WWF for a living planet

Questions and Answers

Electric Vehicles

WWF-UK viewpoint

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June 2010

Revision Date: June 2011
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WWF-UK viewpoint on electric vehicles

Key messages

- To tackle climate change, WWF-UK supports the rapid introduction of electric vehicles to replace petrol/diesel vehicles. This should happen in the context of a strategic approach to sustainable mobility in the UK that first seeks to reduce the need to travel, reduce car ownership and promote a 'modal shift' from cars to more sustainable modes, including public transport, walking and cycling.

- Electric vehicles are already at least twice as efficient as conventional vehicles, but their true value in the transition to a low carbon economy will be dependent on both the speed and scale of decarbonisation in the power sector and our ability to significantly reduce total car km driven.

1. What role do electric vehicles have in our future road transport system?

Electric vehicles (EVs) will have a critically important role to play in the decarbonised road transport system we must secure in order to tackle climate change. EVs offer significantly improved efficiency over conventional vehicles. The lower emissions these vehicles generate will continue to decrease as the electricity sector is steadily decarbonised (a prerequisite for achieving an 80% reduction in greenhouse gases (GHGs)).

However, the introduction of electric vehicles must be made in the context of a strategic approach to sustainable mobility in the UK that prioritises reducing the need to travel, reducing car ownership and promoting a 'modal shift' from cars to more sustainable modes. Unchecked, the number of vehicles globally is expected to rise from the current 800 million to potentially 2 billion in 2030.[1] This is unsustainable even if the power sector is decarbonised. Aside from greenhouse gas emissions there are major environmental impacts from surface transport infrastructure and vehicle production such as soil sealing, pollution, habitat fragmentation and raw material extraction. Additional use of land for transport will mean less land for food production and other essential services.

Despite having received over 100 years of product development a petrol driven car is only approximately 18% efficient in converting the chemical energy in the fuel into motion and a diesel car approximately 23%. A conservative estimate of the tank to wheel efficiency of a battery electric vehicle is approximately 65%, some three times greater than that of the petrol cars2. Even when a full life cycle comparison is made from well to wheel that captures the huge inefficiencies in our large decentralised power plants the battery electric vehicle is still more efficient.

The CO_2 emissions from the electric vehicle are a product of the carbon intensity of the fuel (often referred to as 'plant to tank') supply and the efficiency of energy distribution through the charging network to the battery and through to the wheel.. Both of these are set to improve as the power sector is decarbonised by 2030 and EV battery technology is improved. The UK Committee on Climate Change describes current electric vehicles as being 'far more efficient than internal combustion engines at converting energy inputs to kinetic energy within the vehicle".[3] At the moment

[1] Sperling, D., and D. Gordon, 2009 *Two Billion Cars: Driving Toward Sustainability*. Oxford University Press.

[2] WWF 2008. Plugged in: the end of the oil age, p.84. http://assets.panda.org/downloads/plugged_in_full_report___final.pdf

[3] See http://www.theccc.org.uk/pdf/7980-TSO%20Book%20Chap%202.pdf

for the current EU average grid intensity of 370gCO2/kWh a battery electric vehicle will have emissions of 619gCO2/kWh compared to 1619 for a petrol car and 1300 for a diesel car.[4] Two studies based on the UK showed that EVs would achieve a 50% emissions reduction with the current energy mix, and more than 80% in a future low carbon energy mix scenario.[5] This analysis is repeated by the Committee on Climate Change report to the UK Government that set out how the emissions associated with an electric vehicle decline to almost zero as the power supply is decarbonised.[6]

A study by Arup and Cenex for the Department for Business, Innovation and Skills applies a Life Cycle Assessment model to compare the emissions between a EV manufactured and used in 2010 and a modern day petrol car. The lifetime vehicle carbon use in kg Co_2 equivalent for the EV is 19,161 compared to over 30,000 for a petrol car.[7]

Most importantly, the emissions from an EV are locked on an ever steepening downward trajectory as we ramp up our renewable capacity and retire dirty coal plants. However, for as long as the power grid includes fossil fuels it is important to combine support for electric vehicles with strong commitment to reducing car use if the full emissions reduction potential of this new technology is to be realised. Indeed this is true even with a decarbonised power sector as we seek to reduce congestion, and the emissions associated with the construction of vehicles and roads.

EV's could have a positive role to play in the transition to a low carbon energy system. In conjunction with a smart grid, the nation's fleet of EVs could operate as a vast energy storage network. When charged overnight, EVs could store previously unused wind capacity. Spare capacity stored in EV batteries could then feed back into the grid during peak times to lower carbon intensity.

As well as reducing greenhouse gases, the transition to EVs would also deliver other important environmental benefits. The transition would avoid the local environmental impacts of the oil industry which include habitat destruction, pollution of water, soil and air, transportation spills, and toxic wastes. And because there are no emissions at the point of use, air pollution in cities would be reduced.

2. Are there any problems/limitations associated with electric vehicles?

Large-scale deployment of electric vehicles may lead to significant local environmental impacts associated with the extraction of raw material for battery technology if steps are not taken to mitigate these impacts. Battery technology for cars will drive a massive increase in demand for lithium, most of which is currently mined in South America and China. The extraction of lithium has local environmental impacts but studies vary in their assessment of the severity of these.[8] Further down the life-cycle there will be a pressing need to ensure battery and material recycling is maximised to reduce the need for mineral extraction, and to minimise waste. Electric vehicles require the same infrastructure of roads as conventional vehicles which carries further impacts such as construction emissions and habitat loss. Therefore, while there is evidence of significant energy and GHG savings, there is some uncertainty about other impacts of EVs when compared

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[4] WWF 2008. Plugged in: the end of the oil age, p.88.

[5] E4tech: A review of the UK innovation system for low carbon road technologies. A report for the Department for Transport. 2007; King, J.: The King Review of low-carbon cars. Part 1: the potential for CO2 reduction. London 2007.

[6] See http://www.theccc.org.uk/pdf/7980-TSO%20Book%20Chap%202.pdf

[7] See http://www.berr.gov.uk/files/file48653.pdf for the full report

[8] See for example Tahil, W.: The trouble with lithium 2. Under the microscope. Meridian International Research. Martainville 2008; Evans, R.K.: An abundance of lithium – part two. 2008; Vaughan, A.: Can electric vehicles overtake competing green car technologies? Ecologist, 2009.

to conventional vehicles. This highlights that electric vehicles are not a silver bullet and underlines the importance of the need for a significant overall reduction in car use.

The introduction of hundreds of thousands of large new electrical appliances onto the market has to be managed if they are not to simply add to current peak electricity demand. The carbon intensity of the grid is highest at points of peak demand and the emissions return on electric vehicles is significantly reduced if they are charged at times to coincide with this. This can be relatively easily prevented initially through the use of deferred charging switches that delay the charge time until the middle of the night and eventually with the provision of smart meters. Delayed charging designed to shift demand away from peak times can also be encouraged by financial incentives that offer different unit rates at different times of day.

Electric vehicle investment must not come at the expense of the much needed support for active travel and public transport. These transport modes are an essential part of future sustainable mobility and must not be ignored. There is a risk that this new technology is seen as a silver bullet and diverts resources away from other equally important areas. The promotion of EVs without implementing policies to reduce car use and ownership risks increasing congestion and reinforcing the established reliance on private transport. For example, if a local authority decides to incentivise EVs (lower parking charges, lower city toll), it might lead to people owning two cars, one for the city and one for long distance. The EV must be presented as the replacement for necessary car travel rather than a high tech alternative to public transport or walking and cycling.

While the upfront cost for EVs is currently considerably higher than for ICEV, the operating cost per km can be considerably lower. This could lead to increased car use; this should be avoided when putting the policy framework for EVs in place.

3. What barriers are there to the transition to electric vehicles, and how should these be overcome?

The introduction of a new technology, at the rate required by the targets under the Climate Change Act, presents a number of challenges. The most obvious and immediate of these is there is a significant price premium attached to electric vehicles due to the high cost of the lithium battery technology. As demand increases and R&D is increased this price will decline but in order to kick-start the market a significant level of subsidy will be required. The UK Committee on Climate Change have indicated that this could be in the region of £10,000 per vehicle and may need to be as high as 20K depending on how consumers value the life time costs of an EV.[9] Another key barrier is the current lack of charging infrastructure. This has to be targeted to give the best return on the necessary investment as low use infrastructure will be expensive to install. Charging points will need to combine fast charging infrastructure that provides a fully charged battery in minutes and standard charge which can take up to seven hours. The rollout of these new charging points has to be accommodated by the local grid and in some cases this may require upgrades to the local network.

A third important barrier to the effective roll out of electric vehicles is their perceived range constraint. Although the current battery range of models intended for the market would be sufficient to capture the vast majority of journeys consumers make, there is much evidence that customers purchasing decisions are determined by the potential of the vehicle to drive hundreds of miles on a single tank or at 100mph. Technological development is improving performance, yet the transformation to an all electric car fleet will require a significant shift in public behaviour. Drivers will need to embrace a new and novel technology that has had a bumpy history and they

[9] Climate Change Committee 2009. Meeting Carbon Budgets - the need for a step change, p.207 http://www.theccc.org.uk/reports/progress-reports

may need to adapt their driving practices. They may even need to adapt their relationship to the private car: new business models are emerging to support EVs that shift the financial risk to the manufacturer who leases the car or battery to the consumer.

For all of these barriers to be addressed there must be an integrated transport policy that embeds EVs into the road transport system. This will need to include a strong financial package to reduce the absolute costs, and steps to reduce the relative cost in comparison to the ICEV, for instance through graded road charging. Promotion of EVs has to involve communicating the necessary shift in driving patterns, and new partnerships between the private and public sector will have to emerge to support the establishment of the infrastructure. One immediate step that could help to drive the demand and lower costs is to replace the current public fleet with an all electric fleet by no later than 2020.

FEEDBACK

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