful when demonstrating the benefits of ULEVs to financial controllers or senior decision makers.

	Small family car electric	Small family car diesel
Car value (new)	£31,495	£23,360
Plug-In car grant	£3,500	
Battery/tank capacity	40 kWh	50 litres
Typical range	168 miles	630 miles
Fuel emissions		104 gCO ₂ /km
Grid electricity emissions	47 gCO ₂ /km	
Residual value	£10,400	£7,700
Depreciation cost	£17,595	£15,660
Servicing and maintenance cost	£1,200	£1,700
Fuel cost	£3,090	£7,900
In-use cost	35.1p per mile	39.3p per mile
Total life cycle cost	£21,070	£23,560
In-use CO2 emissions	4,548 kgCO₂e	10,065 kgCO₂e

Figure 2: Example life-cycle cost comparisons, assuming 20,000 miles per year for three years

Available Grants and Funding

The UK government has recently renewed its commitment to supporting the adoption of EV technology. A plug-in car and van grant is available for purchases of new EVs, along with funding towards the installation of workplace and domestic charging points. As well as government grants, local authorities may be running their own schemes, so it is worth contacting your local representatives.

Plug-in Grant Scheme

The government will provide a grant direct to vehicle dealerships or manufacturers to give buyers a discount on a range of low-emission vehicles. The maximum grant available is 35% of the purchase price of the vehicle, up to £3,500.

The list of eligible vehicles has been updated in 2018, and not all low-emission vehicles are eligible. The full list of qualifying vehicles can be found at gov.uk.

Workplace Charging Scheme

The Workplace Charging Scheme (WCS) is a voucher-based scheme that provides support towards the up-front costs of the purchase and installation of electric vehicle chargepoints, for eligible businesses, charities and public sector organisations.

The grant is equal to 75% of the purchase and installation costs, up to a cap of £500 per charge socket.

Electric Vehicle Homecharge Scheme

The Electric Vehicle Homecharge Scheme (EVHS) provides grant funding of up to 75% towards the cost of installing electric vehicle chargepoints at domestic properties across the UK, up to a maximum of £500.

Tax Exemptions

The way vehicle tax is calculated has changed for cars first registered with DVLA from 1 April 2017. For the first year this is based on CO₂ emissions; after that, the amount of tax to be paid depends on the fuel type of the vehicle. All pure electric cars (costing less than £40,000) attract a rate of £0 per year; whilst all alternative fuel vehicles (which includes plug-in hybrids) receive a £10 discount each year.

For company car drivers, electric and hybrid cars emitting 50g/km of CO₂ or less incur a 'Benefit In Kind' tax of only 9% in 2017/18, compared to 22% for a diesel car emitting 100g/km of CO₂⁸.



⁸ Details sourced from: <https://www.goultralow.com/electric-car-savings/tax-savings/>

Smart Vehicles

How can smart technology help businesses reduce vehicle emissions?

Telematics

Telematics use internet connections between vehicles to track real-time GPRS positioning as well as driver behaviour. Telematics can be simple, such as a sat-nav in a car, or complex such as systems used in large heavy goods fleets.

Telematics encourage fuel saving through a number of methods. They can provide live routing updates that direct drivers to the shortest route, as well as live feedback to the driver when accelerating or braking too aggressively. The information captured in the system can also be used by fleet managers to give feedback or training to drivers. Installing telematics can also reduce your insurance costs and encourage safer driving within your fleet.

Car sharing

Some companies have seen that more employees are taking cash allowances as oppose to a company car, but they may still need to drive for work. Car clubs or pool cars may be suitable in this case. Smart systems allow employees to use a phone app or website to see the location of a shared car and reserve the use of it if available. The systems may also track mileage and automate payment.

Pool cars are owned or leased by your business and kept on site, whereas Car Clubs are separate businesses that provide a flexible vehicle service. The benefit of using car sharing is that it reduces the overall number of vehicles on the road and replaces them with a single high utilisation vehicle. Short journeys where the driver returns to the office between uses means that EVs are well suited for pool cars.



Best practice for managing your fleet

The Carbon Trust recommends that you evaluate your current fleet management across 10 key areas

The following advice sets out the Carbon Trust's best practice for managing your fleet. We recognise that all businesses and fleets are different, so some areas for consideration may not be relevant to your business.

This advice is relevant whether you have chosen to switch to EVs or operate a traditionally fuelled vehicle fleet. By implementing best practice into day-to-day operation of your fleet you will be able to take ownership of costs, mileage and driver safety, all of which will benefit your business.

Area for Consideration	Examples of Best Practice Fleet Management
1. Fleet Policy	Examples of good practice include: senior management sign-off; fuel efficiency objectives; mileage reduction objectives; driver training; regular review of policy
2. Responsibility	Examples of good practice include: fuel champions/managers close to operational level; dedicated fleet manager; clearly allocated responsibility for fuel consumption/fleet performance; senior level oversight of fleet performance; fuel/vehicle performance as requirement in relevant job descriptions
3. Vehicle Procurement	Examples of good practice include: low carbon/fuel efficient company car lists; lifecycle costing of vehicles; incentive structures for low carbon vehicles; choice of fleet provider with low carbon vehicles
4. Accounting and Data Management	Examples of good practice include: Integrated fuel accounting systems (e.g. fuel cards, bunker management; expenses); fuel reimbursement policy that incentivises fuel efficient driving/mileage reduction; dedicated fuel manager; consideration of biofuels
5. Performance Monitoring and Targeting	Examples of good practice include: recording of driver performance, e.g. fuel efficiency, mileage per run, driver 'incidents' such as hard braking; fuel and mileage data of individual vehicles; monthly comparative reports; use of benchmarks; driver league table; fleet targets and KPIs; driver targets and KPIs; communication of results

Area for Consideration	Examples of Best Practice Fleet Management
6. Behaviour Change and Telematics	Examples of good practice include: telematics systems including GPS tracking for fleet management; driver monitoring; information systems that provide drivers with live feedback and guidance on driving behaviour; speed limiters
7. Operational Efficiency	Examples of good practice include: incentivising modal shift; route planning for transport fleets; car-sharing; backloading/avoiding empty runs; load optimisation; incentivising public transport/home working/teleconferencing; outsourcing transport/ partnering/insourcing; improving remote support services
8. Staff Engagement	Examples of good practice include: driver training modules, expanding on H&S to include efficient driving; in-house trainer/efficient driving champion; incentivising efficient driving
9. Innovation	Examples of good practice include: novel technologies to improve aerodynamics like skirts, airtabs, etc.; alternative drive trains; consideration of innovative ways of transporting goods; infrastructure for alternative drivetrains, such as charging points; technologies to provide services remotely; innovative distribution network infrastructure; efficient refrigeration (e.g. liquid air); low resistance tyres
10. Maintenance	Examples of good practice include: maintenance policy includes fuel efficiency objective; mandatory regular maintenance intervals; tyre pressure monitoring and education

Your next steps

See if your business could be reducing emissions and saving money by switching to electric vehicles

Step 1: Evaluate your fleet

Audit and evaluate your current fleet and business travel. Are your operations suited to low-emission vehicles? Which EVs are most appropriate? Are there any areas where you are currently behind best practice?

Step 2: Identify your opportunities

Build the business case for switching to EVs, including whether you will need to install charge points, and investigate available grant support. The Carbon Trust's Green Business Fund can provide implementation advice free of charge for SMEs.

Step 3: Prioritise your actions

If there is a compelling case for switching to EVs, work with staff to understand their needs, and to educate them on the benefits of EVs and how best to utilise the vehicles.

Step 4: Implement your action plan

Make the switch to EVs to save money and reduce carbon emissions.

Related Publications

Other relevant guides available on the Carbon Trust's website include:

- [Employee awareness and office energy efficiency](#)
- [Better business guide to energy saving](#)
- [Carbon footprinting guide](#)

Go online for more information

The Carbon Trust provides a range of tools, services and information to help you implement energy and carbon saving measures, no matter what your level of experience.

Website – Visit us at www.carbontrust.com for our full range of advice and services.

👉 www.carbontrust.com

Tools, guides and reports – We have a library of publications detailing energy saving techniques for a range of sectors and technologies.

👉 www.carbontrust.com/resources

Events and workshops – We offer a variety of events, workshops and webinars ranging from a high level introductions to our services through, to technical energy efficiency training.

👉 www.carbontrust.com/events

Small Business Support – We have collated all of our small business support in one place on our website.

👉 www.carbontrust.com/small-to-medium-enterprises/

Our client case studies – Our case studies show that it's often easier and less expensive than you might think to bring about real change.

👉 www.carbontrust.com/our-clients

The Carbon Trust Green Business Fund – is an energy efficiency support service for small and medium-sized companies in England, Wales and Scotland. It provides direct funded support through energy assessments, training workshops, and equipment procurement support.

👉 www.carbontrust.com/greenbusinessfund

SME Network - Join a community of over 2000 small and medium-sized businesses to discuss your strategy and challenges to reducing carbon emissions and improving resource efficiency. Sign up for free to share knowledge, exchange useful resources and find out about the support and funding available in your area, including the details of your local energy efficiency workshops.

👉 www.carbontrust.com/resources/tools/sme-carbon-network

The Carbon Trust is an independent company with a mission to accelerate the move to a sustainable, low-carbon economy. The Carbon Trust:

- advises businesses, governments and the public sector on opportunities in a sustainable, low-carbon world;
- measures and certifies the environmental footprint of organisations, products and services;
- helps develop and deploy low-carbon technologies and solutions, from energy efficiency to renewable power

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