

Facts sheet 5c Electric, hybrid and conventional cars: fuel energy and emissions.

Updated November 2009 – ref regenerative braking

WP ref factssheet05C 2009 Electric cars (2)

The spread sheet attached sets out the data and assumptions that we have used. There are elements of that which are clearly speculative. Hence we invite readers to download the spread sheet and to carry out such sensitivity tests as they think fit. In particular the factors of 0.6 and 0.8, converting the optimum efficiencies of electric and hybrid vehicles to urban values, may be challenged.

Summary results follow where the MUSIC is a spark ignition petrol engine developed by Dr Dan Merritt of MUSI Engineering Ltd. currently awaiting finance for in-vehicle tests.

	Efficiency ratios		Emission ratios	
	MUSIC to Electric	Diesel to Electric	Electric to MUSIC	Electric To Diesel
Peak efficiency	1.49	1.24	1.21	1.00
Urban cycle	2.00	1.58	1.62	1.28



In this tabulation “Efficiency” means the energy delivered to the vehicle’s power train divided by the primary energy burnt. The ratios of the efficiencies and of the emissions compare the vehicles. By way of example, the data means that, under urban conditions, an electric car may use 2.00 times as much primary energy as required by the experimental MUSIC and 1.58 times as much as a conventional diesel with the same power delivered to the drive chain. Similarly the electric vehicle would emit 1.62 times as much carbon as the equivalent MUSIC and 1.28 times as much as the equivalent diesel.

Those numbers assume the UK generating industry efficiency and emission rate. However, if it is coal fired generation that is relevant, on the basis that large scale electrification would extend the life of coal fired power stations, then the emission ratios should be doubled. Further the data takes no account of (a) the greater weight of electric vehicles, said to be 40% to 50% heavier than equivalent conventional ones, on account of the batteries or (b) the carbon emission associated with battery manufacture, recycling or scrappage.

Our calculations do not take account of regenerative braking, currently primarily available to electric and hybrid cars. That cuts the energy needed by 10% to 30% depending on the driving environment. However, Flybrid Systems have developed a mechanical system which, they say, will capture more braking energy than does the electric route and be available to production cars in 4 to 6 years.

The spread sheet also shows that hybrids may use more energy and emit more carbon than do conventional diesels.

Comment:

Currently there is a strongly held belief that electric cars emit significantly less carbon than the internal combustion engine competitors. For that reason the UK government is setting aside £250 million for development and, world-wide, there is interest in the same. However, we find (a) a startling absence of data (b) contrary to the belief, our calculations suggest that the electric car may be an environmental disaster at least with the UK generating industry.

Hence, before taxpayers money is spent in this way we plea that good engineering data should be assembled. Alternatives to our spread sheet might then either confirm or overturn our tentative conclusions.

Subject to that, the electric car should be abandoned at least until coal fired generation has been phased out or until carbon capture is a reality. In the medium term development of internal combustion engines such as the MUSIC offers substantial reductions in emissions and fuel consumption as would junction improvements designed do minimise congestion.