EV20

February 2012

THE CLIMATE GROUP

cenex

energy saving trust

PLUGGED-IN FLEETS

A guide to deploying electric vehicles in fleets

This is part of THE CLEAN REVOLUTION

This report is a guide to deploying electric vehicles (EVs) in fleets. It identifies a number of practical tools that fleet decision makers need to assess the benefits EVs can deliver. By doing so it can help businesses achieve competitive advantage whilst moving fleets towards a sustainable future.

THIS REPORT IS A RESEARCH PARTNERSHIP BETWEEN TRANSPORT FOR LONDON, THE CLIMATE GROUP, CENEX, ENERGY SAVING TRUST AND TNT

THIS REPORT FORMS PART OF THE EV20 INITIATIVE LAUNCHED IN DECEMBER 2009, THE MEMBERS INCLUDE DEUTSCHE BANK, THE STATE OF BAVARIA, THE REGION OF ÎLE-DE-FRANCE, THE GOVERNMENT OF NORTH RHINE-WESTPHALIA, THE PROVINCE OF QUÉBEC, THE STATE OF SOUTH AUSTRALIA, THE GOVERNMENT OF THE BASQUE REGION, JOHNSON CONTROLS, SMITH ELECTRIC VEHICLES, TNT AND FOUNDING FUNDERS DUTCH POSTCODE LOTTERY, THE HSBC CLIMATE PARTNERSHIP AND PRINCE ALBERT OF MONACO FOUNDATION

EDITORIAL AND RESEARCH TEAM

THE CLIMATE GROUP

FLORA MCMORRIN, EV20 UK PROGRAMME MANAGER

CENEX

ROBERT ANDERSON, PROGRAMME MANAGER, FLEET CARBON REDUCTION

ENERGY SAVING TRUST

IAN FEATHERSTONE, FLEET ADVICE MANAGER

CAROLINE WATSON, TRANSPORT STRATEGY MANAGER

THANKS TO OUR FUNDING PARTNER

CONTRIBUTORS

FOREWORDS

The logic is inescapable. The Government has set the most challenging carbon target yet – to reduce greenhouse gas emissions by 50% from 1990 levels between 2023 to 2027. Yet 22% of UK domestic carbon emissions are from transport of which over 90% is on the road. And more than half of all new cars in the UK are bought by fleets.

It's clear that if we are to meet our challenging 2027 target, we must see a big take up of ultra-low emission vehicles in our fleets. We believe this can be good news for business.

There might be a sense of inevitability about shifting to low carbon but there's also a real financial opportunity waiting to be grasped.

Companies that run low carbon vans and cars can benefit from reduced refuelling costs, zero rate Company Car Tax and capital allowance concessions - not to mention 100% discounts for road tax and congestion charge in the capital.

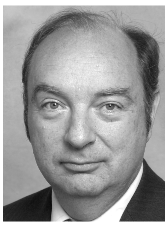
Our new Plug-In Van Grant is designed to make the environment even more conducive to those who back low carbon.

Now when it comes to recognising the importance of switching to electric, we're pleased to see the industry is already some way down the road. But the purpose of this report is to provide companies with the advice and tools necessary to move from good intentions to concerted action.

After all, the consequences of supporting low carbon technology will have far reaching implications.

It will benefit not simply the company or the fleet, but the automotive sector itself – which is developing, manufacturing and investing in green technology. And what benefits our motoring industry benefits UK Plc as a whole.

Creating growth and cutting carbon – two sides of the same coin.



Norman Baker MP,
Transport Minister

Mark Prisk MP,
Minister of State for Business and Enterprise

THE CLIMATE GROUP

Firstly we would like to thank both Cenex and EST for their significant technical input into this report. These findings and recommendations come from a wealth of experience, specifically in the fields of alternative fuelled vehicles and fleets, and will hopefully inspire fleet decision makers to take transformational action on low carbon transport solutions.

Put into action, these innovative fleet solutions will help accelerate a Clean Revolution: the massive upscale of smart technologies, design and new policy and business practices that will ensure that the 9 billion people on the planet by 2050 will not only subsist – but thrive.

Governments worldwide have identified electric vehicles (EVs) as one of the key enablers of this change, as they tackle the issues of both carbon and air pollution, and offer multiple financial and operational benefits to businesses too.

The great environmental benefits of electro-mobility are clearly reflected in the well to wheel carbon emissions of the vehicles. And whole life cost modelling analysis shows that EVs can have lower overall costs than conventionally fuelled vehicles. From cheaper fuel to lower operational and maintenance costs, when EVs are deployed correctly, they can save money.

To help fleet owners achieve these benefits, we have developed this guide to adopting green fleets which meet their businesses' sustainability goals, without affecting the day to day running of their operations.

Although the market is already rapidly transforming, it can be both a technical and a leadership challenge for businesses to steer their fleets towards a sustainable future. But this report will provide businesses with the tools to not just adapt to this transformation, but to prosper.

Today's EV technology presents a ready and viable way to reduce our emissions. And it's clear that those who take advantage of the unique opportunity EVs offer to fleets now, are set to gain the greatest competitive advantage for their businesses tomorrow.

Mark Kenber,
CEO

Robin Haycock,
Head of Transport

CENEX

Electric vehicles come in various forms, from pure battery electric, through variants of hybrid electric vehicle with internal combustion engines and on to fuel cell hybrid electric vehicles. The trend is toward an increasingly electrified powertrain using a common set of technologies. Whilst the trend is common, the vehicle variants will deliver different performances across a range of vehicle types and duty cycles. It is for this reason that the 'one size fits all' solution will no longer apply and greater care needs to be taken in matching the right vehicle to the right application.

Cenex is uniquely positioned between the technology provider and fleet user community. From our position we can see the progress being made in pure and applied Research and Development for low and ultra low carbon technologies and therefore what is progressing towards the market as well as the vehicles moving into a demonstration phase and those ready for full commercial deployment.

Equally, we have a track record of partnerships working with fleet operators on the planning and implementation of fleet demonstration of the latest generation of EVs. Through this work we understand the issues associated with introducing new vehicles and supporting infrastructure into fleet operations and have developed guidance materials and a Fleet Carbon Reduction Tool to provide the data needed for business case development, contrasting electric vehicle investments with those for conventional vehicles and low carbon alternatives such as gas vehicles running on natural gas or bio-methane.

We hope you find this report accessible and informative and hope that it helps foster new project developments within your organisation.

Robert Evans,
Chief Executive

ENERGY SAVING TRUST

We have worked in the business of helping companies reduce fuel use, save money and cut carbon for almost 20 years and today the imperative to protect the bottom line makes those savings even more attractive.

There is also the challenge we all face as a society to reduce our carbon emissions and meet our climate change targets. The good news is that this creates huge opportunity. There are more fuel efficient vehicles in the market than ever before, and vehicle manufacturers are bringing new, less energy intensive and greener products to the market. However, with new technologies comes the need for new information and understanding.

The Energy Saving Trust works to support and advise businesses on how to green their fleet in a way that saves money. We'd like to see the UK meet its climate change targets and we agree that electric vehicles have a significant role to play in this. Over 50% of new vehicles are purchased by business; that's why it is so important for fleets to lead the transition to EVs. Fuel costs are significantly lower for EVs compared to ICEs; at a time of ever volatile fossil fuel prices, electric vehicles offer relative stability of running costs. Other significant advantages EVs can offer are reduced air pollution and a long term solution to carbon emissions.

For a successful transition to EVs it is important that the early adopters are happy and satisfied with the product. An important part of achieving this is to recognise that for every business that will benefit from an EV there will be another where EVs are a poor fit. That's why it's so important to identify which low carbon or electric vehicles will benefit your business and suit your needs.

We think this report comes at a crucial time in the evolution of EVs and will help you understand the potential benefits EVs can deliver in the successful running of your business.

Nigel Underdown,
Head of Transport Advice

IN THE RIGHT CIRCUMSTANCES EVS CAN PROVIDE A CLEAR BENEFIT FOR BUSINESS NOW.

EXECUTIVE SUMMARY

THE TERM EV IS USED TO DESCRIBE A WIDE VARIETY OF DIFFERENT TECHNOLOGIES THAT USE ELECTRIC DRIVE TO POWER, OR ASSIST IN THE POWERING OF A VEHICLE AND CAN BE PLUGGED INTO THE MAINS SUPPLY. THE MAIN TYPES OF VEHICLE COVERED UNDER THIS TITLE ARE A PURE EV, A PLUG-IN HYBRID ELECTRIC VEHICLE (PHEV) AND AN EXTENDED-RANGE ELECTRIC VEHICLE (E-REV). SEE GLOSSARY OF TERMS IN APPENDIX 1 FOR A DESCRIPTION OF EACH.

The analysis in this report demonstrates that in the right circumstances EVs can provide a clear benefit for business now. If the 'sweet spots' are carefully identified, financial benefits and early commercial advantage will flow.

Electric vehicles (EVs) are rapidly emerging as a viable alternative to conventionally fuelled vehicles. EVs from major manufacturers are already available with an increasing range of makes and models due to appear.

However, if the Government is to hit its carbon emissions reduction target of 50% by 2025, the uptake of electric vehicles must be greatly accelerated. The Committee on Climate Change recommends that the Government should aim for 1.7 million EVs on the road by 2020[1]. In order to achieve this level of take up, the focus must be on fleets.

More than half of all new cars in the UK are bought by fleets. If the purchase of EVs starts to make sense for fleets, it will rapidly accelerate their deployment to consumers across the UK too. And for many it makes sense already.

The analysis in this report demonstrates that EVs are ready to be deployed into fleets right now. And it provides a practical guide for fleet managers by offering the tools they need, to find out where EVs work and where they are financially beneficial. It outlines the necessary considerations and explains how to get started, to help fleet decision makers reduce energy consumption and save money.

This report will help fleets to determine if EVs will provide clear financial benefits and early commercial advantage for them. In order to develop a business case for deploying EVs, it is first necessary to understand the range of operations within the fleet. Undertaking such an analysis will allow fleets to clearly identify the optimal operating environment for an EV.

The cost structures of internal combustion engine (ICE) vehicles and EVs are very different. The only realistic way to compare these vehicles is to look at whole life costs. This is vital, as most EVs on the market cannot currently compete with the purchase price and range of conventional fossil fuel vehicles. They can, however, offer other key advantages; there is a significant drop in running costs, noise and tailpipe emissions when EVs are deployed in the right places. For example, it can cost a quarter of the price to refuel an EV compared to a conventional vehicle at today's prices. Over its lifetime, the whole life cost (WLC) of an EV can be less than a conventional vehicle if deployed correctly.

A whole life costing approach is required to take into account a large number of variables beyond simply the purchase price of a vehicle, including some costs that will alter over time. Vehicle taxes, subsidies, fuel and electricity use, battery lifetime, service maintenance and repair (SMR) and length of ownership are the major factors that should be taken into account.

The purchase of EVs also provides branding benefits for fleets. Businesses are competing in an ever more environmentally conscious world. The market is changing as consumers are demanding greener products and services and showing a preference for brands with stronger environmental credentials.

The Government already provides taxation benefits and upfront grants for the purchase of EVs. These clearly strengthen the business case for their deployment into fleets. Infrastructure for charging is now being installed across cities, driven by governments both locally and nationally. Public private partnerships are also coming together and expanding on this early investment, so businesses with fleets will not have to rely just on their own infrastructure to cover their complete business needs.

These fiscal incentives, plus the new infrastructure and vehicles coming onto the market, will all make deployment of EVs in fleets more attractive. This report builds on this emerging opportunity by supporting fleet decision makers through the practical steps they need to take to spark a transformation in their fleet and embrace low carbon transport solutions today.

1 www.theccc.org.uk/sectors/surface-transport/electric-cars

01 INTRODUCTION

There are a number of opportunities available to the fleet decision maker to reduce carbon and energy consumption. These include technologies such as biofuel, gaseous fuels, liquefied fuels, improvements to ICEs and hybridisation, as well as more fundamental improvements to fleet processes. This report concentrates however, on the major opportunities of deploying EVs within a fleet and identifies a number of the tools needed to deliver a sound business case for it.

The term EV refers to any vehicle powered, in part or in full, by a battery recharged from the electricity supply. Procuring EVs is an important investment decision.

This report will support fleet decision makers when procuring EVs for a fleet. There is no 'one size fits all' model for deploying EVs – it is about finding what works best and what works now. The key is to take decisions based on the facts and figures currently available. Forecasts for EV technology imply that the right decision now will prove to be even more beneficial in the future.

This report aims to guide a fleet decision maker through fleet specific considerations such as whole life cost modelling, tax frameworks and financial solutions, that are necessary to successfully purchase or lease electric fleet vehicles.

1.1 THE CURRENT MARKET STATUS

The companies we have consulted with regarding this report are already looking closely at the business opportunities related to operating EVs. This is being driven by the need to reduce energy consumption, increase environmental performance and respond to Government policy. Information and data is also becoming more readily available and companies are willing to share their experiences of EV deployment.

In 2010, UK carbon dioxide (CO_2) emissions rose by 2.8% to 582.4 million tonnes; 25% of which are accountable to transport[2]. There is considerable evidence that combining the electrification of transport with decarbonisation of the electricity grid represents one of the most promising solutions to cutting carbon emissions to combat climate change. As the electricity used to charge the EV comes from an increasingly less carbon intensive energy mix, then the well to wheel (WTW) carbon emissions for an EV will decrease. Even with today's UK energy mix, EVs are part of the solution for carbon reduction.

The Department of Energy and Climate Change (DECC) aims to ensure that three quarters of the UK's electricity comes from low carbon sources by 2030[3] by reforming the energy market. This will have a dramatic and beneficial effect on the WTW emissions of EVs. Switching from petrol and diesel to electricity can also address the challenges of energy security and urban air quality. In the long term EVs will play an essential part in meeting the UK's emissions targets.

Although carbon reduction may not be the main driver for change within fleets, emission reduction targets do help drive collaboration and innovation, and protect future business value. The focus of this document is, however, more directed towards developing a business case using duty cycle and whole life cost analysis.

1.2 THE ROLE OF FLEETS

Fleet sales in the UK in 2011 accounted for 58% of annual new cars and 63% of all new sales, including light commercial vehicles (LCVs). That equates to 1.1 million cars and 0.3 million LCVs[4]. The size of market share and the fact that fleets have a higher turnover of vehicles means they can help EVs to achieve rapid market penetration. We believe using a sound business case to support fleet decision makers in understanding where EVs can be most effectively used will positively affect the scale and speed of EV market growth.

Deploying EVs in fleets is likely to increase the uptake in the consumer market too, because positive user experiences within fleets will build wider confidence.

A factor which has been absent in much of the debate is the fact that EVs are extremely pleasant to drive. The quiet, smooth and relaxing drive regularly wins drivers over. Those who experience an electric car or van in an urban environment may be reluctant to return to a diesel powered vehicle.

The demand for second hand EVs is also anticipated to be strong, and lower fuel costs (typically a quarter) of an equivalent ICE will be attractive to increasing numbers of buyers needing economical transport for local business or commuting. In turn this should bolster the residual values of the early vehicles, encouraging more new buyers into the market.

2 uk.reuters.com/article/2011/03/31/us-emissions-idUKTRE72U-2ZL20110331

3 www.decc.gov.uk/en/content/cms/news/pn10_130/pn10_130.aspx

4 https://www.smmt.co.uk/members-lounge/member-services/market-intelligence/vehicle-data/monthly-automotive-data

To reach these figures we have added 1,019,126 fleet cars to 99,033 business cars to get the 1.1 m. The LCV figure is the combined figure for vans and trucks 303,097.

The vehicle choice will continue to expand in the coming years as more vehicle manufacturers are beginning to introduce new products. Limited production runs are likely to continue at first but eventually the demand from fleets is projected to encourage the economies of scale necessary for this market to expand.

There is a range of vehicle technologies available, making it crucial that fleet decision makers select the right vehicles for the right roles. Deploying an EV for an operation or duty cycle that it doesn't suit will be a waste of time and money as well as having a negative impact on people's perception of this technology.

1.3 THE DRIVE TO REDUCE ENERGY AND TRANSPORT COSTS

With fuel prices rising fast, fleet decision makers are prioritising carbon and fuel reduction strategies. The breakdown of the operating costs of the top 200 fleets in the UK demonstrates that fuel accounts for one third of the total spent, and on average, each company is spending £6 million per year on fuel.[5]

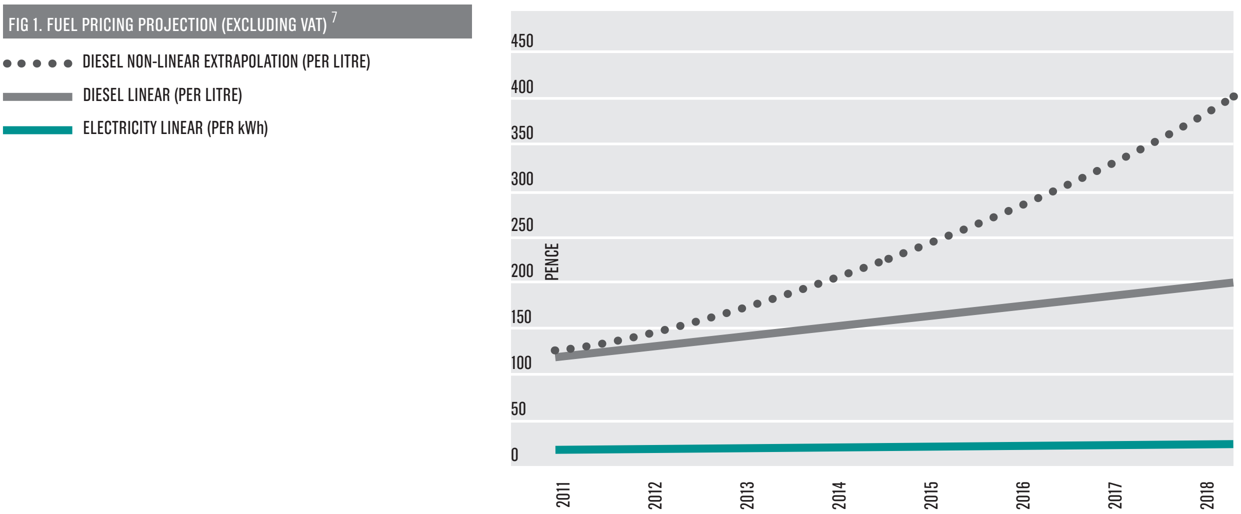
The price of oil has risen approximately five fold since 2000[6] and continues to fluctuate with a general historical trend upwards. The business case for electric vehicles is heavily impacted by the assumptions that are made about future fuel prices, but we cannot predict energy prices. With the current price of diesel, business costs are high, and with the wide variation in fuel prices, the job of predicting fleet running costs is difficult.

It is important to keep in mind that petrol and diesel powertrains will improve over time. They are likely to become 30-40% more efficient by 2020 and this will partially offset higher fuel prices. The 'sweet spots' for EV deployment (those areas where EVs make operational, environmental and financial sense) will grow in number and size as liquid fuel prices continue to escalate. In addition, commercial and industrial electricity rates are negotiable and carry a lower tax burden. The fuel cost per mile travelled is one of the key economic factors differentiating EVs from other technologies.

The graph below (Fig. 1) demonstrates an extrapolation of diesel and electricity prices based on previous trends. This demonstrates that if electricity and fossil fuel prices rise at a constant rate without changes in taxes then electricity costs will remain a fraction of diesel. However, should diesel prices grow in a more exponential manner, then the price differential between the two fuels will further increase.

The benefit to business of running a vehicle on electricity instead of liquid fossil fuel is not just lower costs but the stability or resilience that comes with fuel costs representing a far smaller proportion of vehicle running costs.

FIG 1. FUEL PRICING PROJECTION (EXCLUDING VAT)[7]



1.4 THE DIRECTION OF LEGISLATION, GOVERNMENT AND INCENTIVES

The Government is committed to reducing greenhouse gas emissions by 50% from 1990 levels between 2023 to 2027. Such radical reductions will require people to have a range of options for their travel which encourage them to choose low carbon alternatives. That is why in November 2010 the Government announced its decision to invest £400 million in electric and low carbon vehicles.

The first review of the Plug-In Car Grant took place in January 2012 and the extension of the grant to include vans has further focused attention on the fleet market, and also made the 'sweet spot' analysis shown in this report a great opportunity for saving money. It's a great start for 2012, and clearly confirms the direction of travel for policy in the UK.

5 Bauer Media, fleet 200, 2010 pg6

6 www.cenex.co.uk/consultancy/fleet-carbon-reduction

7 This extrapolation is based on previous price rise trends and is therefore illustrative. No account has been taken of new and emerging policies on electricity prices.

02 BENEFITS OF EVS

Revenue growth, reduced energy spend, increased market share and improved corporate reputation are all benefits that can be brought about by putting in place strategies to minimise energy consumption and carbon emissions.

In the right circumstances EVs can offer multiple benefits for your business. These range from financial, operational and environmental benefits, and include:

- whole life cost savings
- reduction in air pollution and carbon emissions
- a smoother, quieter and more pleasant driving experience

Through detailed analysis, it is possible to identify the benefits that EVs can bring to a vehicle fleet. The scale of these opportunities will increase as the number and variety of car and commercial vehicle models escalate over time. The current cost of ownership models will change as key aspects beyond vehicle cost alter. Much of the scepticism concerning the operational practicalities and financial issues aired within the media and among fleet commentators is based an assumption that EVs need to offer a one size fits all solution. However, we know fleets choose vehicles to suit their business need. As always, those that seize the opportunity will create competitive advantage and with growing financial incentives, the emergence of Low Emission Zones and noise restrictions in our cities, will access benefits and business opportunities.

2.1 FINANCIAL BENEFITS

RUNNING COSTS

One of the biggest costs of running a fleet is fuel use. One of the biggest benefits to introducing EVs to a business is the reduced refuelling costs, electricity being far cheaper than fuel at the pump. At the time of writing, diesel is £1.17 per litre excluding VAT whereas electricity price variations offer the potential for cost optimisation. On the road this typically equates to 13p per mile for a diesel car compared to 3p per mile for an electric car.

The Government has introduced a number of fiscal incentives to make electric and plug-in vehicles more attractive. Local and national incentives, from tax breaks through to direct purchase incentives and local congestion charge exemption, represent a significant reduction in WLC.

COMPANY CAR TAX

From 6 April 2010, cars with zero emissions (e.g. 100% electric) pay zero rate Company Car Tax. Cars with up to 75g CO_2 per kilometre pay only 5% company car tax (plug-in hybrids eligible for the Government's plug-in grant will only pay the 5% rate.)

EMPLOYER NATIONAL INSURANCE CONTRIBUTIONS

Employers benefit from the Company Car Tax incentives too. Class 1A National Insurance (NI) contributions on benefits in kind can, in the case of company cars be a significant expense. For example a diesel car with a list price of £25,000 and CO_2 emissions of 130g per kilometre would cost the employer £656 in the 2011–2012 tax year. This is due to rise through to the 2013–2014 tax year when the cost would be £725 assuming current rates of NI. Current rates of Fuel Benefit Tax (FBT) would attract 2011–2012 contributions of £493 rising to £545 in 2013–2014 assuming current rates of NI and FBT. This is zero for pure EVs and 5% for PHEVs.

CAPITAL ALLOWANCES

Cars with CO_2 emissions of 110g or less receive a 100% capital allowance in their first year of purchase. This concession is currently valid until 2013. Future budgets will confirm any extension of the concession and emission thresholds.

VEHICLE EXCISE DUTY (VED)

Those who purchase a 100% electric vehicle currently pay no annual road tax.

CONGESTION CHARGE (LONDON)

EVs qualify for 100% discounts from the London congestion charge. The savings for a vehicle entering the zone regularly are significant. The current full daily rate is £10 per day, however regular users will pay £9. Therefore one day's commuting a week for 50 weeks results in annual savings of £450 rising to £2,250 if a vehicle travels into the zone five days a week.

CARBON REDUCTION COMMITMENT

The Government in the UK wants to see workplaces providing recharging facilities for their fleet vehicles, but also for their employees, and where appropriate for their customers. Companies whose emissions fall under the Carbon Reduction Commitment (CRC) would avoid additional costs from the extra electricity utilised on site. The Department for Transport publication “Making the Connection: the Plug-in Vehicle Infrastructure Strategy” published in June 2011[8], announced that companies providing such facilities will be able to discount the electricity used to charge plug-in vehicles from their total electricity consumption. This means it is necessary to measure the electricity used for vehicle recharging, which is good vehicle management practice and equivalent to the measurement of fuel and vehicle efficiency (MPG) for ICE vehicles.

PLUG-IN CAR AND VAN GRANTS

The Government’s Office for Low Emission Vehicles (OLEV) is offering a grant to cover 25% of the cost of an electric car up to £5,000 per car. In January 2012 OLEV also announced a grant to cover 20% of the cost of an electric van up to £8,000 per van (see www.dft.gov.uk for information on which vehicles qualify).

A table providing an overview of the incentives that are granted in the member states of the European Union for the purchase and use of electric and hybrid electric vehicles including plug-in hybrid and conventional hybrid vehicles can be found at: www.acea.be/images/uploads/files/20110330_ev_tax_overview.pdf

PLUGGED-IN PLACES

Local charging networks have been set up in eight areas across the country through the Plugged-In Places programme. This initiative has enabled the private sector to enter the market and make significant investments in recharging infrastructure, meaning the creation of an extensive public recharging network, achieved with less public money spent. For example, by the end of next year one such private sector organisation expects to have the UK’s first privately funded large scale network set up in 100 towns and cities, providing 4,000 electric vehicle recharging bays. And other organisations are emerging with national recharging ambitions and business models.

2.2 OPERATIONAL BENEFITS

Whilst previous generations of electric vehicles may not have been able to meet the needs of modern operations, the present generation of vehicles can operate at normal vehicle speeds and with up to a 100 mile range between charges. This means that they are ideally suited to working in an urban or sub-urban environment, but may not be suited to extra-urban working unless combined with rapid charge or battery exchange. The main operational benefits of using EVs are:

REDUCED MAINTENANCE

EVs have fewer moving parts and therefore less scope for parts to wear out or be replaced, hence EVs will require less maintenance. This issue is discussed in more detail in section 4.4.

RESILIENCE PLANNING

The deployment of EVs can ensure essential services and operations are not adversely affected by any rapid rises in liquid fuel prices or any issues concerning fuel supply (e.g. fuel protests leading to blockades).

NO GEAR CHANGES

Perfect for stop-start applications, no gear changes and clutch movements equals less stress and fatigue for drivers.

QUIET RUNNING VEHICLES

This may be a benefit for operating in noise-restricted areas, especially for night time deliveries. Recent reports and work within the Department for Transport (DfT), such as the Quiet Deliveries Demonstration Scheme[9] has highlighted these benefits and some councils are now looking at ways to support quiet running vehicles.

FLEET MANAGER PERCEPTIONS

The results of EV deployment and integration trials carried out by Cenex[10] within a range of fleet operations, show clear evidence of the positive experiences fleet managers have with EVs.

8 www.dft.gov.uk/publications/plug-in-vehicle-infrastructure-strategy
9 www.dft.gov.uk/publications/quiet-deliveries-demonstrationscheme
10 The Smart Move case studies, Cenex, November 2011

The Smart Move trial reports can be downloaded from the Cenex website, however a selection of responses is provided below:

68% OF FLEET MANAGERS SAID THAT INVOLVEMENT IN THE SMART MOVE TRIAL HAD ACCELERATED THEIR COMPANY'S INTEREST IN EVS

75% OF FLEET MANAGERS REPORTED THAT THEY WERE WILLING TO MODIFY THEIR FLEET OPERATIONS TO INCORPORATE EVS

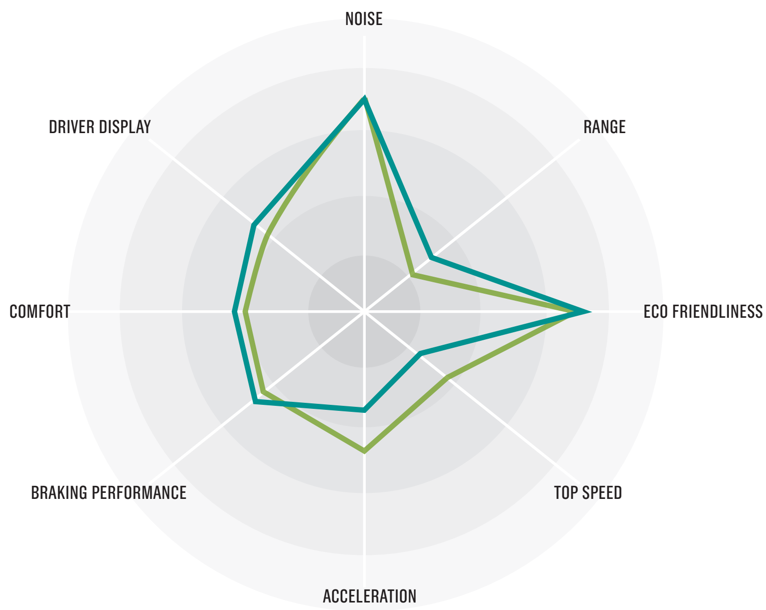
75% OF FLEET MANAGERS SAID THEIR OPINION OF EVS IMPROVED OVER THE TRIAL PERIOD

63% OF FLEET MANAGERS COULD SEE EVS BEING INTEGRATED IN THEIR FLEETS BEFORE 2013 COMPARED TO JUST 25% BEFORE THE TRIAL

DRIVING EXPERIENCE

Within the Cenex Smart Move trial, drivers of the EVs were asked to score their driving experience compared to a conventional diesel vehicle. The results show that drivers scored EVs equivalent to or better than conventional vehicles for a range of features.

FIG 2. EV USERS PERFORMANCE RATINGS



SCORE PERFORMANCE COMPARED TO A CONVENTIONAL VEHICLE

- MUCH BETTER
- BETTER
- SIMILAR
- WORSE
- MUCH WORSE

MITSUBISHI i-MIEV — SMART-ED

DRIVERS ESPECIALLY COMMENTED ON THE:

- SMOOTH DRIVING EXPERIENCE
- STRONG 'NIPPY' ACCELERATION
- LACK OF GEAR CHANGES
- INCREASED COMFORT FROM REDUCED NOISE IN URBAN STOP-START DRIVING

IN ADDITION, 81% OF DRIVERS STATED THAT CHARGING AN EV DID NOT DISRUPT THEIR NORMAL WORKING PATTERNS.

SOURCE: THE SMART MOVE CASE STUDIES, CENEX, NOVEMBER 2011

ELECTRICITY TARIFF AND CHARGING PATTERNS

The management of EV charging to take account of lower cost electricity tariffs has been investigated through a range of additional research studies. The studies carried out by Cenex as part of the Smart Move trial and the Ultra Low Carbon Vehicle Demonstration (ULCVD)[11] programme identified the impact in charge time distribution through the use of timers both built into the charging infrastructure and integrated into electric vehicles.

The electricity tariffs used by those companies taking part in the Cenex Smart Move trial varied between flat rate tariffs and tariffs with two or three times dependent electricity prices. Commonly, users paid a two rate tariff with a low cost night rate typically running from midnight to 7am and a higher rate for electricity used at all other times.

When averaged over the five organisations taking part in the trial, the EVs spent only 11.6% of their charging time on cheap night rate electricity tariffs and 88.4% charging at other times. The charging distribution graph (Fig. 3) indicates that the majority of EV users in this trial were inclined to charge their vehicles when they arrived home from work – hence the early evening peak.

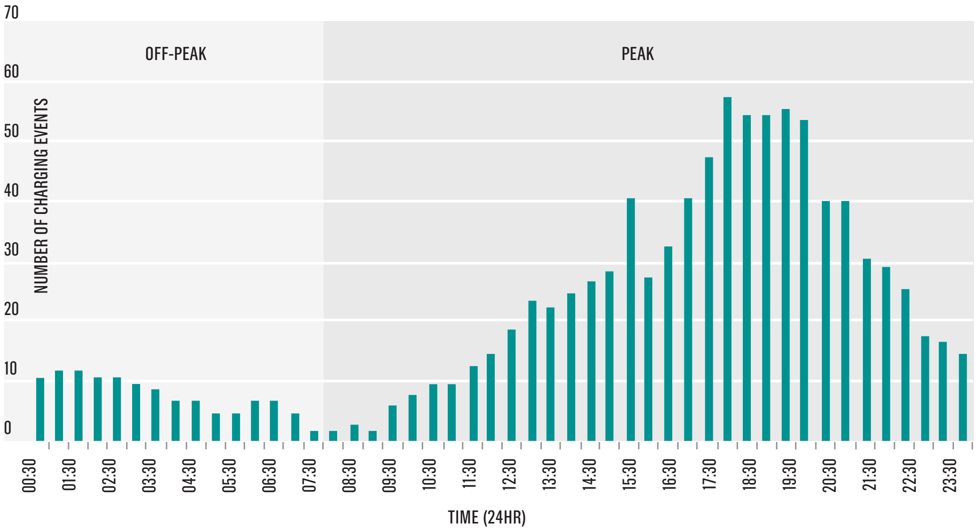
To manage the impact of peak charging, many new EVs come fitted with timers – which can be set to allow the EV to only be charged at certain times of the day. The impact of this was investigated during the Ultra Low Carbon Vehicle Demonstration programme trial.

11 Ultra Low Carbon Vehicle Demonstrator Programme, TSB, Cenex, Oxford Brookes University

FIG 3. CHARGING TIME DISTRIBUTION

CHARGE TIME FREQUENCY FOR CASE STUDY COMPANIES

SOURCE: THE SMART MOVE CASE STUDIES, CENEX, NOVEMBER 2011



The ULCVD research study divided the trial EVs into two subsets. The first mainly utilised dedicated 32 amp circuits for fast charging. These vehicles were fitted with smart meters that included automatic timers that managed the charge start times according to time-dependent electricity tariffs. The second group all used 13 amp chargers that could be plugged in to any standard mains socket. Some of these vehicles also utilised smart meters for managed charging.

For those vehicles with rapid charging capability (where a full charge can be completed in approximately four hours) 65% of all charging started between 11:30pm and midnight.

The graph below (Fig. 4) shows that the distribution for the vehicles with standard 13 amp charging has two distinct peaks between 6pm and 10pm. Possibly due to the longer charge time required, users were more inclined to plug in their vehicles as soon as they arrived home from work, causing a peak in demand at 6-7pm. Some of this subset also has cheap off-peak energy tariffs and appear to be taking advantage of this by plugging in during the off-peak period, accounting for the peak at 10pm–2am.

For the entire trial fleet, the most popular time of day to begin a charging event was between 11pm and midnight. The data shows this to be due to the influence of smart meters and automatic timers. Both patterns indicate that energy demands for electric vehicles can be managed effectively through the use of fast charging and through time-differentiated tariffs.

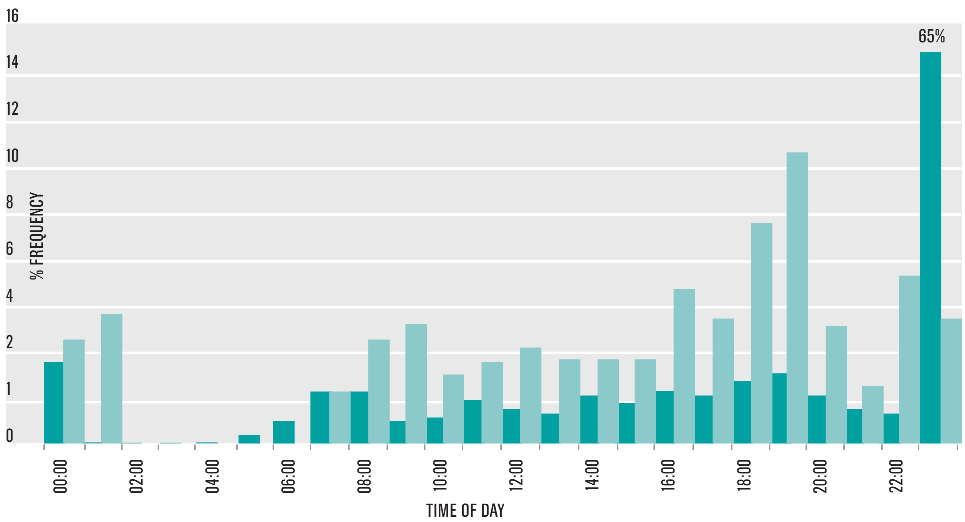
However, it is to be expected that fleet vehicles, where almost all charging is undertaken at dedicated charging installations at the company site, will be plugged in for charging multiple times throughout the working day for short periods.

FIG 4. DISTRIBUTION OF CHARGE START TIMES

DISTRIBUTION OF CHARGE START TIMES

SOURCE: ULTRA LOW CARBON VEHICLE DEMONSTRATOR PROGRAMME

VEHICLES ON 32 AMP RAPID CHARGING
VEHICLES ON 13 AMP CHARGING



2.3 ENVIRONMENTAL BENEFITS

Recent research from Business in the Community (BITC) and consultants KPMG suggests that 95% of companies remain committed to corporate social responsibility even in difficult economic times. FTSE350 businesses that manage and measure corporate responsibility return better value to shareholders than firms of a similar size which do not. One of the pioneering businesses of environmental reporting, BT, says that in 2010 it won £2.1 billion worth of new work by demonstrating its sustainability credentials.[12]

CORPORATE SOCIAL RESPONSIBILITY (CSR)

More and more businesses are putting in place Environmental Management Systems (EMS). These help identify and manage significant environmental impacts. They can save money by increasing energy efficiency, reducing carbon and ensuring compliance with environmental legislation. These systems also provide benchmarks for improvements and give businesses environmental credibility. Within fleets, carbon reduction strategies coupled with local air quality improvement measures can help provide an economic case for looking into the whole life cost of fleet vehicles and a broader study on the benefits of moving fleets away from ICEs.

The ISO 14000 standards provide the guidelines and requirements for an EMS. It is a tool to enable an organisation to identify and control the environmental impact of its activities, products and services.[13] They exist to help organisations minimise how their operations negatively affect the environment and comply with applicable laws and regulations. The standards aim to continually improve processes from an environmental perspective. Many companies that have an EMS that meets the requirements of ISO 14001 are looking beyond their own operations, working with their supply chain to reduce carbon emissions. One way they may achieve this is by requesting that their suppliers agree to targets for low carbon vehicle procurement as well as other environmental objectives. This can already be seen in public procurement frameworks and contracts. Deploying EVs within a fleet operation may help supplier companies achieve these targets and position themselves as leaders in this area.

WELL TO WHEEL (WTW) EMISSIONS

Well to Wheel (WTW) analysis of fuel and electricity emissions enables an accurate assessment of how EVs can help reduce fleet carbon emissions and therefore energy consumption. WTW incorporates the emissions associated with fuel production and vehicle operation. We recognise that for a fleet manager, the WTW analysis is not as relevant as the fuel that the vehicle uses during its daily activities (known as tank to wheel, or TTW), but it is important to determine the true carbon emissions of a vehicle in order to understand whether it is truly contributing to carbon reduction. It is likely that legislation will start to move towards a wider WTW reporting system in the medium term which is why we use this methodology.

EVs under current legislation are classed as zero emission vehicles. However, this is misleading and the carbon savings for EVs should be considered on a WTW basis. However, when calculated this way the carbon savings of EVs are still compelling. Increasingly sophisticated ways of analysing a business's full carbon emissions and energy consumption are likely to evolve over time.

It is possible to calculate the total amount of carbon produced by consumed fuel. To do this, the emissions associated with manufacturing and transporting that fuel must be included. For EVs, it is the electricity required to charge their batteries which is generated in power stations that produces emissions. Electricity generation emissions vary from country to country, depending on the mix of fuels and renewable energy input within a specific country. Electricity networks in Europe are also interconnected and CO_2 associated with electricity production varies. But even given these variations, when we look at the figures, we find that EVs are significantly more efficient and pollute much less.

The WTW analysis carried out by Renault on three comparable cars, (see Fig. 5) shows that even with the current UK energy mix, the EV provides substantial carbon emission savings compared to those of an equivalent ICE or hybrid vehicle.

12 Flemmich Web,Raconter media, Times pullout: crunch time approaches for carbon reporting, 15 Sept 2011

13 www.iso.org/iso/iso_14000_essentials

ELECTRIFICATION OF TRANSPORT AND DECARBONISATION OF THE ELECTRICITY GRID OFFERS A PROMISING SOLUTION TO CUTTING CARBON EMISSIONS

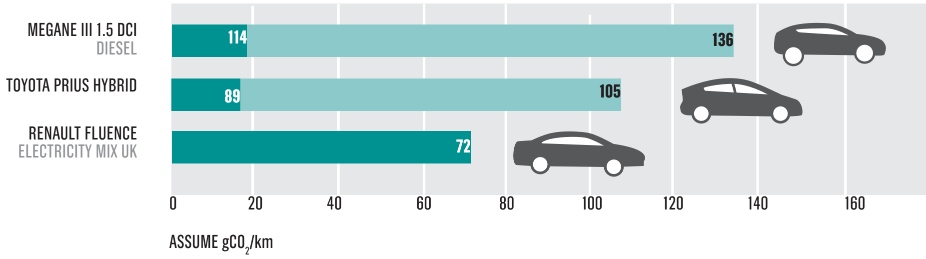
FIG 5. ELECTRIC VEHICLES AND CO_2 - DELIVERING THE LOWEST 'WELL TO WHEEL' CO_2 EMISSIONS

- WELL TO TANK (WTT) EMISSIONS
- TANK TO WHEEL (TTW) EMISSIONS

ELECTRICITY IN THE UK	
COAL	35%
OIL	1%
GAS	42%
NUCLEAR	16%
BIOMASS	3%
RENEWABLE	4%
OTHERS	0%

SOURCE: EFFICIENCY OF FUEL AND ELECTRICITY PROCESSES BASED ON THE 'WELL-TO-WHEEL ANALYSES OF FUTURE AUTOMOTIVE FUELS AND POWERTRAINS IN THE EUROPEAN CONTEXT STUDY' BY JRC-EUCAR-CONCAWE (V3, NOVEMBER 2008)HTTP://IES.JRC.EC.EUROPA.EU

RELATIVE BENEFITS OF EVS[14]



Emissions from EVs are directly related to the carbon intensity of the UK national grid; the most recent (2009) emission figures for the UK grid are 594 g/CO_2/kWh.[15] As renewable and low carbon energy generation sources are installed in the UK the emissions from EVs will reduce. As the UK works towards its 2050 target of 80% CO_2 reduction, the light duty vehicle market will increasingly be able to exploit the potential of electricity as a low carbon fuel.

The table below investigates the impact of low and lower carbon electricity grids[16], in countries that already have supply consisting of predominantly nuclear and renewables. The data in the table is based on the results of the Cenex Smart Move case studies, and shows the relative emissions of each case study based on their energy consumption if they took place in countries with differing electricity grid mixes.

FIG 6. CASE STUDY EMISSIONS FACTORED BY OTHER COUNTRIES' ELECTRICITY GRID CARBON INTENSITY

	DRIVE CYCLE EMISSIONS BY DIFFERENT ELECTRICITY GRID EMISSION FACTORS (gCO_2/km)				
CASE STUDY COMPANY	UK (594 gCO_2/kWh)	DENMARK (375 gCO_2/kWh)	SPAIN (343 gCO_2/kWh)	FRANCE (72 gCO_2/kWh)	SWEDEN (23 gCO_2/kWh)
ASDA	103	65	60	12	4
INDESIT	146	92	84	17	6
GROUNDWORK	112	71	65	13	4
STAGECOACH	110	70	64	13	4
COMMONWHEELS	109	69	63	13	4

14 Values are only relevant on New European Driving Cycle (NEDC) and might not reflect CO_2 emissions in real world driving conditions.The values are extracted from JRC/EUCAR/CONCAWE Well to Wheels study. These are the values considered as the reference for Renault. Other references, such as ELCD, EcoInvent, AIE, etc. can be found in literature. The study is available herehttp://iet.jrc.ec.europa.eu/about-jec/jec-well-wheels-analyses-wtw

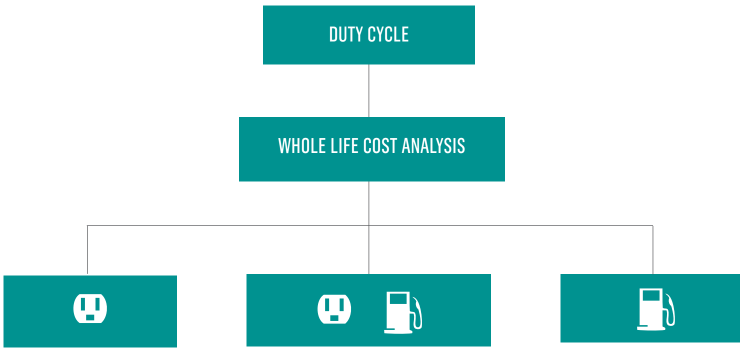
15 DEFRA (2011) Emission factors for company reporting, available from http://archive.defra.gov.uk/environment/business/reporting/pdf/110819-guidelines-ghg-conversion-factors.pdf

16 Ecometrica (2011). Electricity-specific emission factors for grid electricity. http://ecometrica-cms-media.s3.amazonaws.com/assets/media/pdf/electricity_factors_paper.pdf. This data is only relevant for international emission factors as the calculation methodology for international emission factors varies from that of the UK and therefore is not directly comparable. However, the DEFRA emission figure for the UK grid has been included for completeness.

03 MAKING THE RIGHT DECISION

Embracing EV technologies within a fleet needs to be operationally practical. It is important to apply EVs in areas of the fleet where they will bring most benefit. Arguing the marketing benefits of purchasing an initial batch of EVs may be a compelling strategy but it is crucial to have a well developed operational plan as well. Having no plan may result in vehicles being underutilised and criticised by employees, creating a potential barrier to future EV deployment.

FIG 7. THE RIGHT VEHICLE FOR THE RIGHT JOB



Driving range will also have a significant impact on a decision. 60-100 miles is the reality for the majority of EVs available today (allowing for variable driving conditions, weather and duty cycle variance and assuming no opportunity to charge during the day). So it is essential that a detailed assessment of the operational requirements of any potential EV application is carried out. In some instances this will be quite straightforward as there may be existing vehicle tracking data which enables a population of vehicles to be identified as appropriate and worthy of a more detailed analysis. The support available to organisations for this analysis is covered in section 5.

3.1 CONSIDERATIONS

Although EVs are suitable for some businesses, there are a number of considerations that should help in understanding how EVs may suit a fleet's needs.

Looking at whole life costs (WLC) is of a higher importance when comparing EV costs with those of conventional vehicles. The main saving for an ICE vehicle is in the initial outlay and so the list price can be used as a quick comparison between different models. Unfamiliarity with the WLC of an EV can make their viability seem unlikely. We strongly believe that through taking time to find the right applications and by understanding the costs associated with deployment, it is possible to define the areas where EVs will be the best option.

Fiscal influences, including known taxation (already announced in previous budgets) and anticipated taxation for both EVs and ICE vehicles must also be considered. Fleet decision makers need to look at measures related to both vehicle ownership costs (vehicle excise duty) and usage costs (fuel duty). In the case of an ICE vehicle, the current cost of diesel is known and future running costs can be modelled using inflation assumptions. Unforeseen spikes in fossil fuel prices can make this calculation less accurate though. In the case of an EV, electricity (fuel) costs are considerably lower; however, charging at the most optimal electricity price for the day can make a huge difference to fuel price and therefore to the WLC. Further opportunities can be found through deals with energy providers. It may be possible, for example, to take advantage of low-rate, time-of-day driven electricity tariffs, or as a major operator, agree terms with the energy provider that means there is mutual benefit in specific tariffs.

Another factor that could affect buying decisions is local financial incentives or charges, for example, with London's congestion charge which incentivises vehicles with an emission figure of (currently) 100 grams CO_2 per kilometre or lower and Euro 5 emission standards. An increasing number of diesel and some petrol powered cars fall into this discount band. All petrol and diesel vans up to 3,500 kilograms gross vehicle weight are excluded from the greener vehicle discount. However, electric vans are eligible for the electric and plug-in hybrid vehicle discount, something that fleet decision makers should take into account when considering EVs for use in central London.

COMBINING WHOLE LIFE COSTS AND A DUTY CYCLE APPROACH WILL DETERMINE WHERE AN EV WILL BRING VALUE TO A FLEET

FUNCTIONALITY

There are a number of considerations when looking at whether an EV will suit a business's fleet. The powertrain features and capabilities of an EV are very different to an ICE. Currently an EV has limited driving range of, on average, 60-100 miles depending on the model. However, for businesses that use vehicles that will never need to achieve more than 50 miles on a given day this will not be a limitation. Refuelling or recharging an EV is more time consuming, but through planning of activities or the right charging solution, EVs can be used on significantly higher duty cycles.

RECHARGING

Recharging will be a new habit for the driver and before an organisation acquires EVs, consideration must be given to when and where charging will take place. For instance, frequency of recharging will depend on the average mileage of a trip. Recharging will also depend on the EVs in use. An E-REV or PHEV (such as a Vauxhall Ampera or Plug-in Toyota Prius both available in 2012) won't have the same range limitations as a pure EV. These vehicles can run on their ICE once the battery is depleted. Battery swap or other new emerging solutions will further add to the EV opportunity.

Whether it is best to install recharging points on site for staff or whether it is more practical for drivers to charge at home will be a consideration when calculating the costs and practicalities of EVs. Where staff will be required to charge at home it is important that suitable equipment is fitted. A new IET Code of Practice on Electric Vehicle Charging Equipment Installation (January 2012) provides detailed guidance on all aspects of safe electrical connection of EV charging equipment, to ensure installations comply with the requirements of the Wiring Regulations (BS 7671). The charge points recommended by vehicle manufacturers are available to purchase or rent and include useful features such as faster recharge times, timers to ensure the use of lower rate electricity tariffs where available and measurement of the electricity used to recharge the vehicle, thus providing the information required by staff to make expense claims for the electricity used from their household supply. There is an opportunity to reduce the need for installing charging points based on the expanding national charging infrastructure. In the UK a National Chargepoint Registry[17] is being developed to help people find publicly available charge points and allow easy access.

An important issue to consider when looking at the provision of charging infrastructure is the utility of the vehicles. The basic principle being, EVs refuelling costs are a smaller proportion of overall costs compared to an ICE and therefore the higher the mileage the shorter the payback time. It makes sense to optimise the time that an EV fleet vehicle is running, and in the case of E-REVs and PHEVs, maximising the mileage covered when the vehicle is driven purely by electricity will be important in terms of their economic integration into a fleet.

BATTERY LIFETIME

Electric vehicle batteries are typically considered to have reached the end of their life when their capacity has reduced to 80%. This does not mean however that the vehicle can no longer be driven. If, when new, a vehicle is capable of driving 100 miles, 80% capacity will still provide up to 80 miles of range and for future owners this may well be adequate for their needs. They will still benefit from the low fuel and maintenance costs inherent in EV ownership.

The actual speed of degradation of the battery is predominantly determined by the number of full charge and discharge cycles it is subject to. It is likely that regular use of rapid charge points will degrade the battery at a faster rate, however rapid charge could be the key to the vehicles success in some applications and so it is likely that the reduced life of the battery will be compensated by benefits elsewhere.

One of the eligibility criteria for the Plug-In Car Grant is a three year minimum vehicle warranty including the battery and the electric drivetrain.[18] In addition the battery warranty must include the option to be extended to five years. Some manufacturers are extending battery warranties further and it is important that operators take these offers into consideration. The battery lease option model is intended to reduce customer concerns about battery longevity as well as counter the higher cost of an electric vehicle.

3.2 DUTY CYCLE ANALYSIS

When reviewing possible carbon reduction and fuel efficiency strategies a fleet decision maker may start by looking at the lowest carbon bracket vehicles as defined by the official fuel consumption figures measured by the New European Drive Cycle (NEDC). It is important to understand that this data is a guide to the environmental performance and fuel economy of passenger cars. The constraints of electro-mobility such as the range and actual CO_2 emissions (the NEDC considers all EVs as zero carbon) should be looked into further alongside the real world duty cycle of a fleet. A conventional approach to determining whether EVs are appropriate for a fleet is unlikely to work.

17 www.dft.gov.uk/news/press-releases/dft-press-20111111

18 www.dft.gov.uk/topics/sustainable/olev/plug-in-car-grant

This report offers a different approach based on the premise that a significant number of fleet vehicles operate within well-defined parameters, with only a small variance in operation. By analysing the duty cycles of fleet vehicles and the activity of each vehicle over a day (often characterised as a speed-time trace) it is possible to cluster vehicles together and define a unique duty cycle for a typical fleet vehicle cluster. In establishing this we are well on the way to understanding whether an EV solution is feasible. When combined with WLC, this approach will enable a fleet manager to determine whether a certain technology application meets the financial and operational performance required for the fleet.

Duty cycle analysis can lead to some quick wins in finding out where EVs fit into a fleet. It is also possible that by altering the duty cycle within an acceptable and workable range, a fleet decision maker can create further 'sweet spots' that could fit an EV. Without knowing the specific duty cycles within a fleet, a company is more likely to opt for the ubiquitous diesel van knowing it can undertake almost all tasks within a fleet. In this new scenario, the focus for procurement of fleet vehicles should be on 'the right vehicle for the right job'. With subtle changes in operation, energy efficiency improvement can be significant.

CREATING A DUTY CYCLE

Obtaining the relevant information and data to create a duty cycle for the fleet will give fleet decision makers a better understanding of the requirements needed. This will lead to a more suitable choice of vehicle and fuel type. To help define the operational requirements of a vehicle fleet we have included a simple matrix to the right.

FIG 8. DUTY CYCLE COMPATIBILITY - IS AN EV BEST FIT FOR YOUR FLEET?

- ●○○ LOW COMPATIBILITY
- ○●○ MEDIUM COMPATIBILITY
- ○○● HIGH COMPATIBILITY

PURE EV		PLUG-IN HYBRID AND E-REV	
DAILY MILEAGE			
●○○	HIGH (60+)	●○○	HIGH (150+)
○●○	MEDIUM (40–60)	○●○	MEDIUM (60–150)
○○●	LOW (10–40)	○○●	LOW (10–60)
RETURN TO BASE FREQUENCY			
●○○	NEVER		
○●○	RARE (ONCE PER DAY)		
○○●	OCCASIONAL (2-3 TIMES PER DAY)		
○○●	OFTEN (3-6 TIMES PER DAY)		
POTENTIAL FOR OPPORTUNITY CHARGING			
●○○	NEVER	●○○	NEVER
○●○	RARE (ONCE PER DAY)	○●○	RARE (ONCE PER DAY)
○○●	OCCASIONAL (2-3 TIMES PER DAY)	○●○	OCCASIONAL (2-3 TIMES PER DAY)
○○●	OFTEN (3-6 TIMES PER DAY)	○○●	OFTEN (3-6 TIMES PER DAY)
TIME AVAILABLE FOR OPPORTUNITY CHARGING			
●○○	UNDER 20 MIN		
○●○	20–30 MIN		
○○●	OVER 30 MIN		
LOAD CAPACITY REQUIRED			
○●○	FULL		
○○●	HALF		
○○●	LESS THAN HALF		
PAYLOAD PROFILE			
○●○	FULL LOAD ALL DAY [I]		
○○●	HALF LOAD ALL DAY [I]		
○○●	REDUCING LOAD [II]		
AVERAGE DUTY CYCLE			
●○○	MOTORWAY	○●○	MOTORWAY
○●○	RURAL	○●○	RURAL
○○●	SUB-URBAN	○○●	SUB-URBAN
VARIATION IN SPEED			
●○○	HIGH		
○●○	MEDIUM		
○○●	LOW		
TERRAIN			
●○○	HILLY	○○●	HILLY
○●○	MIXED	○○●	MIXED
○○●	FLAT	○○●	FLAT
MAIN CHARGING FACILITY			
○●○	MIXED	○○●	MIXED
○○●	OFFICE	○○●	OFFICE
○○●	DEPOT	○○●	DEPOT
○○●	HOME	○○●	HOME
DRIVER TRAINING [III]			
●○○	NONE		
○●○	SOME DRIVERS		
○○●	ALL DRIVERS		
PEAK / OFF-PEAK CHARGING			
○●○	MAINLY PEAK	○●○	MAINLY PEAK
○○●	MAINLY OFF-PEAK	○○●	MAINLY OFF-PEAK
○○●	MIXED	○○●	MIXED

I. FOR EXAMPLE MAINTENANCE OR SERVICE PROVISION OPERATION

II. FOR EXAMPLE A COURIER OR DELIVERY OPERATION

III. ONGOING DRIVER SUPPORT IS CONSIDERED TO BE IMPORTANT

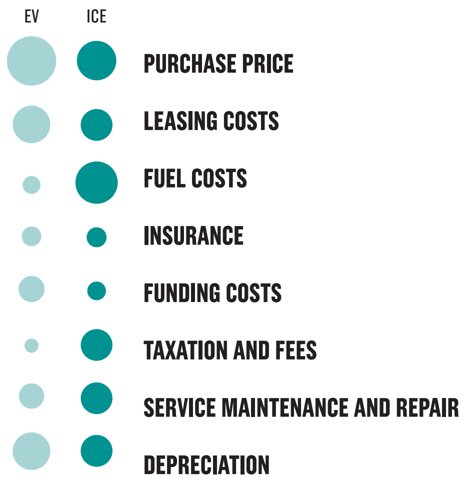
04 WHOLE LIFE COSTS

Whole life cost modelling demonstrates that there is a vast difference in the distribution of costs between conventionally fuelled vehicles and EVs. Under current purchase scenarios, EVs have high upfront costs and much lower running costs than conventional vehicles. Although purchase costs of EVs are higher largely due to battery cost, operational costs are less due to the lower fuel cost of electricity. Maintenance costs are also expected to be lower as EVs have fewer moving parts, and electric motors require less maintenance than the current combustion engines on the market.

There are a number of parameters that should be considered when making an accurate calculation of the whole life cost of a vehicle. Focusing on these costs will help to establish the feasibility of EVs for a fleet. This will provide a basis to make direct cost comparisons between different types of vehicles where the purchase price may be very different. When comparing whole life costs it is important to use costs from a single source. Sourcing and analysing the information can be a challenge, but there is information available from manufacturers, lease and independent companies specialising in whole life costing. (See Appendix 4 for a list of resources.)

FIG 9. TYPICAL WHOLE LIFE COST COMPARISON

THIS DIAGRAM IS FOR ILLUSTRATIVE PURPOSES ONLY



4.1 PURCHASE COST

EVs, as with many new technologies, carry a premium over their more mature counterparts, but this is primarily due to the cost of batteries and low production volumes. As of October 2011, an average electric car list price was £29,300 before the £5,000 Plug-In Car Grant. A similarly sized ICE car would cost between £15,000 and £20,000. New electric car and plug-in hybrid models for release in 2012 are expected to cost less. We recognise that as a fleet operator, manufacturer discounts available on conventional cars will widen this gap further, but depending on the use of the vehicles, the benefits of EVs can make them attractive to a business despite the higher cost. For some businesses the reduced running costs and reduced maintenance costs will decrease the whole life costs for an EV.

4.2 LEASING COST

Leasing EVs at this stage of market development has a number of benefits, not least shifting the uncertainty of future residual value and maintenance costs onto the leasing provider. Initial leasing rates are higher for EVs than conventional cars as would be expected, given the increased purchase price. Using leasing rates as a starting point to calculate WLC, takes into account the purchase price, maintenance, funding, vehicle excise duty and capital allowance variables.

Organisations who lease their vehicles will, no doubt, consider leasing EVs as a matter of course. Lease rates (Contract Hire or Operating Lease) also take into account the purchase price, maintenance, funding, vehicle excise duty and capital allowance (available to the lessor), all variables that are inherent in any vehicle acquisition. These elements are fixed for the term of the lease and if these costs make sense once insurance and fuel have been accounted for, plus the duty cycle analysis is positive, then leasing can offer a relatively risk free solution to the deployment of EVs in a fleet.

The uncertainty of future residual values and maintenance costs will ultimately be borne by the leasing company and the risk reflected in the leasing rates; however, each provider will assess the risk differently, particularly in the market's early days until track records of maintenance and residual values are established.

4.3 FUEL COST

The second biggest cost of an ICE vehicle after depreciation is fuel. As explained in section 1.3 on Energy and Transport costs, electricity is cheaper than diesel or petrol so this not only saves money on fuel but also reduces the impact of the uncertainty of fossil fuel prices on running a fleet. Section 2.1 on Financial Benefits looks at the running cost of EVs.

4.4 BATTERY OWNERSHIP

As a variable factor of the whole life cost of a vehicle, the battery ownership structure implemented can be instrumental to the feasibility of purchasing an EV fleet. To enable an accurate cost comparison, the cost structure of an EV needs to be looked at over the whole time that the vehicle is owned. Manufacturers are addressing this issue by designing different business models that make the initial outlay and cost structure for an EV more comparable with ICE vehicles (the lease model for batteries is a classic example of this).

There are currently two distinct models that focus on different options for battery ownership. The first is similar to the current ICE vehicle purchasing model where the customer buys the whole car, including the battery, and the vehicle is either charged at home or uses vehicle recharging infrastructure supplied by the electricity company, fleet owner or other alternative. This model requires whole life analysis to compare costs of the different powertrains.

The second model involves a company selling a mobility service rather than a vehicle. This model removes the perceived risk associated with the longevity of batteries and allows a competitive upfront cost for the vehicle with the battery costs amortised over the life of the vehicle.

Within the second model a number of different options have emerged. These all lower the purchase price of an EV and spread the cost over time. Two options are described below.

BATTERY LEASING

The manufacturer leases the battery pack, rather than sells it with the vehicle. This would mean that the initial purchase price of the vehicle (excluding battery pack) would be much lower. The battery cost is covered by paying a fee per kilowatt hour, or per kilometre.

Renault is working with this model. At the time of writing, the Renault Fluence will be priced from £17,850 (including the Plug-In Car Grant) when it goes on sale in 2012. This is comparable with the purchase cost of an ICE equivalent. This price parity has been achieved by selling the vehicle without a battery, which is then leased at an extra monthly cost (from £75 per month) for the lifetime of the vehicle.

SUBSCRIPTION MODEL

A subscription model provides a solution to battery affordability, range limitations, and potential strain on the electricity grid, through charge time opportunities, by separating ownership of the car and the battery – thereby removing the upfront cost of the battery for the consumer and enabling drivers to quickly exchange their depleted battery for a fully charged battery on longer drives. For example, through its owned and managed network of charging points and battery switch stations, Better Place offers instant range extension and the convenience to drive, switch and go across an entire region.

Under the Better Place model, drivers buy an electric car that allows for battery switch, (but does not include the battery), from a dealer and then sign up for a miles-based membership plan. As part of this membership, drivers pay a flat monthly fee that includes: 1) private charge point installation; 2) unlimited access to the Better Place network of batteries, public charge points and battery switch stations; 3) the electricity needed to charge the battery and provide mobility; 4) personalised energy management; and 5) 24/7 roadside assistance.

Appendix 3 shows a hypothetical WLC comparison assuming current UK market conditions between a switchable battery electric car operating with a Better Place membership and a comparable class ICE vehicle. The Renault Fluence ZE was compared with a Renault Laguna Dynamique.

Other models will develop over time and in response to tackling the issues of battery cost and lifespan. For example, car club schemes are based around an annual membership fee and hourly usage charges. Car clubs are more popular in urban areas where personal parking spaces are at a premium and small numbers of electric cars are in use. Corporate membership of car clubs can unlock the potential for their success; organisations committing to block bookings during working hours can simultaneously reduce their dependence on grey fleet travel and provide the utilisation necessary for the success of the scheme overall. Car club operators are open to discussions with organisations that may also be in a position to host vehicles, and EVs could be incorporated. Carplus is the national charity promoting car club membership.[19]

Within this report we remain technology agnostic to all EV solutions. We are excited by new mobility solutions and this is why we have included them.

4.5 SERVICE, MAINTENANCE AND REPAIR (SMR)

EVs generally have fewer moving parts which can lead to a reduction in servicing cost and downtime. As with all vehicles, a significant part of a service is down to routine checking of non-powertrain components, and hence a pure-EV service will be similar to that of an ICE vehicle. The powertrain however, is significantly different, and is far less maintenance intensive. It is also important to note that pure-EVs (as opposed to range extended) will typically have lower annual mileage and therefore will hit date derived service intervals before mileage intervals. We have included data from Renault on the service and maintenance cost of a Renault Kangoo ZE and a Kangoo 1.5 dCI as an illustration of this. Figs. 10 - 12 shows the SMR costs for a Renault Kangoo EV compared to a diesel equivalent.

FIG 10. SMR KANGOO ZE-5YRS / 60K FLEET

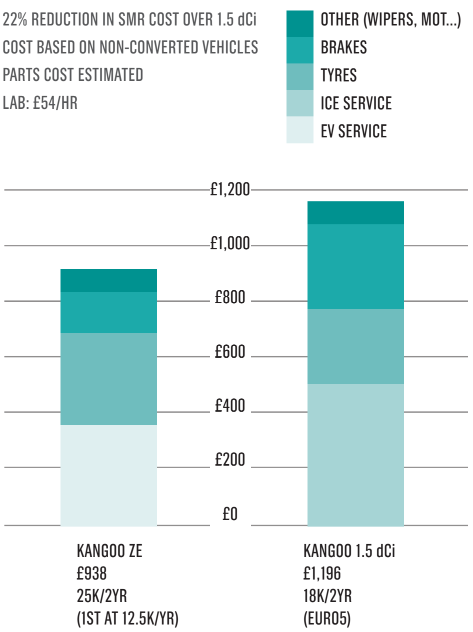


FIG 11. KANGOO II VAN ZE

			MILEAGE INTERVALS					
			12.5K		25K		50K	
DESCRIPTION	**RRP**	**QTY**	**PARTS**	**LAB**	**PARTS**	**LAB**	**PARTS**	**LAB**
SERVICE CHECKS				0.6		1.0		1.0
CABIN FILTER	£18.62	1			£18.62	0.3	£18.62	0.3
BRAKE FLUID	£5.11	2					£10.22	0.7
COOLANT 5I	£9.95	1						
COOLANT 1I	£3.95	1						
BATTERY	£105.00	1					£105.00	0.2
SUB TOTAL				0.6		1.3		2.2
TOTAL				£32.40	£18.62	£70.20	£133.84	£118.00
TOTAL SERVICE COST			**£32.40**		**£88.82**		**£252.64**	
TOTAL CUML SERVICE COST			**£32.40**		**£121.22**		**£373.86**	

			QTY	
TYRES	195/65R15C	£77.57	4	£310.28
BALANCE AND VALVE		£7.00	4	£28.00
				£338.28
FRONT PADS		£63.00	1	£63.00
REAR PADS		£87.37	1	£87.37
				£150.37

FIG 12. KEY BENEFITS FOR KANGOO ZE VS KANGOO ICE

REDUCED PARTS COST

NO ENGINE OIL, OIL FILTER, AIR FILTER AND FUEL FILTER

REDUCED SERVICE CHECKS LABOUR

ZE **4.1 HR** (3 SERVICES) **ICE** **5.5 HRS** (3 SERVICES)

REDUCED CABIN FILTER FREQUENCY

ZE 25K / 2YR (2 FILTERS) **ICE** 18K / 2YR (3 FILTERS)

BATTERY WARRANTY

As mentioned earlier, all manufacturers who utilise the Plug-In Car Grant (UK only) must offer a minimum three year battery warranty on the vehicle as standard. They are also required to offer an option for the consumer to purchase a further two year warranty extension.[20] We feel that this type of assurance created through OLEV's grant is something that a fleet decision maker should take into account.

4.6 DRIVER TRAINING

Training is an important aspect of any business to ensure health and safety and efficient product use. As with any new system or procedure, training can help maximise the benefits of investment made by a company. This is certainly true for EVs. The benefit to a business will only be seen if EVs are used to fulfil the function they have been purchased for. It is therefore in the interest of a company to ensure that the driver gets the training they need to optimise the vehicle and maximise driver satisfaction. Training should cover recharging (where, how, and how often), range issues, and driving style.

19 www.dft.gov.uk/topics/sustainable/olev/plug-in-car-grant

20 www.smmt.co.uk/wp-content/uploads/SMMT-Electric-Car-Guide-2011.pdf

TO CHOOSE THE RIGHT VEHICLE IT IS IMPORTANT TO COMPARE THE WHOLE LIFE COSTS OF ICEs TO EVs

05 DUTY CYCLE AND WHOLE LIFE COST MODELLING

AVAILABLE TOOLS

Collecting and analysing the range of fleet performance data outlined in section 3 and 4 will allow for the financial and environmental performance of different vehicles to be assessed in an accurate manner for any particular fleet operation. For example, once energy consumption has been measured, CO_2 emissions and fuel consumption can be calculated.

Analysing the duty cycle of a fleet can be a complicated process, especially regarding the deployment of EVs into a fleet operation. Help is available to assist the fleet decision maker.

To illustrate the potential ownership cost and environmental savings that can be achieved through the WLC modelling approach, example outputs available via Cenex and EST are provided below.

5.1 CENEX: FLEET CARBON REDUCTION MODELLING

Cenex has used its leading-edge expertise to develop its Fleet Carbon Reduction Tool (FCRT), which allows for the accurate estimation of the carbon reduction performance of different transport fuels and technology options in real-world fleet applications.

The FCRT is a simulation tool that can calculate the fuel usage, carbon dioxide emissions (CO_2) generated and operating costs incurred by the operation of a fleet of vehicles. The tool is designed to be flexible in operation and allows the evaluation of the cost and CO_2 reduction potential of a variety of differing powertrain technologies within a fleet.

The model outputs whole life cost and greenhouse gas emission predictions relevant to each low carbon technology option for a given fleet. In addition, the FCRT can be used to ascertain the vehicle power and battery size required to cover a specified duty cycle and hence allows the selection of the lowest cost vehicle capable of achieving the task.

Cenex has used the FCRT to model the economic and environmental performance of a variety of electric and diesel passenger cars and panel vans within a range of real world fleet operations. The full WLC and operational inputs used for this modelling are provided in Appendix 1.

CENEX WLC MODEL OUTPUTS

The tables below show the differential annual ownership cost for an EV under a range of real-world drive cycle and ownership duration scenarios, against the baseline of owning a comparable diesel vehicle. The figures are based on analysis of a range of energy price, mileage utilisation and charge time scenarios. Differential cost figures are colour coded to highlight where cost savings are possible.

FIG 13 & 14

FOR THE PURPOSE OF THESE ANALYSES, THE 'MARGINALLY MORE EXPENSIVE TO OWN AN EV' COST INDICATOR WAS SET TO £250 AND £500 PER ANNUM FOR THE PASSENGER CAR AND LIGHT COMMERCIAL VEHICLE MODELS RESPECTIVELY. NUMBERS MEASURED IN POUNDS (£)

- MORE EXPENSIVE TO OWN AN EV
- MARGINALLY MORE EXPENSIVE TO OWN AN EV
- CHEAPER TO OWN AN EV

		ELECTRIC PASSENGER CAR											
		CURRENT ENERGY PRICES						LINEAR RISING ENERGY PRICES					
		90% PEAK			90% OFF-PEAK			90% PEAK			90% OFF-PEAK		
	DRIVE CYCLE	3 YR	5 YR	7 YR	3 YR	5 YR	7 YR	3 YR	5 YR	7 YR	3 YR	5 YR	7 YR
BASE MILEAGE	COMPANY CAR	531	375	336	398	241	202	388	136	2	254	3	**-132**
	POOL CAR	556	419	389	492	355	325	449	241	140	385	177	75
INCREASED MILEAGE	COMPANY CAR	398	242	203	211	54	15	150	**-149**	**-332**	**-51**	**-350**	**-532**
	POOL CAR	484	328	289	395	238	199	297	34	**-112**	201	**-63**	**-208**

		ELECTRIC PANEL VAN											
		CURRENT ENERGY PRICES						LINEAR RISING ENERGY PRICES					
		90% PEAK			90% OFF-PEAK			90% PEAK			90% OFF-PEAK		
	DRIVE CYCLE	3 YR	5 YR	7 YR	3 YR	5 YR	7 YR	3 YR	5 YR	7 YR	3 YR	5 YR	7 YR
BASE MILEAGE	URBAN CYCLE	3095	979	157	2806	689	**-132**	2011	**-828**	**-2373**	1721	**-1118**	**-2663**
	DELIVERY CYCLE	4935	2819	1997	4832	2716	1894	4521	2129	1031	4418	2026	927
INCREASED MILEAGE	URBAN CYCLE	2170	**-99**	**-995**	1764	**-505**	**-1401**	651	**-2629**	**-4538**	245	**-3034**	**-4944**
	DELIVERY CYCLE	4478	2361	1539	4333	2216	1395	3897	1395	186	3753	1250	41

RISING ENERGY PRICES AND UTILSATION OF OFF-PEAK TARIFFS

The variation in economic performance shown in Figs. 13 and 14 demonstrates the influence of energy costs and, more critically, energy consumption on the analysis results. Essentially, the driving duty and daily mileage must allow the savings in fuel costs to recover the additional purchase cost of the EV. Extending vehicle ownership periods and utilising cheaper off-peak electricity can be used to fine tune the economic case. Due to the limited range of an electric vehicle, drive cycle based WLC modelling is essential if sweet spots of economic operation are to be accurately identified in fleets.

Clearly, fixing energy costs and fuel at today's prices for the duration of the analysis is unrealistic but estimating future energy costs is fraught with uncertainty. The tables show the results using two energy cost scenarios. The extrapolated costs analysis is a more likely scenario and incorporates a cautious linear rise in energy prices based on historical trends.

The electric passenger car analysis shows that marginal ownership costs can be achieved when fixing today's energy prices. Cost beneficial operation can be achieved if considering a linear rise in energy prices during the analysis period. The electric panel van analysis shows that cost beneficial operation can be achieved over the Urban Cycle, especially in the increased mileage scenario where the daily mileage of the vehicle was stretched beyond that available from a single battery charge through additional daytime charging. This therefore focuses attention on opportunity slow, rapid, or swap solution as financially viable alternative solutions.

Using cheaper off-peak rate electricity resulted in average annual savings of £121 and £236 for passenger car and van analysis respectively.

5.2 ENERGY SAVING TRUST: TAILORED FLEET ANALYSIS

EST provides consultancy to analyse fleets, identify carbon reduction initiatives and the business case for fuel efficient technologies including low carbon and electric vehicles. All recommendations must be practical, attractive to staff and financially sound. The Energy Saving Trust keeps up to date with relevant legislation, new technologies and what has worked well (and not so well) elsewhere and clients benefit from their years of experience with a wide variety of fleets across all sectors of industry. A Smarter Driving programme is available which trains drivers to drive in a fuel efficient manner. This training is also available for EVs helping drivers maximise the range available from their vehicle. Motorvate, the Energy Saving Trust's client certification programme, provides auditing and verification of fleet emissions and recognises the achievements of fleets which have made real progress in tackling emissions. Networking events and the sharing of best practice is encouraged through a members' on-line network.

The Energy Saving Trust promotes the use of WLC analysis for all vehicle decisions and has developed WLC tools for cars and vans which take into account these financial variables and enable comparisons to be made between ICEs, Pure EVs and Plug-in Hybrids under a range of assumed conditions.

For this report the Energy Saving Trust has considered scenarios for two examples of company car use and two for urban delivery / service vans. The costs are based on typical examples of diesel and electric vehicles available in the first quarter of 2012 in the UK. The car leasing figures have been provided by Alphabet[21] and the van figures derived from data available on the Fleet News Website.[22]

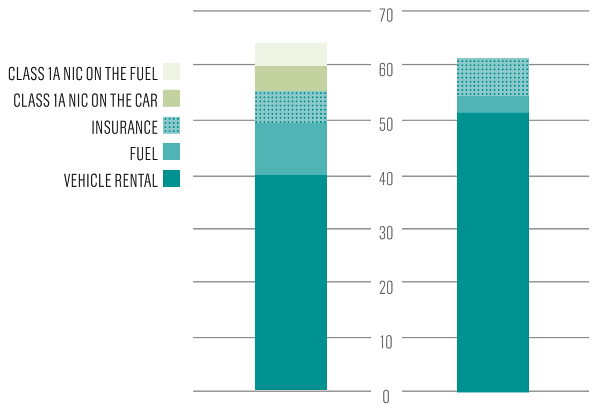
The WLC data inputs used for this modelling are provided in Appendix 2.

EXAMPLE 1.

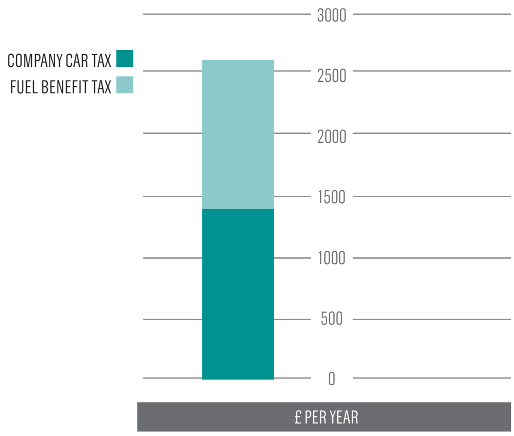
The table below represents a company "perk" car which is leased and where the company pays for all fuel. The business mileage is assumed to be less than a quarter of the total mileage for the period it is on fleet. If EVs are included within employee choice lists, the acquisition cost (often a monthly lease) to the organisation will be no greater than for an ICE chosen from the same list and savings will be made in lower fuel costs and the absence of National Insurance contributions. The driver benefits from a car free of Company Car Tax and Fuel Benefit Tax (where applicable) until April 2015. This includes the Plug-in Car Grant.

	DIESEL VEHICLE	ELECTRIC VEHICLE
EMPLOYER PPM COSTS AND CARBON FOOTPRINT	BMW 116I 5 DOOR (PENCE PER MILE)	NISSAN LEAF (PENCE PER MILE)
DEPRECIATION	0	0
INTEREST	0	0
VEHICLE RENTAL	39.2	51.3
BATTERY RENTAL	0	0
VED	0	0
SERVICING, MAINTENANCE AND REPAIR	0	0
FUEL	9.8	3
INSURANCE	6	7
CLASS 1A NIC ON THE CAR	4.7	0
CLASS 1A NIC ON THE FUEL	4.3	0
CONGESTION CHARGE	0	0
TOTAL PPM	64	61.3

	DIESEL VEHICLE	ELECTRIC VEHICLE
EMPLOYEE ANNUAL COSTS	BMW 116I 5 DOOR (£ PER YEAR)	NISSAN LEAF (£ PER YEAR)
COMPANY CAR TAX	1,363	0
FUEL BENEFIT (NET OF VAT)	1,241	0
FUEL (NET OF VAT)	0	0
TOTAL £ PER YEAR	2,604	0.00



CARBON FOOTPRINT (TONNES PER YEAR)	2.12	1.53

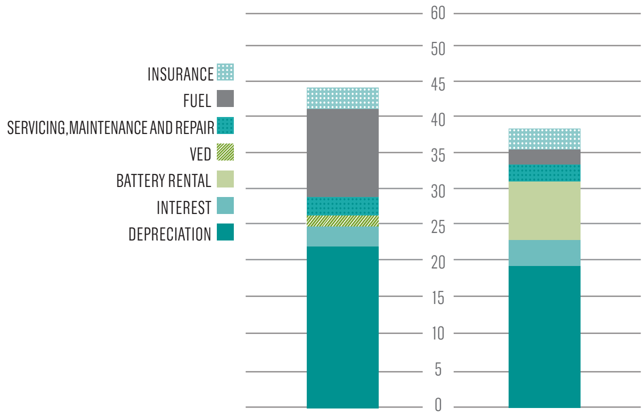


21 https://www.alphabet.co.uk/?set_language=en
22 www.fleetnews.co.uk/costs/van-running-costs

EXAMPLE 2.

The table below represents an electric van, acquired through outright purchase and operated outside London; the Renault Kangoo ZE has been selected for this comparison. The vehicle purchase cost is represented by the list prices of the vehicle in each case. Any discount available will have a significant impact on the WLC calculation and is likely to make the electric van less competitive, however the overall running costs in this example will still favour the EV in most cases. This includes the Plug-in Van Grant.

	DIESEL VAN 1 WLC RESULTS	ELECTRIC VAN WLC RESULTS
	RENAULT KANGOO ML19 75	RENAULT KANGOO ZE 60
DEPRECIATION	21.3	18.6
INTEREST	2.7	3.8
VEHICLE RENTAL	0	0
BATTERY RENTAL	0	7.0
VED	1.5	0.1
SERVICING, MAINTENANCE AND REPAIR	2.7	2.1
FUEL	12.7	2.3
INSURANCE	3.3	3.3
CLASS 1A NIC ON THE VAN	0	0
CLASS 1A NIC ON THE FUEL	0	0
CONGESTION CHARGE	0	0
TOTAL PPM	44.2	37.3

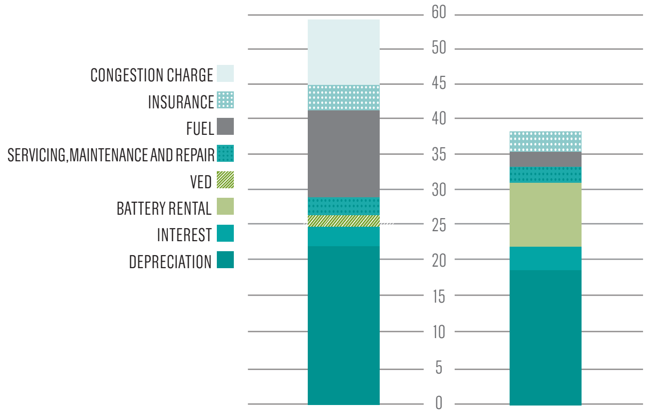


CARBON FOOTPRINT (TONNES PER YEAR)	4.10	1.73

EXAMPLE 3.

The table below represents the van in example two operated five days a week in the London Congestion Charge zone. The current discounted rate of £9 per day has been assumed and entry into the zone for 50 weeks of the year. In this environment the electric van is highly competitive with a diesel van. This includes the Plug-in Van Grant.

	DIESEL VAN 1 WLC RESULTS	ELECTRIC VAN WLC RESULTS
	RENAULT KANGOO ML19 75	RENAULT KANGOO ZE 60
DEPRECIATION	21.3	18.6
INTEREST	2.7	3.8
VEHICLE RENTAL	0	0
BATTERY RENTAL	0	7.0
VED	1.5	0.1
SERVICING, MAINTENANCE AND REPAIR	2.7	2.1
FUEL	12.7	2.3
INSURANCE	3.3	3.3
CLASS 1A NIC ON THE VAN	0	0
CLASS 1A NIC ON THE FUEL	0	0
CONGESTION CHARGE	15	0
TOTAL PPM	59.2	37.3



CARBON FOOTPRINT (TONNES PER YEAR)	4.10	1.73

This section proposes a process for owners to analyse the suitability of their fleets for EVs. The examples used above highlight compelling opportunities, however each fleet decision maker will need to identify his or her strategy by applying the analysis to their own situation.

We believe however that for light duty vans operating in London and benefitting from OLEV's new Plug-In Van Grant, the business case is now encouraging. We also believe this highlights the most significant 'sweet spot' for EV deployment we have yet seen in the UK.

THE PLUG-IN VAN GRANT IS LIKELY TO BE ONE OF THE MOST IMPORTANT FACTORS INFLUENCING A FLEET OWNER'S DECISION TO BUY.

06 INFRASTRUCTURE

Electric vehicle recharging infrastructure includes charge points located in a variety of locations: at people's homes, workplaces, in public and private car parks and on the street.

Charging points are being installed across the UK and the current status will be available on the National Chargepoint Registry. The opportunity to use public charging infrastructure for fleet vehicles will vary between businesses and duty cycles. It is likely that most fleet operators will need to have access to their own recharging provision.

The cost of the charging infrastructure needed to run a fleet of EVs must be considered as vehicles are brought into a fleet. Domestic charging could be a valuable secondary location but must be metered or reported on to allow the employee's costs to be claimed. Infrastructure provision is also a significant consideration in terms of whether a vehicle can perform its required duty cycle with or without opportunity charging provision. A balance between battery size or range, vehicle numbers and charging infrastructure is an important consideration when mapping out the solution. Optimising this parameter will ensure the lowest cost of running an EV fleet.

Within this report we have treated infrastructure provision separately to the whole life cost of an EV. We recognise that a fleet decision maker will need to handle the costs of infrastructure provision and work out where this cost is accounted for. Costs associated with charging infrastructure are largely dependent on the extent of the provisions already available within an organisation. Energy companies can offer a service to analyse the infrastructure requirements of your business when considering EVs. The determined solution, including a wider analysis of energy management and renewables options, can offer an additional benefit and financial incentive to your EV deployment plan.

A code of practice (CoP) for charging infrastructure has been developed for the UK by the Institution of Engineering and Technology (IET) who worked with industry specialists to develop an agreed set of standards for infrastructure deployment.

Charge times are dependent on the power that a circuit supplies; a standard UK circuit is likely to take in the region of seven hours to charge a vehicle fully from flat. However, top up charging times will be significantly reduced and will be the norm in most situations. On top of that, much shorter charge times are possible with dedicated high power charging systems.

Further details on different charging technology can be found in the glossary.

07 FUTURE OPPORTUNITIES

This report is tailored to finding business models where EVs are competitive for fleet operators now. There are challenges to overcome when adopting EVs into a fleet, but there are also opportunities that will save money and allow fleet vehicle drivers to carry out their job effectively. As the market develops and new policies are adopted the size of these opportunities will grow.

7.1 BATTERY RIGHT SIZING

The Electrification Coalition in the US has published a report on the policies necessary to spur electric drive technology in commercial and government vehicle fleet applications.[23] It claims that one of the ways to optimise the cost of an EV is for the fleet decision maker to right size the battery to meet the needs of low mileage fleet applications. It is more likely that as the market for EVs increases, manufacturers will begin to look at commercial battery usage and optimise their vehicles in response to this. This means that different range vehicles would be aimed at different segments of the market. Costs can then be optimised by ensuring that the duty cycle of fleet vehicles matches the range of the vehicles on offer.

7.2 LOW EMISSION ZONES (LEZs)

Road transport is a significant contributor to poor air quality and is the main source of air pollution in 92% of areas identified by local authorities as having problematic pollution levels.[24] While air quality has improved significantly over recent decades, current levels of air pollution remain harmful to health in some locations; experts estimate that fine particulate matter ($PM_{2.5}$) in 2008 reduced life expectancy by an average of six months across the UK population.[25] The 2008 ambient air quality directive sets legally binding limits for concentrations in outdoor air of major air pollutants that impact public health such as PM_{10}, $PM_{2.5}$ and NO_2.[26]

Pure electric vehicles produce no pollutant emissions at the tailpipe and most use regenerative braking technology that reduces particulate emissions from brake wear.

Increasing the number of vehicles with zero-emissions at the tailpipe will help the UK comply with legal obligations and help reduce the impact of poor air quality on human health and the wider environment, particularly in the worst affected areas such as urban centres with high transport volumes. The recent RAC report 'Going Green'[27] highlights how local authorities can influence the take up of lower-carbon vehicles. It also demonstrates where it is likely that councils will take action. LEZs potentially followed by zero emission zones[28] are currently being put in place or being considered, and the implications on business fleets is becoming increasingly important. It is possible that fleets with policies that encourage the use of EVs will be given preferential treatment over those which continue with conventional ICE vehicles and are not demonstrating support for the low emission development of local authorities.

7.3 INCREASED RECHARGING INFRASTRUCTURE

The UK plug-in vehicle infrastructure strategy[29] identifies how recharging infrastructure will develop over time. It sets out the steps that both Government and industry will take to advance infrastructure within the UK. The strategy suggests that plug-in infrastructure should be supported by workplace charging for fleets and a targeted amount of public infrastructure.

It aims to enable industry to utilise public charging posts by:

- Creating a National Chargepoint Registry
- Ensuring systems are in place so that all charge points can be used by all motorists
- Ensuring smart metering is implemented so that it is possible to take advantage of cheaper tariffs
- Making it easier for companies to install charge points by removing planning barriers

There will be an Ofgem consultation this year on an exemption to allow charge point owners and operators to sell electricity via charge points at the market rate. This could enable a fleet owner to sell electricity to the wider community through their private charge points.

23 www.electrificationcoalition.org/policy/electrification-roadmap
24 www.archive.defra.gov.uk/environment/quality/air/airquality/local/documents/laqm-report.pdf
25 www.comeap.org.uk/membership/128-the-mortality-effects-of-long-term-exposure-to-particulate-air-pollution-in-the-uk.html
26 European Union Ambient Air Quality Directive (2008/50/EC)
27 www.fleetdrive-electric.com/blog/wp-content/uploads/2011/11/going_green-hanley-041111.pdf
28 ec.europa.eu/transport/strategies/2011_white_paper_en.htm
29 www.dft.gov.uk/publications/plug-in-vehicle-infrastructure-strategy

08 CONCLUSION

The analysis in this report demonstrates that in the right circumstances EVs can provide a clear benefit for business now. If the 'sweet spots' are carefully identified, financial benefits and early commercial advantage will follow.

In order to develop a sound business case for deploying EVs in a fleet, it is first necessary to fully understand the range of operations within the fleet. Undertaking such an analysis will allow a fleet decision maker to clearly identify the optimal operating environment for an EV.

Careful consideration of how EVs can fit your business purpose can lead to significant financial savings. However, it is important to recognise that the cost structures of ICE vehicles and EVs are very different. The only realistic way to compare these vehicles is to look at whole life costs. Although upfront cost is greater, EVs can offer key advantages over their lifetime; there is a significant drop in running costs, noise and emissions when EVs are deployed in the right places within a fleet. It can cost a quarter of the price to refuel an EV compared to a conventional vehicle. Over its lifetime, the WLC of an EV can be less than a conventional vehicle if deployed correctly.

The Government already provides taxation benefits and upfront grants for the purchase of EVs. With the expansion of the Plug-In Car Grant we now have a fleet focus and the application of light duty vans within the London congestion charge zone is compelling. These clearly strengthen the business case for EV deployment into fleets. Infrastructure for charging is now being installed across cities, driven by governments both locally and nationally. These fiscal incentives, the investment in new infrastructure and the acceleration of new EV models onto the market, will all make deployment of EVs in fleets more attractive.

The purchase of EVs also provides branding benefits for fleets. Businesses are competing in an ever more sustainability conscious world. The market is changing as consumers are demanding greener products and services and showing a preference for brands with stronger environmental credentials.

EVs offer a significant opportunity for reducing carbon emissions and energy consumption from fleets. By embracing electric vehicles, companies can not only transform their fleet, they can transform their business by reaping the financial and operational benefits today.

A thorough analysis of a vehicle fleet will confirm if EVs are the right choice for your business now.

GLOSSARY OF TERMS

VEHICLE GLOSSARY		
ABBREVIATION	FULL DESCRIPTION	EXPLANATION
EV	**Electric vehicle**: a generic term to cover the vehicles listed below.	A vehicle powered, in part or in full, by a battery that can be directly plugged into the mains. In short: any vehicle that can be plugged in.
PURE-EV/ PURE-ELECTRIC CAR	**Pure-electric vehicle** Alternative descriptions: · Electric · All electric · Battery electric vehicle (BEV) Fully electric	A vehicle powered solely by a battery charged from mains electricity. Currently, typical pure-electric cars have a range of approximately 100 miles.
PHEV	**Plug-in hybrid electric vehicle** Alternative descriptions: · Plug-in hybrid vehicle (PHV)	A vehicle with a plug-in battery and an internal combustion engine (ICE). Typical PHEVs will have a pure-electric range of over ten miles. After the pure-electric range is utilised, the vehicle reverts to the benefits of full hybrid capability (utilising both battery power and ICE) without range compromise.
E-REV	**Extended-range electric vehicle** Alternative descriptions: · Range extended electric vehicle (RE-EV) · Series hybrid	A vehicle powered by a battery with an ICE powered generator on board. E-REVs are like pure-EVs but with a shorter battery range of around 40 miles. Range is extended by an on board generator providing many additional miles of mobility. With an E-REV the vehicle is still always electrically driven.
HYBRID	Alternative descriptions: hybrid electric vehicles (HEV) · Normal hybrid · Parallel hybrid · Standard hybrid	A hybrid vehicle is powered by, either or both, a battery and an ICE. The power source is selected automatically by the vehicle, depending on speed, engine load and battery charge level. This battery cannot be plugged in; charge is maintained by regenerative braking supplemented by ICE generated power. A number of fuels can power hybrid ICEs, including petrol, diesel, compressed natural gas, liquid petroleum gas and other alternative fuels.
	Full hybrid	A full hybrid has the same attributes as a hybrid (above) plus the ability to operate solely on battery power although the battery cannot be plugged in.
	Mild hybrid	A mild hybrid vehicle cannot be plugged in, nor driven solely on battery power.
	Micro hybrid	A micro hybrid normally employs a stop-start system and regenerative braking which charges the vehicle's 12 v battery.
	Stop-start hybrid	A stop-start system shuts off the engine when the vehicle is stationary. An enhanced starter is used to support the increased number of engine starts required in a stop-start vehicle.
ICE	**Internal combustion engine**	Petrol or diesel engine, including those adapted to operate on alternate liquid or gaseous fuels.

ADDITIONAL TERMS	
PLUG-IN CAR GRANT (PICG)	The Government grant to reduce the purchase cost of eligible pure-electric, plug-in hybrid and hydrogen cars by 25% (to a maximum of £5,000).[30]
PLUG-IN VAN GRANT (PIVG)	The Government grant to reduce the purchase cost of eligible plug-in vans by 20% (to a maximum of £8,000).[31]
PLUGGED-IN PLACES (PIP)	The Government scheme to trial a range of charging technologies in regions around the UK. [32]

BATTERY AND CHARGING GLOSSARY		
CHARGE TIMES	**Charge time** Alternative terms: · EV charge time · Recharge time	The time it takes to charge an EV. EVs require different lengths of time to charge according to the size of the battery, how much charge is left in the battery before charging and the type of charger used. The information below is based on the example of a pure-electric car to illustrate the most extreme charge time. PHEVs and E-REVs will take less time to charge.
	Standard charge (3kW) Alternative terms: · Slow charge · Normal charge	Standard charge is available in all UK homes.[33] It will take approximately six to eight hours to charge the average pure-electric car.[34]
	Fast charge (7kW) Alternative terms: · Faster charge	Fast charge will normally occur at dedicated charge bays rather than at home. This will fully charge an average pure-electric car in three to four hours.
	Rapid charge (20-50kW) Alternative terms: · Quick charge	Rapid charge will only occur at dedicated charge bays. This will charge the average pure-electric car in around 30 minutes.
	Opportunity charge Alternative terms: · Top up charge	Opportunity charging means the vehicle is charged whenever there is a chance to do so, allowing the battery to be topped up, for example, at a supermarket whilst you shop.
ALTERNATIVE CHARGING METHODS	**Battery exchange** Alternative descriptions: · Battery swap	Battery exchange systems allow a depleted battery to be quickly exchanged for a fully charged battery at a battery exchange (or swap) station. Vehicles must be specially designed to accommodate battery exchange technology.

SOURCE: WWW.SMMT.CO.UK/WP-CONTENT/UPLOADS/SMMT-ELECTRIC-CAR-GUIDE-2011.PDF

30 www.dft.gov.uk/topics/sustainable/olev/plug-in-car-grant/

31 www.dft.gov.uk/topics/sustainable/olev/plug-in-van-grant/

32 www.dft.gov.uk/pgr/sustainable/olev/infrastructure/

33 It is recommended to install a home charging unit on a dedicated EV circuit. This will ensure the circuit can manage the electricity demand from the vehicle and that the circuit is activated only when the charger communicates with the vehicle, known as the 'handshake'. If you are charging outdoors, an external weatherproof socket can also be installed.

34 For this example we have assumed the vehicle is a standard EV sized car and that the battery is completely empty before recharging. An average pure-electric car can travel 100 miles on a single charge. However, charging can take longer when the vehicle is connected to domestic sockets (such charging cables will limit the amperage drawn by the car in order to reduce the load on the electricity circuit and ensure maximum safety for the user).

APPENDICES

APPENDIX 1 CENEX FLEET CARBON REDUCTION TOOL INPUTS

The inputs to the Cenex Fleet Carbon Reduction Tool (FCRT) analysis, as outlined in section 5, are summarised below.

VEHICLES

Passenger cars and light commercial vehicles were modelled for comparison.

The passenger car model was based on the smart fortwo ed (electric drive) and smart fortwo Cdi (diesel).

The light commercial van model was based on the electric Allied Boxer (with the standard battery right-sized reducing the overall cost of the vehicle) and the Peugeot Boxer 2.2l (diesel) panel van.

DRIVE CYCLES

The energy consumption of the vehicles was modelled over real-world drive cycles representative of the types of duties each vehicle may encounter. The drive cycles are detailed in the table below.

PASSENGER CAR DRIVE CYCLES		
DRIVE CYCLE	**DISTANCE TRAVELLED**	**AVERAGE SPEED**
COMPANY CAR CYCLE	80 KM DAILY COMMUTE TO WORK	41 KPH
POOL CAR CYCLE[35]	40 KM GENERAL POOL CAR DUTIES FROM ASDA'S HEAD OFFICE IN LEEDS	28 KPH

LIGHT COMMERCIAL VEHICLE DRIVE CYCLES		
DRIVE CYCLE	**DISTANCE TRAVELLED**	**AVERAGE SPEED**
URBAN CYCLE	80 KM INNER CITY URBAN STOP-START DRIVING	18 KPH
DELIVERY CYCLE	35 KM POSTAL DELIVERY OPERATION IN LONDON	11 KPH

DRIVE CYCLE DERIVED DURING THE SMART MOVE CASE STUDIES PROJECT WWW.CENEX.CO.UK/PROJECTS/ELECTRIC-VEHICLE-TRIALS/SMART-MOVE

ENERGY COSTS

The energy costs were modelled using both current and extrapolated fuel price data.

Current energy prices: the current diesel price data were taken from the AA UK forecourt price reports. Electricity price data were taken from a survey of organisations participating in the Cenex Smart Move case studies project.

Linear rising energy prices: this is a more likely scenario and applies a steady linear fuel cost rise to both diesel and electricity prices for the duration of the analysis based on historical data from DECC fuel statistics.[36]

The economic analysis included both 90% peak and 90% off-peak charging scenarios to demonstrate the effect of charging time management on EV economics.

MAINTENANCE COSTS

Scheduled maintenance costs were supplied by the vehicle manufactures. Unscheduled maintenance costs were excluded.

VEHICLE PURCHASE COST AND DEPRECIATION[37]

The annualised ownership costs were derived from the vehicle purchase cost minus the residual value (RV) factored over the analysis period. Publicly available RVs for EVs and hybrid electric vehicles (HEVs) are similar to incumbent technologies; therefore it has been assumed that EVs may follow a similar depreciation curve to the diesels in the analysis. The RV of the vehicles was modified (based on Parkers Guide data) to take into account the annual mileage of the modelled scenario.

ANNUAL MILEAGE

To understand and demonstrate the effect of annual mileage on fleet economics, two scenarios were considered as described below.

Base mileage case: the base mileage of the drive cycle

Increased mileage case: the base mileage case increased by 40%

To achieve the range required for the increased mileage case over the Company Car Cycle and the Urban Cycle the EVs needed an opportunity charge throughout the day. Clearly this would not be an issue for the Company Car Cycle model which was based on a commute to work with an eight hour duration of non use between journeys.

35 Drive cycle derived during the Smart Move Case Studies project www.cenex.co.uk/projects/electric-vehicle-trials/smart-move

36 DECC energy price statistics, www.decc.gov.uk/en/content/cms/statistics/energy_stats/prices/prices.aspx. The diesel costs were extrapolated from quarterly diesel price data for years covering 2009 to 2011. The electricity costs were extrapolated from the annual electricity price data for years 2002-2009. This gave regression lines of best fit of 94% and 95% respectively.

37 Depreciation for the diesel vehicles was based on an average of a number of web sites including Expert Opinion, Fleet News and Wisebuyers Guide

CENEX WLC MODELLING: INPUT SUMMARY

The table below summarises the WLC and operational data used in the FCRT analysis.

ENERGY SCENARIOS

Fixed energy cost model (current energy costs)

- 111.4 ppl diesel
- 9.4 p/kWh peak electricity
- 5.7 p/kWh off-peak electricity

Linear rising energy cost scenarios

- 111.4 rising to 200.4 ppl in year 7
- 9.4 rising to 15.1 p/kWh peak in year 7
- 5.7 rising to 11.4 p/kWh off-peak in year 7

Charging time scenarios

- 90% peak / 10% off-peak
- 10% peak / 90% off-peak

Fuel consumption modelled using the Cenex FCRT

VEHICLE PURCHASE AND RESIDUAL VALUES

- £8,392 for diesel smart (40 kW Cdi) and £15,833 for smart ed (based on insurance value, including PICG). smart residual value 40%, 32% and 22 % in yrs 3, 5 and 7 (not including PiCG)
- £23,416 for diesel Peugeot Boxer (L2H2 120HP 2.2l HDi) and £50,000 for an EV van. Residual value 25%, 18% and 9% in yrs 3, 5 and 7 (not including PIVG)
- Residual values adjusted to incorporate annual mileage

DRIVE CYCLES

- Company car (80 km per day, avg speed 41 kph)
- Pool car (40 km per day, avg speed 28 kph)
- Urban Cycle (80 km per day, avg speed 18 kph)
- Delivery cycle (35 km per day, avg speed 11 kph)

ANNUAL MILEAGE SCENARIOS

Base mileage case

- Average daily mileage extrapolated to 312 days per annum (6 days per week) for fleet vehicles and 260 days per annum (5 days per week) for the Company Car model.

Increased mileage case

- Daily mileage increased by 40% (EVs require opportunity charging during the day to acheive the increased mileage scenarios over the Company Car and Urban cycle.

MAINTENANCE

- Scheduled maintenance costs included
- Unscheduled maintenance costs excluded

OTHER

- No insurance cost differential
- EVs and the diesel smart fortwo pay £0 rate UK road tax. The Peugeot Boxer pays £210 pa UK road tax.
- No soft incentives included (e.g. exemption from parking charges, road pricing fees etc.)
- No allowance was included for the installation and maintenance of recharging infrastructure

APPENDIX 2 ENERGY SAVING TRUST WLC MODELLING

The inputs to the WLC calculation are summarised in the tables that follow.

All calculations use current Defra/DECC 2011 GHG Conversion Factors of 2.55g/km CO_2 for "retail fuel station" diesel (includes 3.6% biodiesel by volume) and 486g/kWh for electricity generation on "Grid Rolling Average" basis and excluding transmission losses. Energy Saving Trust considers that this is the nearest equivalent to the tailpipe emissions of ICE vehicles which excludes fuel transportation. Electricity rates are for typical peak and off-peak rates, however these may vary considerably depending on electricity supplier. These are based on domestic rates and organisations may be able to negotiate more favourable terms.

The contract hire rates are provided by Alphabet and include the non-recoverable VAT (NRV) associated with company cars where private use is allowed.

Insurance costs are assumed typical company costs. Based on a small survey of online quotations, similar costs for EVs and ICE vehicles are available in the market.

Adjusted MPG figures for ICEs are the official fuel consumption figures adjusted to take into account an average 15% increase in fuel consumption of cars when driven in real life conditions. This percentage uplift was derived from research carried out on a large sample of company car users by Energy Saving Trust and Arval. The figures for EVs are the electricity consumption of the vehicle on the same (NEDC) test cycle as the ICEs. The consumption has been uplifted by the same percentage as for ICE vehicles, further work in this area may lead to a different uplift being more representative.

EXAMPLES OF COMPARATIVE WHOLE LIFE COSTS OF DIESEL VS. EV

EXAMPLE 1. LEASED COMPANY "PERK" CAR

ASSUMPTIONS	DIESEL VEHICLE	ELECTRIC VEHICLE
TERM	48 MONTHS	48 MONTHS
TOTAL MILEAGE	40,000	40,000
BUSINESS MILEAGE	8,000	8,000
FUEL COST	£1.18 +VAT /LITRE	13.7p/kWh STD, 8.1p/kWh OFF-PEAK
P11D	£20,655	£31,375
CONTRACT HIRE COST / MONTH INCL NRV	£326.98	£427.68
INSURANCE	£600	£700
TAILPIPE CO_2 g/km	117	0
NEDC COMBINED MPG / ELECTRICITY CONSUMPTION	62.8 MPG	173 Wh/km
ADJUSTED MPG / ELECTRICITY CONSUMPTION	54.6 MPG	199 Wh/km
PRIVATE USE OF VEHICLE	Y	Y
PRIVATE FUEL PROVIDED	Y	Y
EMPLOYEE TAX RATE	40%	40%
% PEAK ELECTRICITY ASSUMED		25
VISITS TO C-CHARGE ZONE/WEEK	0	0

EXAMPLE 2. PURCHASED VAN OPERATED OUTSIDE THE LONDON CONGESTION CHARGE ZONE

ASSUMPTIONS	DIESEL VEHICLE	ELECTRIC VEHICLE
TERM	36 MONTHS	36 MONTHS
TERM MILES	45,000 MILES	45,000 MILES
FUEL COST	£1.18 +VAT /LITRE	13.7p/kWh STD, 8.1pkWh OFF-PEAK
PURCHASE PRICE	£12,170	£17,485
DEPRECIATION	£9,590	£8,363
BATERY RENTAL	£0	£87/MONTH
SMR (PPM)	2.67	2.11
URBAN MPG / ELECTRICITY CONSUMPTION	48.7 MPG	130 Wh/km
ADJUSTED URBAN MPG / ELECTRICITY CONSUMPTION	42.3 MPG	149.5 Wh/km
INTEREST RATE	5.50%	5.50%
% PEAK ELECTRICITY ASSUMED		30%
VISITS TO C-CHARGE ZONE/WEEK	0	0

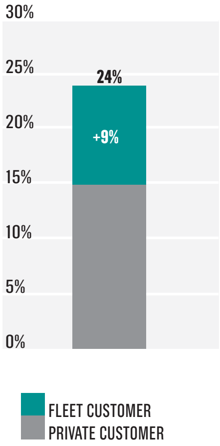
EXAMPLE 3. PURCHASED VAN OPERATED INSIDE THE LONDON CONGESTION CHARGE ZONE EVERY DAY OF THE WORKING WEEK

ASSUMPTIONS	DIESEL VEHICLE	ELECTRIC VEHICLE
TERM	36 MONTHS	36 MONTHS
BUSINESS MILEAGE	45,000 MILES	45,000 MILES
FUEL COST	£1.18 +VAT /LITRE	13.7p/kWh STD, 8.1p/kWh OFF-PEAK
PURCHASE PRICE	£12,170	£17,485
DEPRECIATION	£9,590	£8,363
BATTERY LEASE	£0	£87/MONTH
SMR (PPM)	2.67	2.11
URBAN MPG / ELECTRICITY CONSUMPTION	48.7 MPG	130 Wh/km
ADJUSTED URBAN MPG / ELECTRICITY CONSUMPTION	42.3 MPG	149.5 Wh/km
INTEREST RATE	5.50%	5.50%
% PEAK ELECTRICITY ASSUMED		30%
VISITS TO C-CHARGE ZONE/WEEK	5	5

APPENDIX 3 BETTER PLACE WLC ANALYSIS

WLC COMPARISON: SWITCHABLE BATTERY ELECTRIC CAR VS. ICE VEHICLE HYPOTHETICAL COMPARISON YEAR 2014
(ASSUMING BETTER PLACE MEMBERSHIP FOR ELECTRIC CAR)

WLC ADVANTAGE FOR ELECTRIC CAR OVER ICE



ASSUMPTIONS FOR MODEL (GBP)	RENAULT LAGUNA (ICE)	RENAULT FLUENCE ZE (EV)
PURCHASE PRICE (INCL. VAT)	£20,700	£22,850
ANNUAL MAINTENANCE	£1,033	£900
ANNUAL INSURANCE	£1,262	£1,000
4 YEAR SALVAGE VALUE	40%	40%
FINANCING COST	6%	6%
COST OF PETROL PER LITRE	1.46	N/A
ANNUAL FUEL COST GROWTH	2.0%	N/A
ANNUAL KM DRIVEN: PRIVATE CUSTOMER / CORPORATE FLEET	20,000 / 31,500 km	20,000 / 31,500 km
BETTER PLACE MONTHLY MEMBERSHIP FEE BASED ON A 4-YEAR CONTRACT (INCL. COST OF ELECTRICITY FOR KM DRIVEN): PRIVATE CUSTOMER / CORPORATE FLEET	N/A	£200 / £300
BETTER PLACE UPFRONT FEE: PRIVATE CUSTOMER / CORPORATE FLEET	N/A	£500 / £1,000
ELECTRIC CAR NAT'L GOVT. PURCHASE INCENTIVE*	N/A	£5,000
ELECTRIC CAR LOCAL GOVT. INCENTIVES (ANNUAL)*	N/A	£750

*THE FOLLOWING GOVERNMENT INCENTIVES FOR ELECTRIC VEHICLES ALL WERE INCLUDED IN MODELLING THE ABOVE TCO CALCULATIONS:

£5,000 NATIONAL PURCHASE INCENTIVE

£150 ANNUAL ROAD TAX (VED) EXEMPTION

£750 ANNUAL LOCAL INCENTIVES (SOURCE: DEPARTMENT FOR TRANSPORT)

ADDITIONAL ANNUAL BENEFIT ON COMPANY CAR TAX FOR ELECTRIC FLEET CARS (BUT EXCLUDING TAX BENEFIT ON FUEL CHARGE FOR EV DRIVERS)

APPENDIX 4 RESOURCES

Whole life costs

www.energysavingtrust.org.uk/publications2/transport-fleets/fleet-briefings/May-2010-Whole-life-costs
www.fleetnews.co.uk/costs

A subscriber service that advices on whole life costs: www.kwikcarcost.com

Plugged-In Places website

www.dft.gov.uk/topics/sustainable/olev/recharging-electric-vehicles

Cenex fleet carbon reduction

www.cenex.co.uk/consultancy/fleet-carbon-reduction

Smart Move

www.cenex.co.uk/projects/electric-vehicle-trials/smart-move

General information on EVs

SMMT Electric Car Guide: www.smmt.co.uk/wp-content/uploads/SMMT-Electric-Car-Guide-2011.pdf

Plug-in Car Grant

www.dft.gov.uk/topics/sustainable/olev/plug-in-car-grant

Plug-in Van Grant

www.dft.gov.uk/topics/sustainable/olev/plug-in-van-grant

ABOUT THE CLIMATE GROUP

The Climate Group is an independent, not-for-profit organisation working internationally with government and business leaders to advance The Clean Revolution: a massive upscale of smart technologies currently available, design and new business practices, that is the only viable way to avert catastrophic change and to ensure that the nine billion people on the planet by 2050 will not only subsist – but thrive.

Founded in 2004, The Climate Group has operations in Australia, China (Beijing and Hong Kong), Europe, India and North America; this unique network ensures that its messages are being heard by leaders who can effect change. The Climate Group's global coalition of companies, states, regions and cities around the world recognise the economic and environmental imperatives of taking transformational action on climate change and the low carbon economy now.

www.theclimategroup.org
www. thecleanrevolution.org

ABOUT CENEX

Cenex, the UK Centre of excellence for low carbon and fuel cell technology, is a UK Government founded independent not-for-profit company. We have established a position as leading independent experts in understanding low carbon vehicles and fuels, delivering demonstration trials, as well as managing the practical measures required to aid market transformation.

Cenex runs a number of early market programmes for UK national and regional government, including the Low Carbon Vehicle Public Procurement Programme (LCVPPP), the UK Infrastructure Grant Programme (IGP) and is the lead delivery partner for the Plugged in Midlands project.

To support our diverse customer base Cenex has used its leading-edge low carbon vehicle expertise to develop a new approach to Fleet Carbon Reduction. This business support package uses the Cenex Fleet Carbon Reduction Tool: a bespoke simulation tool, backed up by our real world experience, that can quantify the environmental and economic impact of deploying low carbon vehicles in operational vehicle fleets.

www. cenex.co.uk

ABOUT ENERGY SAVING TRUST

The Energy Saving Trust is a social enterprise with charitable status. We are independent and provide businesses, communities and households with impartial advice. We have an innovative range of transport programmes including Smarter Driving training and bespoke fleet and consumer advice. We support fleets in their transition to low carbon in a way that benefits their businesses, by focusing on the reduction in costs that can be achieved by reducing emissions. We are working with The Climate Group, TfL and the Department for Transport to deliver analysis to public and private sector fleets on how EVs can benefit their business.

www. energysavingtrust.org.uk/fleet

CONTACT THE CLIMATE GROUP

T:+44 (0)20 7960 2970
E: info@theclimategroup.org
www.theclimategroup.org
twitter.com/climategroup

WWW.THECLIMATEGROUP.ORG