A Guide to Driving Electric

Tusker.

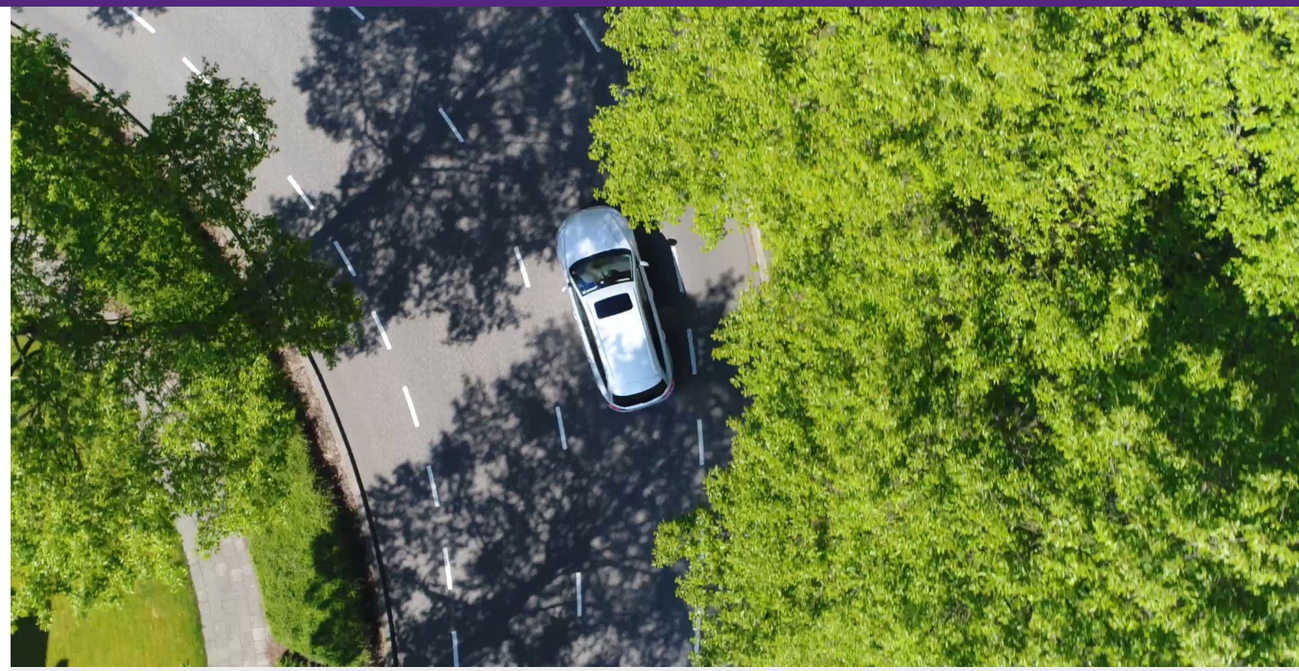
Adoption of Electric Vehicles is growing at a rapid pace. This is driven by a number of factors – and by 2030, drivers won't be able to buy new petrol or diesel vehicles. So, the move to electric motoring is somewhat inevitable for all of us – but it should also be viewed as an exciting and environmentally critical move into a new era of motoring.

But what is this new technology like to drive? What tips and techniques would be good to know before a driver gets behind the wheel of an EV for the first time?

This guide looks to provide all of this information, so that a driver taking the wheel in an EV has all the information they need to make the most of the exciting new technology.

Contents

Introduction	5
1. What is different about the vehicle itself?	6
2. What's different about driving an Electric Vehicle?	8
3. How (and where) to charge an Electric Vehicle	9
What charging connector do I use?	11
How long does it take to charge an EV?	12
4. Maximising the range of an Electric Vehicle	13
5. The importance of energy tariffs for charging at home	15
6. Breaking down in an EV	15
7. Conclusion	16
Bibliography	17



Introduction

Many of us will have learnt to drive in a time when Electric Vehicles (EVs) did not exist on our roads. Many of us will certainly be unfamiliar with how they work, how they 'feel' and whether it is a completely different experience.

In many ways, an EV is just a car, like any you may be used to. It just has a battery to power the vehicle instead of an engine fuelled by petrol/diesel. So much about driving an EV is the same as you experience in any other car. Press the accelerator and the car moves, press the brake and it slows down, turn the steering wheel and it changes direction – everything an experienced driver is already used to. In fact, driving an EV is, in many ways easier than driving a conventional petrol/diesel vehicle.

As well as being easy to drive, they carry a number of additional advantages over petrol/diesel cars. They are quieter and they are also cheaper to run – imagine, no more trips to the petrol station.

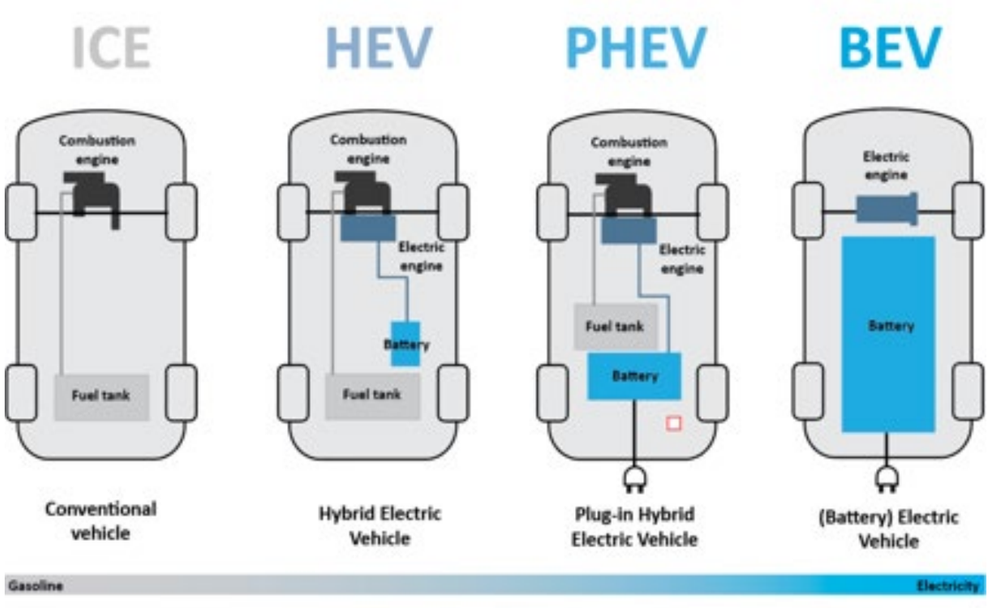
But it's also true to say that there are subtle differences in how an EV is driven, and also how a driver of an EV can get the most out of EV motoring.

This guide will explore these differences, providing tips and techniques to get the best out of EV driving – whether this be maximising the range of the battery, minimising the cost of charging, or simply removing some of the fear and uncertainty about embracing new technology.

It is natural that many people may fear change and be nervous about stepping away from the driving habits they are used to, but the benefits of electric motoring are numerous, and the time when the only new vehicles on sale will be electric will be upon us before we know it. It may also be a lot easier than you thought it was!

1. What is different about the vehicle itself?

The most obvious difference between a conventional vehicle and an EV, is that there is no engine. Instead, an EV has a battery and a motor (or motors) to power the car. The battery charges up just like your mobile phone would (more on charging later), and when you press the accelerator, power is sent from the battery to the motor(s) to propel the vehicle forward (or backward if you are in reverse).



Electric cars are 'automatic'

With a simple, and instant transmission of power from battery to motor, there is no need for any more gears than 'drive' or 'reverse' – this is the same as an automatic vehicle with an engine, and as a result, EVs do not have a clutch either.

A few new lights on the dashboard

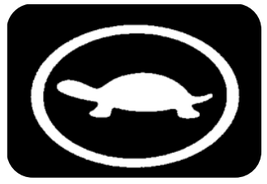
Many lights you will be used to on a traditional vehicle will still appear on an EV – such as low tyre pressure, headlights on, indicators or seatbelt not applied.

But there will also be some new indicators that you may have not seen before. These vary by manufacturer and any new EV driver should always consult their manufacturer handbook to become familiar with lights specific to the vehicle they are driving. Below is an example (with description) of some of the new lights you may come across when driving an EV for the first time.

Ready to Drive

As there is no noise coming from an engine to tell you that the vehicle is switched on (because there is no engine) many EVs have an icon – often accompanied with a small tune – to notify the driver that the vehicle is ready to be put into drive or reverse.

'Limp mode'



When driving an EV, the vehicle will provide several warnings if range is low. If the driver ignores these warnings and 'runs the gauntlet' of getting down to the lowest possible charge, the vehicle will move into 'limp mode' to preserve what charge is left – removing the ability to use features such as air conditioning, and possibly capping speed to help the driver get to a chargepoint. Typically, a driver would have ignored up to 4 warnings before this sign shows on the dashboard.

12 volt battery issue

Drivers new to EVs may not be aware that there are two batteries – a high voltage one to power the vehicle (like an engine would in a traditional vehicle) and a 12v battery – the same as any other car. This 12v battery will power features like central locking, heated seats, power steering, and infotainment systems. As with any vehicle, this lower voltage battery can go flat – this icon notifies you of that.

High Battery Temperature

Similar to the icon used for engine overheating in a traditional vehicle, this icon indicates that the high voltage battery that powers the vehicle is too hot. All EVs use battery coolant fluids to ensure this shouldn't happen, but if it does, the driver should stop the car immediately and call for support.

Charging cable plugged in

If you were wondering whether you could drive off and forget to unplug your EV (possibly damaging your charging unit), this is prevented by the vehicle. If you are plugged in and try to drive away, the vehicle will not move, and this icon will be displayed. Unplug the vehicle to remove the icon.

Low battery charge level

All drivers are familiar with the 'low fuel' warning light on their vehicle, so many EV manufacturers play on this familiarity with EVs and low battery charge – they just put a plug on the picture everyone is used to.

2. What's different about driving an Electric Vehicle?

They are quiet

Because there is no engine noise, EVs are much quieter to drive than petrol cars – in fact, when they are stationary, they are silent. When on the road, the dominant noise from the vehicle will come from the rolling resistance of the tyres.

While this is a wonderful feature of EV driving, leading to a pleasurable driving experience, a driver should also be aware of the safety risk they may present to nearby pedestrians and cyclists that may not be aware of you reversing towards them.

They are quick

Unlike petrol vehicles (whether manual or automatic), the power that propels EVs is delivered instantly once the accelerator pedal is depressed. The perception that EVs are 'sluggish' (probably coming from people's memory of milk floats) is well and truly removed with the first press of the accelerator, where the driver notices instant 'torque' and power available to them. This applies to all EVs, not just high-end luxury models.

Regenerative braking – another way to slow the vehicle down

All EVs have conventional brake pedals, but they also contain a clever feature called 'Regenerative Braking' or 'Regen'. This is an alternative method of slowing the vehicle down, simply by taking your foot off the accelerator.

When moving forwards, power is sent from the battery to the motor (like a petrol vehicle sends power from the engine). In taking the foot off the accelerator, the EV driver is able to reverse this process, sending power back from the motor to the battery – thus slowing the car down and recovering energy (and that is miles, or range) back into the battery.

The driver can often set the level of 'regen' in the car to their preference (harsher regen recovers more energy into the battery and gives a stronger braking sensation, less regen delivers the opposite)

An added advantage of using 'regen' is that this means the conventional brakes are used less – thus extending the life of the brake discs and pads.

Higher tyre pressures

EVs are heavier than petrol cars (because of the battery) – although it's unlikely you would notice this in the handling of the car when it's driven.

This requires an EV to hold higher tyre pressures to accommodate the increased weight.[1] As underinflated or overinflated tyres will impact the vehicle's range (in the same way they would impact fuel efficiency in a petrol vehicle), it's important for an EV driver to be familiar with the correct tyre pressures, and tyre types for their vehicle.

1. https://www.tyresafe.org/tyres-for-electric-vehicles/

3. How (and where) to charge an Electric Vehicle

One activity that all EV drivers will need to become familiar with is how to charge their vehicle – but this is much simpler than many may think.

In broad terms, a driver could have 5 alternatives to where they could charge their EV:

At home

Around 60% of the UK driving population has off-street parking, or a driveway. This can allow them to have a chargepoint fitted to the side of their house. Drivers who have this may never need to charge their vehicle anywhere else. It's effectively like having your own petrol station attached to your house. EV drivers will simply plug their vehicle in when it needs a charge, and the charging would take place overnight. In the morning, the driver is ready to go with a 'full tank'.

At work

If a driver's employer has chosen to install chargepoints, a driver may be able to use these and charge their vehicle while they are at work. There may be rules of engagement as to who can use these, and whether the driver needs to pay for the electricity, but these can be a useful charging point, especially if a driver cannot charge at home.

Destination charging

More and more retail businesses are installing chargepoints to offer to their customers while they visit them. This provides opportunities for EV drivers to charge their vehicles up at locations where they would spend an amount of time going about their normal business – taking the opportunity to 'top up' while they are there.

Examples of this include supermarkets, restaurants, shopping centres, railway stations, theatres, gyms, hotels, pubs, and retail parks. Brands such as McDonald's. KFC, Costa and Starbucks have all negotiated deals with chargepoint operators to have rapid charging points installed in their car parks. Many more will follow as they see this as an opportunity to attract customers to their stores. Plug your car in, grab a coffee and use free wi-fi to do some emails for half an hour.

Kerbside charging

The 40% of drivers who cannot charge at home – because they may live in flats, terraced housing or housing with communal parking areas – are seeing more and more opportunities to charge their vehicles on the street overnight.

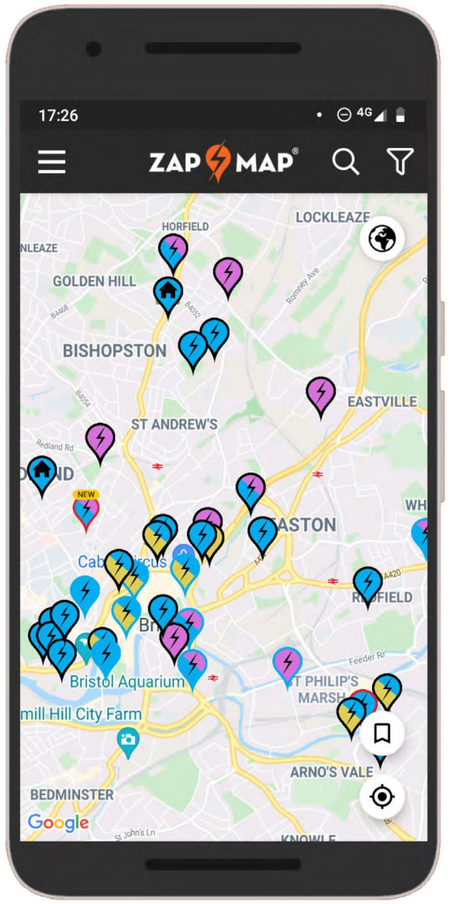
Innovations like lampposts converted into EV chargepoints, wireless charging, pop-up bollards recessed into pavements and under-the-kerb charging solutions are all combining to produce an extensive charging network that can be used by any EV driver, but particularly those who cannot charge at home.

Highway charging

For drivers on longer journeys, who need a charge along the way to get to their destination, there is an extensive, and rapidly expanding network of chargers along the country's motorways and A roads. Clearly, these need to be rapid chargers that deliver a significant amount of charge into the vehicle in the shortest possible time. It is not acceptable to wait 4 hours by the side of the road to recharge an EV, so these chargers look to impart a significant boost to the vehicle's battery in, say, a half hour period. Ideal to allow the driver a break, possibly a bite to eat and use of the facilities.

Technology is developing at rapid pace with these chargers, and it will become usual for these facilities to charge a vehicle (at least to 80% of charge) in as little as 10-15 minutes. That's broadly comparable to the time taken to fill up a tank of petrol and pay for it.

Apps such as www.zap-map.com are an invaluable resource to an EV driver as they display all EV chargepoints in the country in a clear map format.



Journey planning (certainly for long journeys) is an essential element of EV driving – and using Apps such as Zap-Map allow drivers to identify the charging locations they will need to build into their journey. This small planning element is the key to unlocking the financial and environmental savings from driving electric rather than petrol/ diesel.

2. https://www.drivingelectric.com/your-questions-answered/99/how-much-does-it-cost-charge-electric-vehicle
3. https://electriccarchargersuk.co.uk/2020/01/23/ev-charging-speeds/

What charging connector do I use?

Many drivers considering moving to an EV fear they will not understand the various connectors that can be used to charge an EV, but the reality is that this is far more simple than it may appear once you know the vehicle you will be driving.

We cover each of the potential connector types below – and if a driver is comfortable with making a choice between a diesel pump and a petrol pump at a petrol station, then the choice of EV connectors will pose little issue.

Fast chargers (Charging at home, kerbside or destination)

7kW – 22 kW

Charging at these locations (that is, broadly anywhere except when using main roads), the power of the charging units will typically range from 7Kw to 22Kw. For context, 7Kw is approximately the same power as is used by an electric shower in the home.

The connector that is used to take power from these chargers will be one of two, depending on the make of vehicle, but it will only ever be one or the other.

'Type 2 Connector': This is the international standard charger and used by the overwhelming majority of EVs driven in the UK. Vehicles will be supplied with this cable and you can plug one end into your vehicle charging port, and one end into the charging unit.

'Type 1 Connector': This is an alternative connector that is only used by a very small proportion of (typically) Asian EV models such as older Nissan Leafs and Mitsubishi Outlander plug-in Hybrid. It is rarely used on newer EVS and even many of the Asian manufacturers who previously used it are moving over to 'Type 2'.

If you can charge at home and never have need for the rapid charging solutions on the public highways (for much longer journeys), over 90% of your charging will be done using either of the above cables.[2]

Rapid/Ultra Rapid charging (Charging on the public highway)

50kW – 350kW

If you need to charge up en-route, this is typically incorporated into a stop you may usually make on longer journeys. Clearly, in these circumstances, the charge needs to be quick, and not delay the journey unduly.

To achieve these quicker charges, the power of these charging units is much greater than those used at home, or at supermarkets – ranging from 50Kw right up to 350Kw.

There is a maximum amount of power an EV can receive from these chargers, known as the maximum DC charging rate, and this varies by vehicle.[3] It is worth checking the rate of any EV you are considering – and the higher the charge rate the better, as this will allow you to charge your vehicle quicker on the more powerful units. In short, if your maximum DC charging rate is 77Kw, you will charge no quicker on a 350Kw charger than you would at a 100Kw charger – as your vehicle is limited to receiving 77Kw of power.

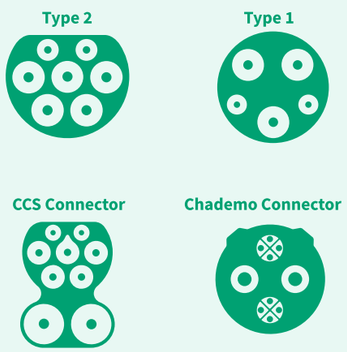
If you use a Type 2 connector for Fast charging (CCS Connector): If your vehicle uses a Type 2 connector for fast charging, CCS is the compatible charger for rapid and ultra-rapid charging. These connectors have cables attached to them that you plug into your car (like a petrol pump) so you do not need an extra cable to access these chargers.

If you use a Type 1 connector for Fast charging (Chademo Connector): If your vehicle uses a Type 1 connector for fast charging, Chademo is the compatible charger for rapid and ultra-rapid charging. These connectors have cables attached to them that you plug into your car (like a petrol pump) so you do not need an extra cable to access these chargers.

Slow charging (Charging on the public highway)

All EV drivers have the backup option of charging their vehicle using a standard 3 pin plug.

This is the slowest form of EV charging and, while many drivers are comfortable using this for overnight charging, the slow speed of charge would generally relegate this to a last resort option for many, with a preference for any of the fast/rapid options described above.



How long does it take to charge an EV?

This depends on a number of factors, including the speed of the charging unit you are using, and the rate at which your vehicle can accept charge – the maximum speed of charge will be the lowest common denominator of these two factors.

For example, an EV with a DC charge rate of 77Kw, charging on a 50Kw charger, will only charge at a maximum of 50Kw. An EV with a DC charge rate of 77Kw charging on a unit with 200Kw of power will charge at a maximum of 77Kw – the lower of the two figures.

The amount of charge in the battery will also affect the speed of charge – with that speed slowing down dramatically once the battery reaches 80% of charge – this variation of charge speed is known as the 'charge curve'.[4] As the rate of charge slows considerably once the battery reaches 80%, many EV drivers do not charge beyond this level on public rapid chargers – simply because it is a waste of time. A useful analogy is to consider whether you would stand by your petrol vehicle watching droplets of petrol fall into the tank.

Notwithstanding the above consideration, a good rule of thumb to calculate speed of charge is to divide the size of battery in the vehicle by the speed of charger to determine the number of hours taken to charge the vehicle – so a 64Kwh Battery using a 7Kw charger will charge from 0-100% in 9.14 hours (64/7). The same vehicle using a 50Kw charger will charge in 1.28 hours (64/50).

A useful calculation tool is included in the references to this guide. [5]

4. https://insideevs.com/news/555406/charging-curve-peak-rate
5. https://www.inchcalculator.com/electric-vehicle-charging-time-calculator/

4. Maximising the range of an Electric Vehicle

A common concern of drivers making the switch to EVs is running out of charge. This is often referred to as 'range anxiety'.

While it is extremely rare for EV drivers to run out of charge (The AA reported that less than 4% of their callouts to EVs were for such instances), there are a number of tips and techniques an EV driver can adopt to maximise the range of their vehicle. [6]

Pre-heating or cooling the vehicle while it is still plugged in

Heating or cooling a car takes energy (whether it is powered by electricity or petrol/diesel). In a conventionally fuelled car, this energy comes by using more fuel from the tank, and with an EV, it requires energy from the battery. This leaves less energy (and therefore range) to use when driving the vehicle.

To minimise this, an EV driver can set the car to heat or cool while still plugged in. Using this approach ensures that the energy used to deliver the heat/aircon is taken from the power source – not the battery.

This has the added advantage of stepping into a car that is pre-defrosted and heated on cold days, and pre-cooled on hot days.

Use of heated seats and steering wheel

When driving, the use of fan heaters and air conditioning can impact the vehicle range by up to 30%, so on longer journeys, where the driver may want to maximise range, use of the heated seat and steering wheel to warm the driver will be more efficient.[7] There is an argument to say, 'why heat or cool the rest of the car when no-one is sitting there?'

Clearly, when there is a greater need to use fan heaters or air conditioning on very hot or cold days, the driver could and should use them, but with an acknowledgement that this will affect range.

Smooth driving style

While EVs can be driven very quickly because of the instant power and torque delivered by the motor, this faster driving style will clearly impact range – the same as it would impact fuel economy in a petrol car.

Driving at 75mph instead of 70mph on a motorway could impact range by up to 10% - 80mph could impact it by 15%.[8]

Similarly, harsh acceleration and braking will also affect battery efficiency. By adopting such a harsh driving style, the driver is affecting the momentum of the car moving forward. Braking hard at traffic lights or roundabouts removes any momentum gained by the vehicle's acceleration. Having to accelerate again from this position requires additional energy – energy that comes from the battery and leaves less in the battery to drive more miles.

An EV driver, keen to maximise range, will try to adopt a smooth driving style, trying to minimise these losses in momentum, and driving at a speed that does not erode range excessively.

6. https://www.motoringelectric.com/news/ev-battery-breakdown-survey/
7. https://www.skoda.co.uk/electric-hybrid-cars/electric-car-range-explained
8. https://www.motoringelectric.com/driving/why-electric-cars-less-efficient-motorway/

Use of regenerative braking

As covered in section 2, EVs have an alternative option to slowing the car down (regen) which recovers energy back into the battery and helps to maximise range.

An EV driver trying to get the most out their vehicle range will use this facility wherever possible, to the point that it becomes more widely used than the brake pedal.

Clearly, in emergency braking situations, the brake pedal can be used for more extreme braking.

Avoiding unnecessary weight in the vehicle

Carrying extra weight takes more energy. This is also true in a petrol vehicle, but the impact on fuel economy may not be so obvious. In an EV, the battery will have to work harder to transport a heavier weight, and this will mean the vehicle will travel less miles than if it were free of the additional load.

Correct tyre pressures

As explained in section 2, having incorrect tyre pressures on a EV (either underinflated or overinflated) will impact range. It is important therefore to know the correct tyre pressures for the vehicle, and keep these regularly maintained.

5. The importance of energy tariffs for charging at home

For those EV drivers that have a driveway at home, and can have a chargepoint fitted, the choice of home energy tariff becomes very important.

While the driver will not be spending money on fuel at the petrol station, and the cost of energy (even factoring in recent increases in energy cost) will deliver savings against previous fuel spend, the impact on home energy bills of charging an EV at home is likely to be significant.

Understanding when demand on the National Grid is at its lowest and having a tariff that offers cheaper costs of energy at times of low demand can mitigate this impact, and ensure the driver is keeping running costs on their vehicle to a minimum.[9]

By setting timers on their smart charger, the driver can program the vehicle charge to operate within the cheaper timeframes – usually at times throughout the night.

6. Breaking down in an EV

EVs break down, just like any car. And in many cases, the reason for the breakdown will not be EV specific – more likely, it will be due to issues that may affect any vehicle, such as punctures or an issue with the low voltage battery (i.e., not the battery that powers the car, but the smaller battery that powers low voltage elements of the car such as central locking and power steering).

Roadside recovery organisations are well equipped to handle callouts to EVs, but there is one key difference they must employ when attending an EV breakdown – the vehicle cannot be towed away as this could damage the motor.

So, the breakdown organisations have developed their own solutions for getting an EV off the road so that it be transported to its destination.

9. https://www.zap-map.com/charge-points/ev-energy-tariffs/

7. Conclusion

Driving an Electric Vehicle offers many advantages over a petrol/diesel vehicle: -

- They are much quieter to drive (because there is no engine noise)
- They are much more responsive (power from the battery to the motor is available instantly)
- Running costs are much cheaper than petrol/diesel vehicles
- The are far kinder to the environment, because of no tailpipe emissions
- They will not incur charges in Clean Air/Zero Emission zones

In many ways, they are the same as a conventional vehicle – press the accelerator and it moves forward, use the brake and it slows down, turn the steering wheel and it changes direction, and the rules of the road are just the same.

But there are some subtle differences to driving an EV that the allow the driver to embrace the new technology and ensure the vehicle is driven safely, and the driver can get the most out of the new driving experience.

With a subtle change in the driving mindset, the driver will be able to maximise the range of their vehicle, avoid fears like 'range anxiety' and 'charging anxiety' and unlock the significant financial and environmental advantages from EV driving.

This change of mindset may involve planning a journey to identify suitable places to charge, use of regenerative braking to slow the vehicle down rather than the brake pedal, using alternative means to heat or cool the cabin (use of pre-heating, use of heated seats and steering wheel rather than fan heaters) and adopting a smooth driving style.

In the same way as a petrol driver may seek out the cheapest place to fill up, the EV driver will identify the cheapest place to charge – and if home charging is an option, this will involve close scrutiny of home energy tariffs, with an off-peak option to take advantage of lower energy costs when demand on the National Grid is lower.

This will form part of the driver's overall charging strategy – and whether they can charge at home, or at work, or by the kerb, or at destinations like supermarkets and restaurants, it is crucial for each EV driver to develop this charging strategy to ensure they can realistically accommodate EV driving (and charging) into their daily life.

In considering this, the advantages of EV driving are many, so it is important to look at how an EV could be included into a driver's lifestyle, rather than looking at the reasons why it won't work. Factors like high mileage or not being able to charge at home can often be overcome.

Small compromises may be very worthwhile considerations to unlock the benefits offered by Electric Vehicles.

Produced in assocation with...

Jon Burdekin

Jon Burdekin Fleet Consulting Ltd

Jon has 30 years' experience in the UK leasing and fleet finance industry, having previously worked for such major leasing companies as Alphabet GB Ltd and GE Capital Fleet Services. His 15 year career with Alphabet incorporated roles as Account Manager, Head of Account Management, Head of Product Management, and Head of Consulting Services where he was responsible for adding key value differentiation and technical innovation.

A subject matter expert in tax efficient alternatives to company cars, Jon also has deep levels of knowledge in the application of electric vehicles, grey fleet management and project management, and is also experienced in delivering training in financial products.

Jon has run his own fleet consultancy business since January 2019 with the aim of helping businesses manage their fleet more effectively, and is now also working with direct clients, leasing companies and brokers to help them make the transition to electric vehicles by helping them develop a comprehensive EV roadmap.

Bibliography

1. https://www.tyresafe.org/tyres-for-electric-vehicles/

2. https://www.drivingelectric.com/your-questions-answered/99/how-much-does-it-cost-charge-electric-vehicle

3. https://electriccarchargersuk.co.uk/2020/01/23/ev-charging-speeds/

4. https://insideevs.com/news/555406/charging-curve-peak-rate/

5. https://www.inchcalculator.com/electric-vehicle-charging-time-calculator/

6. https://www.motoringelectric.com/news/ev-battery-breakdown-survey/

7. https://www.skoda.co.uk/electric-hybrid-cars/electric-car-range-explained

8. https://www.motoringelectric.com/driving/why-electric-cars-less-efficient-motorway/

9. https://www.zap-map.com/charge-points/ev-energy-tariffs/

To get a quote and see the range of cars available simply visit **tuskercars.com/welcome/universityofsussex** to log in. To create an account, you will need your **employee number** (found on payslip) and your company code **TUOS**.

Call us on **0333 400 7431**

or email **EETeam@tuskerdirect.com**

Tusker.