Net zero costsheet 2

COST OF DECARBONISING CARS

Andrew Montford

Introduction

Decarbonising transport will be one of the major challenges of the net zero project, in both cost and engineering terms. While for many forms of transport – HGVs and air transport for example – it is still not clear how the aim might be achieved, this is not the case for private transport, where politicians seem to agree that battery electric vehicles (BEVs) are the way forward, although without apparently having considered the challenges involved.

General approach

I consider the capital expenditure that will necessary between 2020 and 2050, and the costs of running vehicles in 2050, in each case estimating the difference in costs between two hypothetical futures: one in which all private vehicles are BEVs and a no-policy alternative, based around internal combustion engine vehicles (ICEVs). I assume there will be 40 million cars and 38 million households by 2050.

Capital cost of vehicles

The relative cost of BEVs and ICEVs is highly uncertain and potentially large. I use the VW Golf as a representative 'average' car. The BEV version, the eGolf, is currently nearly 40% more expensive than the ICEV version (the TSi 1.5 Life). BEVs have been getting more expensive in recent years, apparently because larger batteries have been installed to try to counter range anxiety. Advances in battery technology and larger production volumes may tend to reduce the difference, while competition for the relatively scarcer materials used in EVs may have the opposite effect. I therefore assume no change in relative costs. The results are very sensitive to this assumption.

Charging infrastructure

Homeowners will need to install car chargers in their homes. I assume 60% of homes will have a slow charger, and that 40% will have a fast charger too. I make no allowance for 'smart chargers'.[1] Charging mostly takes place at night. For public charging infrastructure, the cost to consumers is based on current retail prices for fast and rapid chargers, adjusted in line with predicted energy price increases (see below). Retail prices are assumed to incorporate the capital cost of the related infrastructure, so no separate estimate of the capital cost is made.

Energy costs

Petrol and electricity use is based on manufacturer's figures for variants of the VW Golf. I exclude fuel tax from petrol prices, on the grounds that this will eventually need to be recovered from EV users somehow. I assume no change in petrol prices.

It is clear, however, that electricity prices will continue to rise and the share of renewables on the grid increases. In this study, electricity prices are based on the system cost modelling of Gibson and Aris, who compared a renewables based grid with one based on gas and nuclear.[2] Thus we can split the fuel cost element of switching from ICEVs to BEVs into two parts: a cost associated with switching to low-cost electricity from gas/nuclear, and a cost associated with using renewables-based electricity instead.

The various retail prices of electricity – night rate, standard rate, and rates at public chargers – are estimated as fixed adjustments to the Gibson and Aris system cost, calibrated to give prices equal to those charged today. It is assumed that only the system cost changes, rising at 2.3% per year with policy, and falling at 1.5% per year without.

Other costs

- BEV owners will need to replace their car batteries – I assume every 8 years – at a cost likely to exceed £5000.
- Servicing is assumed to be £100 cheaper for BEVs, which are simpler than ICEVs. Insurance is assumed to be the same price.
- Because of the limited range of BEVs, it is assumed that their owners will need to pay for alternative transport once each year, at a cost of £400.
- In order to deal with the increased demand for electricity, homes and the electricity distribution grid will need to be rewired, at a cost estimated at £206 billion.[3]
- Allowance is made for the time spent waiting for vehicles to charge at public chargers (1 hour at fast chargers and 0.5 hours at rapid chargers). The calculation assumes average UK wage of £16/hr.

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Results

Subject to the caveats above, by 2050, when the switch to BEVs is assumed to be complete, the UK will have spent around £2.1 trillion[4] on replacing ICEVs with more expensive BEVs (some will have worn out and been replaced again), and making homes and the distribution grid ready to deal with them. This amounts to £0.7 trillion more than would have been spent in the absence of policy measures.

	With policy £bn	Before policy £bn	Difference £bn
Vehicle cost	1243	911	332
Vehicle replacement	621	456	165
Home chargers	23	–	23
Wiring and distribution	206	–	206
Total capital works	2093	1367	726

This is around £19,000 per household. It is important to note however, that this cost could be as low as £0.2 trillion, or £6000 per household, if BEVs can achieve price parity with ICEVs.

The ongoing costs are significant too. Converting from petrol to even low-cost electricity from gas and-nuclear brings extra fuel costs of £8 billion per year (charging at home at night is cheap; using public fast chargers is not). However, there is then another £12 billion cost driven by the price rises caused by using renewables.

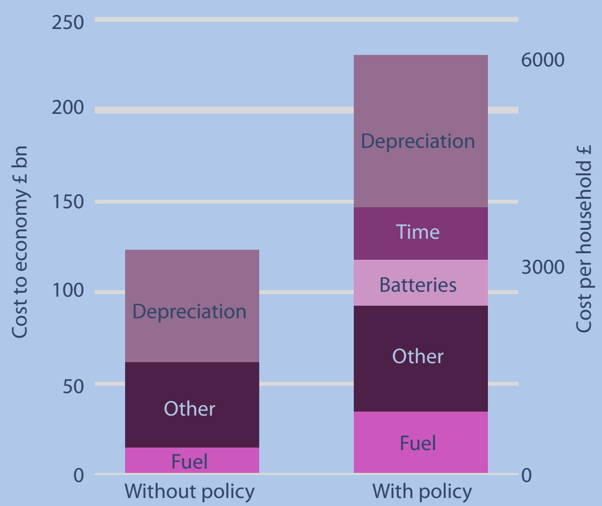
Battery replacement cost amounts to £25 billion per year, and the cost of alternative transport adds another £15 billion. The extra depreciation may be as high as £22 billion, although this figure again could vary substantially.

Time spent waiting at public rechargers will cost the economy around £16 billion per year, and with alternative transport being required for longer journeys, at least another £15 billion will be required – if current lifestyles are to be maintained, the figure is likely to be much larger.

In total, electrification will mean ongoing extra operating costs of £107 billion. This amounts to an extra £2,825 per household, approximately doubling the cost of keeping a car on the road. In reality, for many people the cost will not be supportable and they will be forced to rely on public transport.

	With policy £bn	Before policy £bn	Difference £bn
Cost of switching fuel	23	15	8
Cost of renewables	12	–	12
Battery replacement	25	–	25
Depreciation	83	61	22
Alternative transport	15	–	15
Service and insurance	43	47	(4)
Time cost	29	–	29
Total cost	230	123	107

Annual cost of motoring in 2050



Endnotes

1. Smart chargers allow central control of EV charging speeds, so as to prevent grid overloads.

2. Gibson C and Aris C. *The Future of GB Electricity Supply*. Technical paper 4, Global Warming Policy Foundation, 2020.

3. Travers M. *The Hidden Cost of Net Zero: Rewiring the UK*. Briefing 48, The Global Warming Policy Foundation, 2020.

4. All monetary values are in £2020.

Published by:

The Global Warming Policy Forum
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