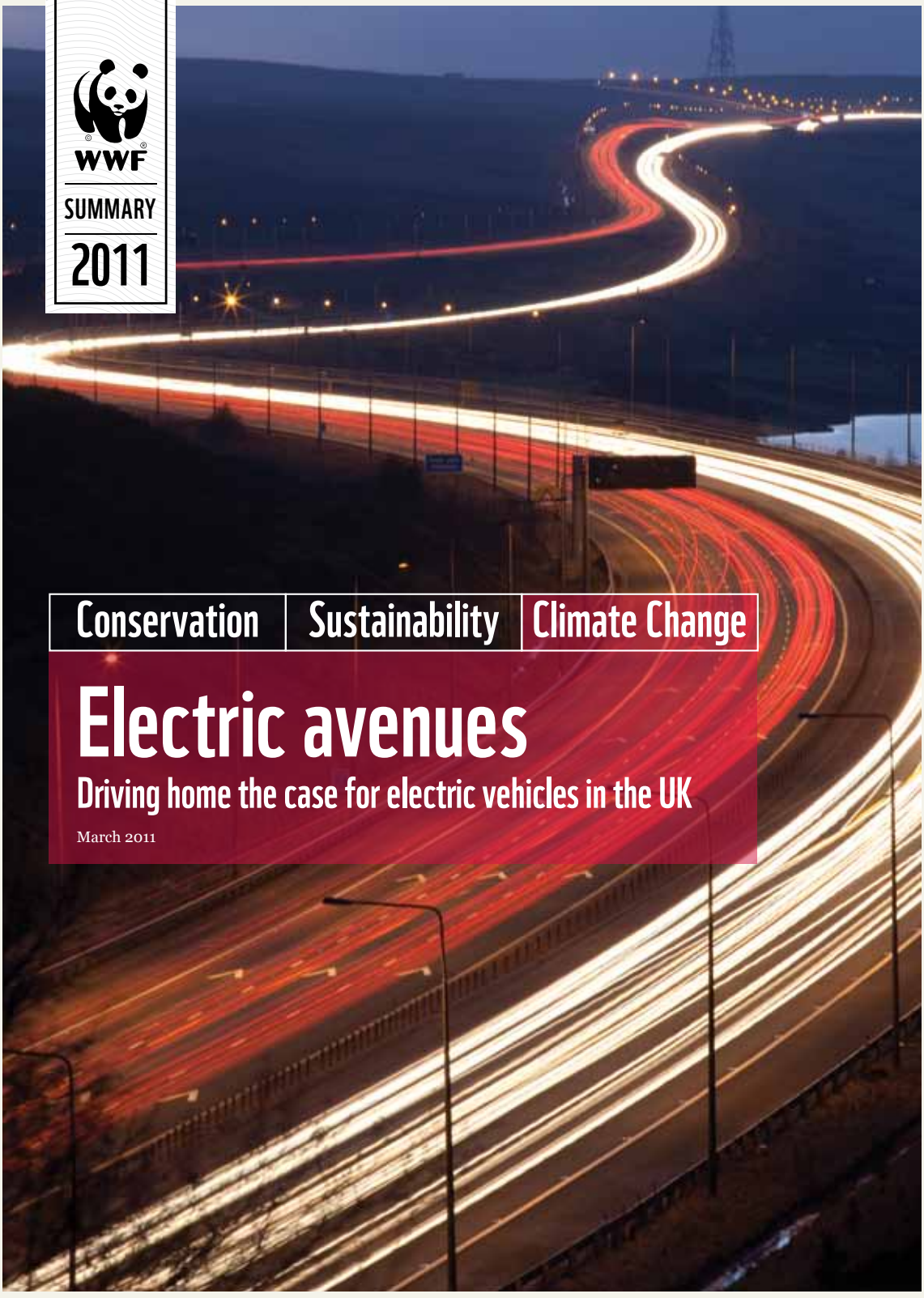


WWF

SUMMARY

2011

Conservation | Sustainability | Climate Change

Electric avenues

Driving home the case for electric vehicles in the UK

March 2011

KEY MESSAGES

- Electric vehicles (EVs) have an important role to play in decarbonising road transport and reducing the UK's dependency on oil. They'll also be essential in delivering the level of reduction in emissions from cars that's necessary to achieve the targets required under the UK Climate Change Act.

1.7 MILLION

AT LEAST 1.7 MILLION EVS WILL BE NEEDED BY 2020 AND 6.4 MILLION BY 2030

- EVs have strategic importance to the UK economy: thousands of future jobs are expected in this industry. The development of a strong domestic market will help to attract future investment. The UK is already a leader in commercial EVs and battery technology and, with the announcement of the Nissan Leaf manufacturing facility in Sunderland, can expect to play a leading role in the international EV market.
- WWF-UK supports the rapid introduction of EVs to replace petrol/diesel vehicles. However, the full value of EVs to a low-carbon economy will be dependent on decarbonising the power sector and reducing the amount we drive.
- This study shows that at least 1.7 million EVs will be needed by 2020 and 6.4 million by 2030 in order to achieve the UK's climate change targets. EVs would then represent 6% of all UK cars in 2020 and 18% in 2030. Capital grants and other incentives to encourage an increase in numbers of EVs will be essential to stimulate the market.

£5 BILLION

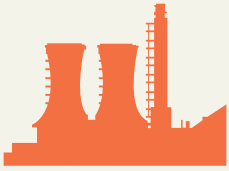
EVS COULD ACCOUNT FOR NEARLY A THIRD OF THE REDUCTION IN FUEL DEMAND, REPRESENTING OVER £5 BILLION A YEAR IN AVOIDED OIL IMPORTS BY 2030

- A combination of high EV uptake, improvements in the efficiency of internal combustion engine vehicles (ICEVs), and demand management measures to reduce the amount people drive could potentially deliver a 75% reduction in car emissions by 2030. EVs could provide nearly a third of this emissions reduction.
- This same combination of factors could also reduce UK fuel demand for cars by nearly 80% by 2030. EVs could account for nearly a third of the reduction in UK fuel demand, representing over £5 billion a year in avoided oil imports by 2030.
- Grid impacts of EVs are manageable and within National Grid forecasts in terms of additional load and peak electricity demand, even with high levels of EV uptake. However, EVs could overload current local distribution systems and transformers, so these may need upgrading as the number of EVs increases.

- EVs support the rapid growth of renewable energy. They can help balance the grid by charging late at night, using renewable power when electricity demand is otherwise low. Using renewables to recharge EVs also reduces their carbon impact. Once technical issues are resolved, there's also potential for EVs to feed power back into the grid at times of high demand.
- To ensure EVs deliver significant carbon savings in the 2020s, the UK needs to become 'EV ready' now. Early actions needed include the roll-out of charging infrastructure, encouragement of delayed charging, and development of 'smart grids' that include intelligent monitoring, control and communications technologies to optimise EV charging for grid stability and at times of lowest carbon intensity.
- Other priorities for innovation and investment are reducing the cost and improving the performance of EV batteries, and decarbonising the grid. A Europe-wide approach to grid infrastructure will also be needed if EVs are to be powered by a decarbonised European grid, in order to deliver maximum carbon savings both in the UK and on the continent.

EXECUTIVE SUMMARY

EVs have an important role to play in decarbonising road transport. To ensure they realise their full emissions-saving potential, we also need to decarbonise the power sector by 2030 and deliver demand management measures that will reduce the amount people drive



Burning liquid hydrocarbon fuels made from oil is responsible for around 30% of global CO2 emissions contributing to climate change

Why EVs are an important issue for WWF

WWF's Living Planet Report 2010 shows that, globally, we're currently using natural resources at a rate that's 50% higher than the planet can replenish each year. If everyone lived as we do in the UK, we'd need 2.75 planets of resources. This overshoot is largely due to our carbon footprint. We believe that a move towards transportation systems powered by renewable electricity, together with improvements in conventional vehicle efficiency and a reduction in the amount people drive, can play a major role in reducing our reliance on oil and other fossil fuels, thereby cutting carbon emissions significantly.

Helping to reduce our oil dependency

The world is running out of cheap and easily accessible sources of oil.[1] This reduction in affordable supply should focus our efforts on developing alternatives - yet we continue to seek increasingly risky and more polluting sources of oil in the Arctic, deep waters such as the Mexican Gulf and the tar sands of Canada.

Burning liquid hydrocarbon fuels made from oil is responsible for around 30% of global CO2 emissions contributing to climate change.[2] We need to wean ourselves off oil and decarbonise our economies in order to ensure that average global temperatures rise by no more than 1.5C compared to pre-industrial levels. This is necessary if we want to ensure the safety, sustainability and prosperity of people, places and wildlife.

1 The UK Energy Research Centre (UKERC) *Global Oil Depletion* report (October 2009) states that there is significant risk of peak oil occurring before 2020; and that large resources of conventional oil are 'unlikely to be accessed quickly', pp ix-x.
2 http://cdiac.ornl.gov/trends/emis/tre_glob.html, 2007 data (June 2010).

In its recent report[3], the Industry Taskforce on Peak Oil and Energy Security warned that Britain was unprepared for oil price shocks which could happen in the next five years, placing the UK economy at risk.

"Be it oil and coal or flights and car kilometres, people need to consume and travel less – and more intelligently – if the UK is to meet its climate change targets. We need to make the right set of choices to bring about fundamental change if we're to reduce our oil dependency and make the transition to a low-carbon economy"

Keith Allott, Head of Climate Change, WWF-UK

The growing danger of dirty oil

Energy companies are increasingly looking to meet continuing growth in energy demand by exploiting risky and highly polluting sources of oil and gas, such as deep-water oil and unconventional oils like tar sands. But these come at an enormous cost, economically and environmentally, at a time when we should be investing in renewables. Many oil reserves are located in pristine places that are vital for biodiversity – including tropical rainforests and the Arctic. Extracting them is difficult and dangerous, and further disasters like the Deepwater Horizon oil spill in the Gulf of Mexico are inevitable.

Closer to home, there are now moves to license deep-sea drilling for oil near the Shetland Islands and off the west coast of Scotland – vulnerable areas where environmental damage would be difficult to contain in the event of a blow out.

We've recently highlighted an obscure legality in Crown Estate leases that shows a clear institutional bias towards offshore oil and gas exploration to the detriment of renewables. But if the use of EVs and renewables were expanded, this would help to reduce fuel demand, meaning there would be less need to rely on increasingly risky sources of oil and gas.

We believe there's a way forward. Our vision is for a low-carbon future based on renewable energy, energy efficiency and demand reduction, where fossil fuel-dependent cars are increasingly replaced by EVs.

In our view, EVs only make sense in the context of a new, more sustainable approach to transport. As Keith Allott, WWF-UK's Head of Climate Change explains: "Be it oil and coal or flights and car kilometres, people need to consume and travel less – and more intelligently – if the UK is to meet its climate change targets. We need to make the right set of choices to bring about fundamental change if we're to reduce our oil dependency and make the transition to a low-carbon economy."

3 Industry Taskforce on Peak Oil and Energy Security, *The Oil Crunch: a wake-up call for the British economy*, February 2010.

Energy companies are increasingly looking to meet continuing growth in energy demand by exploiting risky and highly polluting sources of oil and gas, such as deep-water oil and unconventional oils like tar sands.

EVs as part of the solution, not a panacea

If we're serious about reducing our oil dependency, then EVs have to be an important part of the solution as they are a much lower carbon alternative to conventional cars, which produce 14% of CO2 emissions in the UK.[4] EVs are also more energy efficient, with 75% efficiency compared to the 20% efficiency of fossil fuel-powered cars.[5] But EVs are not carbon-free. Ultimately, the scale of the contribution they could make to a low-carbon transport sector depends on the carbon intensity of the electricity that powers them. That's why EVs need to go hand in hand with decarbonisation of the grid.

EVs could start delivering substantial carbon savings by 2020. But we need lots of them – at least 1.7 million EVs by 2020 and 6.4 million by 2030 – if they are to make a serious dent on car emissions.

It is also important that EVs are used to drive less, not more – which will be a challenge as EVs have lower operating costs. If EVs contribute to a rise in car kilometres, we'll need far more of them to achieve the same result as driving less in terms of reducing fuel demand and car emissions.

Greater support for walking and cycling, car sharing and more attractive public transport options would all help to bring down car kilometres by reducing the need for private car travel. Other measures such as road and congestion charges or higher parking charges would also help to curb demand.

Even without EVs, there is significant potential to reduce car emissions and oil consumption by improving ICEV engine efficiency. Pressing for stronger EU legislation to reduce average fleet emissions from ICEVs[6] needs to be a continuing priority, especially before 2020 while EVs are in their infancy and the grid is still substantially powered with fossil fuels. Tighter emissions targets will be critical in driving the widespread investment in research and development (R&D) that will bring down EV costs and make them commonplace on the roads.

4 Committee on Climate Change, www.theccc.org.uk/sectors/transport

5 See pages 82-83 of WWF's *Plugged In* report for an efficiency comparison of electrical versus mechanical powertrains. The energy efficiency of EVs is heavily dependent on the 'generation mix' of the electricity used to power them. Using coal or gas-fired plant to generate the electricity used for charging EVs significantly reduces their overall energy efficiency and, in the worst case, can put them nearly on a par with ICEVs, as discussed on page 95 of *Element Energy's* research report.

6 The European Parliament passed new car CO2 legislation that sets an emissions cap of 130gCO2/km averaged over all new vehicles produced by each manufacturer by 2015. Achieving this goal will be phased in over three years, from 2012. An extended target is set to be an average of 95gCO2/km by 2020.

EVs offer a promising way of reducing our oil dependency and improving our ability to meet climate change targets. At high levels of uptake and together with ICEV efficiency improvements and demand management, EVs could deliver a reduction of nearly 80% in fossil fuel demand from cars by 2030, and at the same time deliver a 75% reduction in carbon emissions from cars.

EVS CAN HELP TO SUPPORT THE TRANSITION TO RENEWABLES BY CHARGING AT TIMES OF LOW OVERALL DEMAND ON THE GRID, USING POWER FROM RENEWABLE SOURCES WHEN IT MIGHT OTHERWISE NOT BE USED

Replacing the need for biofuels

Another low-carbon alternative to EVs would be to opt for high levels of biofuel use in conventional cars. Although we believe that bioenergy could play an important role in meeting the world's energy needs in future, it's important to realise that it is a finite resource with numerous potential impacts on land use, food and water security and biodiversity.

Biofuels should therefore be considered a last resort for sectors where at present there are no practical alternatives to fossil fuels – such as aviation, shipping and heavy goods transport. In contrast, an attractive and feasible alternative – electrification – is available for passenger cars, so the use of biofuels for this sector should not be considered a high priority.

Supporting the rapid growth in renewables

EVs can help to support the transition to renewables by charging at times of low overall demand on the grid, using power from renewable sources when it might otherwise not be used. Charging at times when the CO2 intensity of the grid is low also helps to reduce the carbon impact of EVs.

Challenges and opportunities

Price, range and infrastructure are the biggest barriers to EVs being accepted by consumers. Changes to driver attitudes will also be required for EVs to gain acceptance and to encourage less driving. Government policy intervention will be needed to overcome these issues and help UK companies make the most of EV market opportunities.

The importance of investing now to ensure the UK is 'EV ready'

In order for people to want to drive EVs, they need to get used to seeing them, perhaps initially in government or corporate car fleets or car sharing clubs. They also need plenty of encouragement to use EVs, from free parking spaces to exemption from congestion charging and Vehicle Excise Duty (VED). But capital grants will be most important in order to reduce the high upfront cost of EVs relative to ICEVs.

Most charging points will be needed at home, with delayed overnight charging to put less pressure on the grid. Workplace charging points will also be required, although travel to work by private car needs to reduce. Charging points at other high visibility locations such as supermarkets or in front of town halls will also be important.

Much market learning is still needed for new business models to succeed, such as EV car sharing instead of ownership or (borrowing from the mobile phone business model) battery leasing and swapping, perhaps at petrol station forecourts, to help reduce the cost of EVs and increase their uptake.

The three scenarios

We've tested three different scenarios for EV uptake: a Business as usual (BAU) scenario representing low levels of EVs (1.7 million EVs by 2030); an Extended scenario with medium EV levels (6.4 million EVs by 2030); and a Stretch scenario which stress tests a future with very high EV uptake (26.3 million EVs by 2030).

We've used the term EVs generically to include battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). Hybrid Electric Vehicles (HEVs) are excluded from our definition of EVs as they do not need charging from the grid. Our three scenarios assume an even split between BEVs and PHEVs.

Table 1: Comparing the three scenarios

Scenario	EV support policies	EV contribution to UK CO2 target	Demand for car travel	EV cost	EV range
BAU	Existing and announced	Minimal	Growth	Medium	Medium
Extended	Some additional support	Medium	Stabilisation	Medium	Medium
Stretch	Very high support and investment	High	Stabilisation	High[7]	High

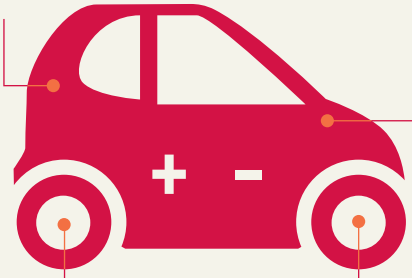
Table 2: EV numbers needed for each of the three scenarios (UK)

	BAU		Extended		Stretch	
EVs	2020	2030	2020	2030	2020	2030
Number of EVs needed	160,000	1.7m	1.7m	6.4m	4.2m	26.3m
EVs as % of new car sales	1%	8%	15%	20%	44%	80%
EVs as % of all UK cars	0.5%	5%	6%	18%	13%	74%

These scenarios are intended to provide insights, not forecasts. They aim to provide a better understanding of the role EVs could play, as well as what has to happen in order for EVs to realise their potential. The future is likely to lie somewhere between the scenarios featured here. However, it's clear that at least 1.7 million EVs will be needed by 2020 and 6.4 million by 2030 in order to achieve the level of ambition that we need.

7 The cost is high due to the assumption that BEVs have a high range (250km) in the Stretch scenario, which means larger capacity batteries, resulting in higher cost. There is a debate to be had around the impact of any battery cost reductions in future – i.e. the extent to which they will feed through into lower cost EVs versus higher cost EVs with greater range.

We need to wean ourselves off oil and decarbonise our economies in order to ensure that average global temperatures rise by no more than 1.5C compared to pre-industrial levels



EVs are a much lower carbon alternative to conventional cars, which produce 14% of CO2 emissions in the UK

We need at least 1.7 million EVs by 2020 and 6.4 million by 2030 if they are to make a serious dent on car emissions

EVs are also more energy efficient, with 75% efficiency compared to the 20% efficiency of fossil fuel-powered cars

THE ROLE OF EVS IN REDUCING CAR EMISSIONS AND FUEL DEMAND

EVs can make a significant contribution to helping the UK meet its emissions reduction targets and to reducing our oil dependency.

The transport sector currently accounts for a quarter of UK CO2 emissions, of which 55% come from passenger cars. Emissions from the transport sector have been on an upward path for most of the last two decades. Yet indicative figures from the Committee on Climate Change (CCC) suggest that car emissions need to fall by 26% by 2020 to be in line with the existing 34% carbon reduction target.

28%

HIGH NUMBERS OF EVS, AS PER THE STRETCH SCENARIO, COULD REDUCE CAR EMISSIONS BY 28% BY 2030

We believe that meeting the Committee's more ambitious 'intended' carbon reduction target of 42% by 2020 will give the UK a better chance of achieving its 80% reduction target for 2050. This would require car emissions to be cut by 32% by 2020 and 51% by 2030.[8] These emission milestones are indicated below.

Projected emissions from cars to 2030: UK

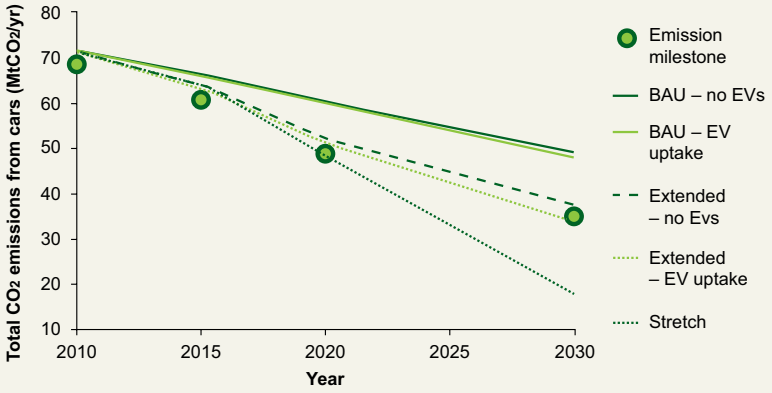


Figure 1: Emissions projections under each scenario for cars in the UK (emissions are calculated for 2020 and 2030, with the dashed lines indicating the trajectories)

8 The CCC's indicative figures by type of vehicle are contained in *Meeting Carbon Budgets – the need for a step change*, Progress Report to Parliament by the CCC, table 3.4, p240 (October 2009). For further information on the methodology used to derive the emission reduction figures from cars for 2020 and 2030, see Section 1.2 in WWF's full report, and Appendix 8.3.1 in *Element Energy's* research report.

30%

HIGH NUMBERS OF EVS COULD ALSO PROVIDE 30% OF THE REDUCTION IN FUEL DEMAND FROM CARS BY 2030

Figure 1 demonstrates that, in order to achieve the emission milestones most in line with UK climate change targets, we'll need medium to high levels of EVs consistent with the Extended and Stretch scenarios. But even with few or no EVs at all, we can reduce car emissions significantly, mostly through effective EU policies that result in reduced gCO2/km for ICEVs.[9]

A combination of EVs, ICEV improvements and demand management measures could potentially deliver a 75% reduction in car emissions by 2030. High numbers of EVs, as per the Stretch scenario, could provide 28% of this emissions reduction.

The higher the level of EV uptake, the greater the difference they can also make to reducing fuel demand – and hence our oil dependency. Figure 2 shows that high numbers of EVs in the Stretch scenario, combined with improvements in ICEV efficiency and demand management measures, have the ability to reduce fuel demand in the car sector by nearly 80% by 2030. High numbers of EVs, as per the Stretch scenario, could provide 30% of the reduction in fuel demand from cars.

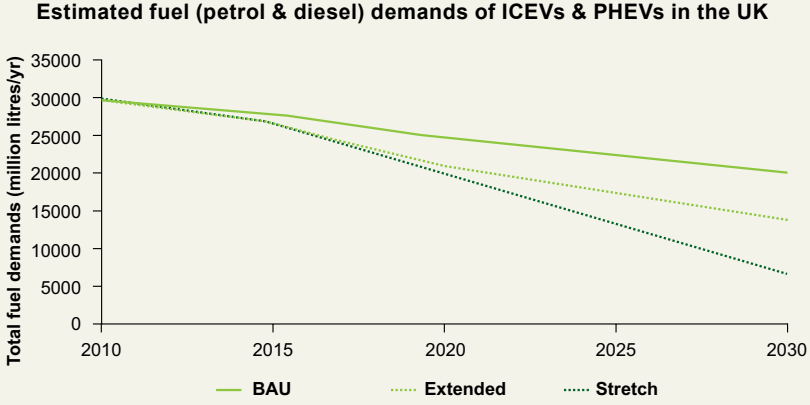


Figure 2: Projected fossil fuel demands from the passenger car sector in the UK

9 These results show the huge importance of EU legislation in reducing average fleet emissions for new cars to 130gCO2/km by 2015, with a future target of 95gCO2/km by 2020. Even lower levels of emissions are desirable to improve ICEV efficiency and would drive investment in EVs.

45-60%

IN ITS 2010 ANNUAL ENERGY STATEMENT, DECC STATES THAT BY 2020 OUR "OIL IMPORT DEPENDENCE IS LIKELY TO BE IN THE REGION OF 45-60%", COMPARED TO THE 8% IT IS TODAY

Reducing the cost of oil imports

The UK's declining oil reserves mean that we're increasingly exposed to a high and volatile global oil price. The current complete dependence of the road transport sector on this single fuel means it is especially vulnerable to the impacts of price spikes and sustained high prices. As well as reducing our energy demand, electric vehicles have an important role to play both in divorcing our transport sector from the projected high costs of oil and limiting our trade deficit by reducing our dependence on imported fuel.

In its 2010 annual energy statement, DECC describes how the "country's energy security is heavily dependent on international developments". It also states that by 2020 our "oil import dependence is likely to be in the region of 45-60%", compared to the 8% it is today. DECC's figures show that if we secure the number of EVs needed to ensure the transport sector plays its full part in achieving a 42% reduction in greenhouse gases by 2020, then even assuming its conservative central price forecast, the UK economy could save over £5 billion in avoided fuel imports per year by 2030 and as much as £8.5 billion under higher price forecasts. EVs make sense not only as the credible transport technology to reduce emissions but also as part of a strategy to reduce our dependence on expensive oil imports over which we have very limited control.

For further information about these calculations, please see Appendix C in our full report.

EVs make sense not only as the credible transport technology to reduce emissions but also as part of a strategy to reduce our dependence on expensive oil imports over which we have very limited control.

THE IMPACT OF EVS ON THE GRID

EVs can play an important role in helping to balance the grid, which will encourage greater use of renewables. The impact of EVs on the grid is generally less than feared, but delayed charging will be important to spread peak demand from EVs.

9%

IN THE MOST AMBITIOUS STRETCH SCENARIO WITH VERY HIGH EV UPTAKE, EVS WOULD ONLY ADD A MAXIMUM ADDITIONAL LOAD OF 29,000GWH/YR IN 2030, OR 9% OF TOTAL FORECAST DEMANDS FOR ALL END USES

The impacts that EVs will have on the grid have to be understood at both a national and local level. Simultaneous demands on the grid can add to peak loads, and generation capacity must be planned accordingly. But localised peaks in demand for power also have an impact on local distribution systems and transformers, which are smaller scale and lower specification than national level transmission systems and therefore are less able to handle surges in demand.

Any extra demands that EVs place on the grid must also be compatible with greater electrification of other sectors, such as heat pumps for domestic housing and rail electrification – which are also increasingly relying on their energy from a decarbonised grid.

Additional loads from EVs

In terms of additional annual electricity demand, EVs will not place too much extra demand on the grid in Great Britain, which covers all areas of the UK except Northern Ireland. By 2020, EVs only add an extra 1.5% demand because their uptake is limited. But even in the most ambitious Stretch scenario with very high EV uptake, EVs would only add a maximum additional load of 29,000GWh/yr in 2030, or 9% of total forecast demands for all end uses.

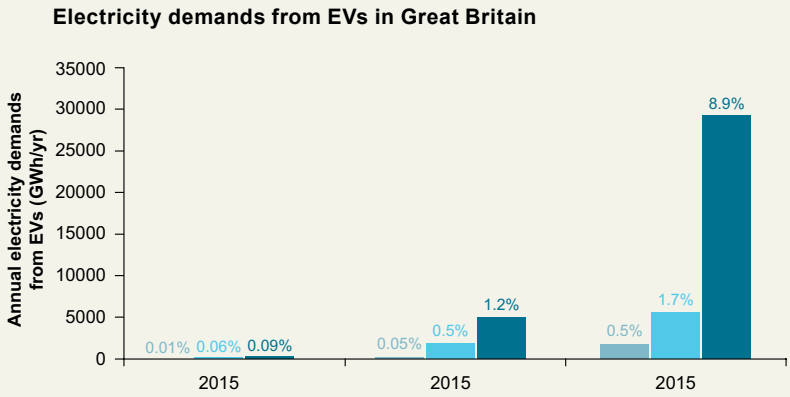


Figure 3: Average annual electricity demands from EVs in Great Britain under each scenario in years of interest

Modelling of the BAU, Extended and Stretch scenarios separately for Northern Ireland, which is on the same grid as the Republic of Ireland, produces a similar picture to that of Great Britain.

Peak demand from EVs

1.1 GW

THE REALISTIC PEAK DEMAND ON THE BRITISH GRID DUE TO EVS IN 2020 WOULD ONLY BE AROUND 1.1GW, ACCORDING TO THE EXTENDED SCENARIO

Even if there was uncontrolled charging of EVs, which assumes that most people will want to start charging their EVs once they come home from work, the realistic peak demand on the British grid due to EVs in 2020 would only be around 1.1GW, according to the Extended scenario.

The use of charge delay devices would help to smooth out the spikes of peak demand by pushing back the time when EVs are charged, ideally to late at night when demands on the grid are low.

Even under the Stretch scenario in 2030, where EVs make up 75% of the car stock, a realistic worst case peak demand due to EVs is still below 10GW, which is within the range of National Grid forecasts of load growth. The worst case scenario represents all EVs demanding power at the same time. But this is never likely to happen as not all EVs are driven each day and there are different arrival times home. The importance of charge delay devices to reduce peak demand due to EVs is shown below.

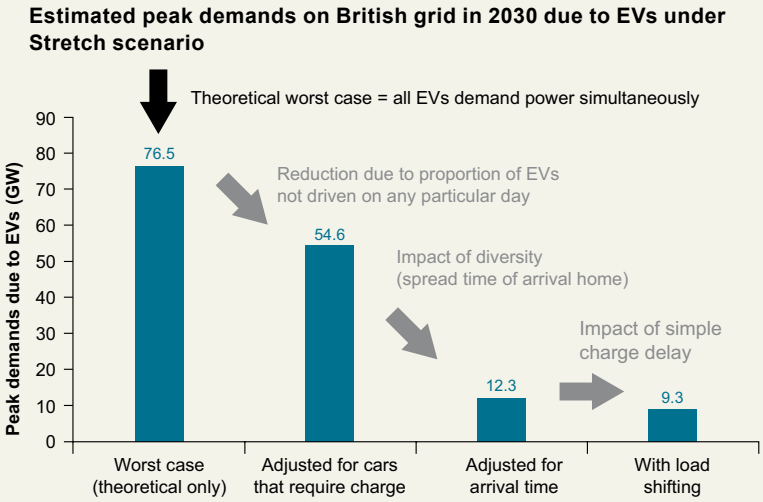


Figure 4: Peak demands on the electricity grid in Great Britain with 25.5 million EVs in stock (Stretch scenario in 2030) based on average charging rate of 3kW per EV

Widespread use of charge delay devices would also reduce potential strain on local distribution networks and transformers, which are less able to cope with peaks in demand than the national grid, given their lower voltage and thermal rating.[10]

The need for smart grids and flexible charging

10GW

EVEN UNDER THE STRETCH SCENARIO IN 2030, A REALISTIC WORST CASE PEAK DEMAND DUE TO EVS IS STILL BELOW 10GW

Smart electricity grids that include intelligent monitoring, control and communications technologies could also help to minimise the impact that EVs have on the grid by helping to determine optimum charging times, at the lowest carbon intensity. The use of smart grids could, for example, shift EV charging to the middle of the night, when the overall demand for energy is lower and therefore renewable energy sources are more likely to provide most of the electricity needed to charge EVs, at a lower grid CO_2 intensity.

By contrast, charging EVs at times of peak demand is more likely to involve high carbon 'peaking plant' (generators that come on line for short periods to meet surges in electricity demand, which are usually powered by coal or gas). This would reduce the potential CO_2 savings of EVs.

10 In *Strategies for the uptake of electric vehicles and associated infrastructure implications*, prepared by Element Energy for the CCC (2009), it was estimated that local distribution networks could accommodate reasonable levels of EV uptake (up to a third of households owning EVs). Upgrading the local distribution systems at the same time as the national grid to maximise synergies would also help to reduce local impacts.

Flexible charging of EVs using charge delay devices and smart grids will clearly become more important as other sectors also electrify and place greater demands on the national grid and local distribution systems. The cumulative impacts of all these additional demands must be borne in mind in planning and upgrading future infrastructure.

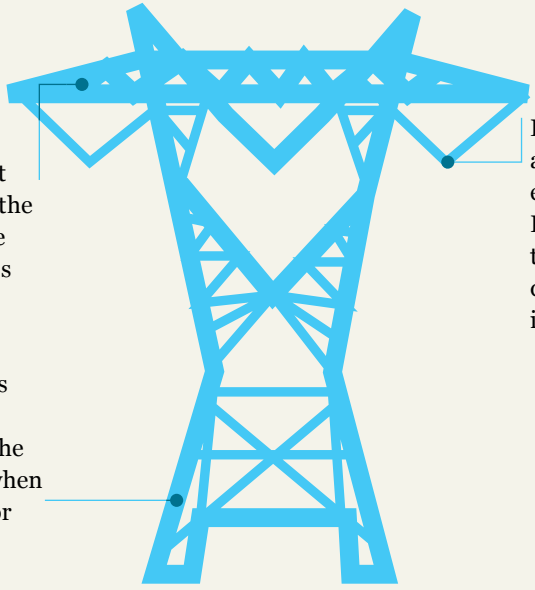
EVs and renewables

DECARBONISATION OF THE GRID IS A PREREQUISITE IF EVS ARE TO ACHIEVE THEIR MAXIMUM CARBON SAVINGS POTENTIAL

Decarbonisation of the grid is a prerequisite if EVs are to achieve their maximum carbon savings potential. At high levels of EV uptake, decarbonisation of the grid reduces car emissions by approximately 70% more than if the grid is powered by fossil fuels, as it is currently.[11]

EVs are therefore highly compatible with greater use of renewables. EVs can help to 'fill in the troughs' of electricity demand, by using renewable power when it might otherwise not be used. They can also 'shave off the peaks' by storing excess generation capacity of renewables. In future, EVs may be able to supply power back to the grid at times of peak demand through 'vehicle to grid' (V2G) applications, although this capability is still some way off.

EVs can play an important role in helping to balance the grid, which will encourage a greater use of renewables



In terms of additional annual electricity demand, EVs will not place too much extra demand on the grid in Great Britain

The use of smart grids could, for example, shift EV charging to the middle of the night, when the overall demand for energy is lower

11 See Appendix B of WWF's full report for a sensitivity analysis of car CO_2 emissions by carbon intensity level of the grid.

100% RENEWABLES BY 2050

WWF has a vision of a world that is powered by 100% renewable resources by the middle of this century. Unless we make this transition, the world is most unlikely to avoid predicted escalating impacts of climate change.

See *wwf.org.uk/energyreport* for more information

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POLICY RECOMMENDATIONS

Early action by the government will be necessary if numbers of EVs are to increase to the levels necessary, and with the right conditions and infrastructure to deliver significant carbon savings and reduce our oil dependency.

We're calling on the government to take the following early actions to enable EVs to realise their full carbon savings potential:

-42%

THE GOVERNMENT SHOULD SWIFTLY ADOPT THE CCC'S 'INTENDED' TARGET TO CUT UK EMISSIONS BY 42% BY 2020

1. Support ambitious EU and domestic climate change targets

We welcome the government's calls for increasing the EU level of ambition to a 30% reduction in emissions by 2020 from 1990 levels. In line with this move, the government should also swiftly adopt the CCC's 'intended' target to cut UK emissions by 42% target by 2020. Both the UK and EU targets should be met through domestic action rather than offsetting.

Early government action to encourage the growth of EVs will help the UK to achieve both EU and UK climate change targets. It will also prove critical in reducing our dependency on increasingly risky liquid fuels.

2. Decarbonise the power sector

We advocate the decarbonisation of the power sector by 2030, as recommended by the CCC, if the UK is to achieve its climate change targets. Rapid growth in renewables is essential to achieving this goal and should be a priority for receiving government support and investment.

A high renewables future is also compatible with the growth of EVs. It ensures both the utility of renewables and the carbon savings potential of EVs by reducing the CO_2 intensity of the grid when charging EVs.

3. Support tougher EU legislation for ICEV emissions, higher VED and other charges for the most polluting cars

We call on the UK government to support the implementation of EU emissions legislation for 2015, which requires average emissions for new cars to be 130gCO2/km. Given the early achievement of this requirement by the automotive industry, we believe that the EU 2020 target should be even more ambitious than the 95gCO2/km target currently being proposed. We support a further tightening of this target. Longer term, we support the CCC's 4th carbon budget recommendation for an 80gCO2/km emissions target for conventional cars in 2030.

The government also needs to support the implementation of the recently agreed EU emissions legislation for van and light commercial vehicles of 147gCO2/km by 2020. The CCC's recommended target for conventional vans of 120gCO2/km by 2030 should also be pursued.

The 'polluter pays' principle, at the point of purchase, the fuel pump and on the roads, should increasingly be used to encourage a switch away from conventional cars. This will help to make up for the gradual decline in tax revenue due to EVs.

4. Invest in charging infrastructure

If EVs are to be successful and environmentally beneficial, far greater government and business investment in battery charging infrastructure, particularly at home and in the workplace, will be required

The UK currently lacks a comprehensive national framework for EVs. If EVs are to be successful and environmentally beneficial, far greater government and business investment in battery charging infrastructure, particularly at home and in the workplace, will be required.

A strategic, national-level infrastructure plan to support the roll-out of EVs is urgently needed. Introducing a clear planning policy for EV charging and fast-tracking applications for new charging infrastructure will also help to increase the number of charging points available. We'd like to see subsidies for business and homeowners to install off-street charging points.

The use of charge delay devices should be encouraged so that drivers don't charge their EVs at times of peak demand. Lower off-peak charging tariffs for EVs should also be introduced to encourage EV charging at times of low electricity demand and when the carbon intensity of the grid is low.

>£43M

A KEY PRIORITY NEEDS TO BE THE CONTINUATION OF THE £5,000 CAPITAL GRANT FOR EVS BEYOND THE £43 MILLION FUNDING SET ASIDE FOR THIS PURPOSE

5. Provide stimulus measures for rapid EV uptake

We recognise the fiscal constraints that the government currently faces. But a key priority needs to be the continuation of the £5,000 capital grant beyond the end of this Parliament – and therefore an increase in the £43 million funding set aside for this purpose.

The £400 million announced in the Comprehensive Spending Review for funding low-carbon vehicles may also need to be substantially increased. We support the CCC's suggestion, in its recent report on the UK's innovation challenge, that funding of up to £800 million for low-carbon vehicles should be seriously considered, including a possible increase in the capital grant per vehicle, given the need for a rapid and widespread roll-out of EVs to reduce transport emissions. These costs should be viewed against the greater benefits of less oil dependency and a smaller trade deficit, with EVs able to reduce the bill for oil imports by over £5 billion by 2030.

Incentives to drive down the price of EVs and encourage broad public support and market commercialisation should be complemented by a targeted approach to ensure their comprehensive uptake in those sectors where they offer the greatest immediate return – for example, LGV fleets, public sector fleets and car sharing clubs. This will help to 'normalise' the EV and create economies of scale and market learning that will help to drive the broader market.

£800M

FUNDING OF UP TO £800 MILLION FOR LOW-CARBON VEHICLES SHOULD BE SERIOUSLY CONSIDERED

We'd also like to see the widespread installation of charging infrastructure on the government estate and a government fleet of EVs to demonstrate commitment to carbon reduction from cars and support for UK EV manufacturers.

6. Support demand management measures to reduce car kilometres

Support for EVs should not reduce the government's commitment to its 'smarter choices' agenda to encourage walking and cycling, or the improvement of public transport to reduce the need for car travel. Other demand management measures, such as an increase in fuel duty, more toll roads and congestion charging, should be considered to reduce car kilometres and reduce emissions from both ICEVs and EVs. A focus on road maintenance rather than major road building is also needed to discourage traffic growth.

Support for EVs should not reduce the government's commitment to encourage walking and cycling, or the improvement of public transport to reduce the need for car travel

7. Encourage UK EV industry competitiveness

Government support for UK manufacturers and investment in EV technology research and development – especially to reduce battery cost, extend EV range and result in faster charging – should be early priorities to ensure the future competitiveness of the UK EV industry. Bank loans for low-carbon vehicle projects from UK and EU sources such as the European Investment Bank should continue to be supported.

8. Commit to an integrated European grid

We'd like to see greater UK commitment to an integrated European grid and support for a standardised charging infrastructure, using compatible charging technology for EVs across Europe. As the recent report from the European Climate Foundation[12] made clear, cooperation at the European level is key in order to achieve the decarbonisation of the power sector, as well as that of other sectors – in particular transport and heat. Enhanced interconnection between the different European grids would make it technically feasible to develop a future European electricity system based on 100% renewable energy sources at a cost that is not substantially higher than other options available to decarbonise the power sector.

9. Support the development of smart grids

Greater government support of smart grids needs to start now so that they are ready once EVs are more widespread. Smart grids will help to manage the impact of EVs on the grid and help to ensure charging happens at times when the carbon intensity of the grid is low. They will also help to unlock the potential of EVs to deliver power back to the grid at times of high demand – although development of supporting technologies such as grid-tie inverters[13] will also be needed. Once again, an integrated European approach is called for, as this would increase their overall utility and benefits.

UK government support for integrated smart grids and standardised charging points and compatible charging technology across Europe will be important if EVs are to provide more than a localised solution to reducing transport emissions. Doing this early will help to shape and develop the future market for EVs and provide a consistent model for EV charging across the UK and Europe.

12 European Climate Foundation, *Roadmap 2050: A practical guide to a prosperous, low-carbon Europe (2010)*. See in particular pages 19 to 21.

13 Grid-tie inverters convert the direct current produced by EVs into the alternating current supplied by the grid for homes and businesses.

BUSINESS RECOMMENDATIONS

The EV industry and power sector also need to focus on ways to stimulate the EV market.

1. Reduce ICEV emissions beyond EU legislation targets

AS EV BATTERIES ARE BY FAR THE LARGEST COST ELEMENT, PROVIDING BATTERIES THROUGH LEASING OR OTHER SCHEMES TO SPREAD THE COST WILL HELP TO REDUCE THE PRICE OF EVS

WWF challenges UK vehicle manufacturers to achieve emissions standards for ICEVs that are tougher than those currently agreed or under discussion, for passenger cars and vans. Vehicle manufacturers should work together with government to support tougher targets at EU level.

2. Focus on reducing EV price, improving battery technology, and delivering a national network of standardised charging points

As these are the biggest issues that could potentially limit the uptake of EVs, they are the areas where EV and battery manufacturers, as well as infrastructure providers, need to focus their efforts.

As EV batteries are by far the largest cost element, reducing the cost of lithium batteries or developing a suitable, low-cost alternative – or providing batteries through leasing or other schemes to spread the cost – will help to reduce the price of EVs.

Extending EV range to well beyond 100 miles will help to reduce range anxiety. This will require improvements to battery energy density. In addition, greater power density of batteries to facilitate faster charging will increase public willingness to drive EVs.

Power companies need to work together with central and local governments to ensure that charging points are rolled out in a planned and strategic way, mindful of the need for standardised EV charging technology across both the UK and EU.

3. Have a clear plan for recycling batteries

EV and battery manufacturers need to have a clear plan for how they intend to recycle and ultimately dispose of EV batteries to limit their environmental impact. Non-car uses for battery materials should also be considered as part of this full lifecycle planning.

4. Work together with large fleet owners to encourage widespread, early uptake of EVs

EV manufacturers should be working with large public and private fleet owners to deliver an attractive package to reduce upfront EV costs. These could include leasing or subscription schemes with providers of battery swapping stations. Such ventures would not only help to increase the number of EVs on the road and improve economies of scale for manufacturers, they would also be very useful in developing new, lower cost business models for EV roll-out.

5. Work collaboratively to encourage uptake, avoiding proprietary solutions

Proprietary solutions should not be a barrier to EV uptake. The EV industry needs to work together with the power sector to ensure that there is a common charging technology, to support a national charging infrastructure for EVs. Interoperability of batteries is also desirable as it would enable battery swap stations to cater for more types of EVs.

6. Provide incentives for delayed charging

Power companies will need to give consumers strong incentives to recharge their EVs at times of low electricity demand and when the grid's carbon intensity is low. A tiered pricing structure is needed to shift battery charging away from times of peak demand. This should be incorporated into billing systems.

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This summary presents the key messages and findings from our full *Electric avenues* report, which is based on technical findings prepared by Element Energy Ltd. Both WWF's report and the consultants' research report can be downloaded from *wwf.org.uk/electricvehicles*

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Electric Vehicles in numbers

100% RECYCLED

1.7M

At least 1.7 million EVs will be needed by 2020 and 6.4 million by 2030

£5 BILLION

EVs could account for nearly a third of the reduction in fuel demand, representing over £5 billion a year in avoided oil imports by 2030

30%

Burning liquid hydrocarbon fuels made from oil is responsible for around 30% of global CO_2 emissions contributing to climate change

28%

High numbers of EVs could reduce car emissions by 28% by 2030

Why we are here
To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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