Accelerating the electric vehicle revolution

Why the UK needs a ZEV mandate

May 2021

Methodology for emissions savings analysis

Emissions savings were estimated by assessing the number of battery electric and plug-in hybrid cars and vans that will be part of the UK fleet by 2030, assuming different rates of uptake over the next decade. Rates of uptake are based on three scenarios:

- **'CCC recommended uptake'**: the Climate Change Committee's (CCC's) recommended share of battery electric cars and vans and plug-in hybrid cars and vans as a proportion of new sales (sixth carbon budget advice, balanced scenario). Battery electric vehicle (BEV) car and van share of new sales is 48 per cent and 56 per cent in 2025, respectively, and 97 and 100 per cent in 2030. Plug-in hybrid (PHEV) car and van share of new sales is 26 per cent and 0.1 per cent in 2025, respectively, and three and zero per cent in 2030.
- **'Steady uptake'**: share of battery electric cars and vans as a proportion of new sales, based on the proposed uptake curves for a 2035 phase out, based on Transport & Environment, 2020, *Phasing out sales of new cars with engines: a UK approach*, figure 3. Battery electric cars and vans account for 23 per cent of new sales in 2025 (for both cars and vans) and 69 per cent in 2030. Plug-in hybrid cars and vans account for 11 per cent of new sales in 2025 (for both cars and vans) and 31 per cent in 2030.
- **'Delayed uptake'**: assume that battery electric and plug-in hybrid car and van sales increase more gradually until the late 2020s; share of new sales in 2025 is 18 per cent for battery electric cars, and 14 per cent for plug-in hybrid cars, and 60 per cent and 40 per cent, respectively, in 2030. The 2025 and 2030 battery electric cars shares are in line with forecast for battery electric car uptake by Bloomberg New Energy Finance (BNEF) (see Bloomberg New Energy Finance, 2021, *Hitting the EV inflection point*), based on current policy, and assume no further regulatory driver is put in place. The 2025 share for plug-in hybrid cars is also consistent with BNEF's forecast, while the 2030 proportion is based on the assumption that sales of all new conventional petrol, diesel and full hybrid vehicles will be phased out. Uptake rates for battery electric vans are lower in 2025, consistent with forecast by BNEF, with battery electric and plug in hybrid vans representing 10 per cent and 5 per cent of new sales, respectively. Uptake rates are assumed to reach the same levels as cars in 2030.

Car and van sales per year are assumed to remain constant at the number of sales reported in 2019 (Department for Transport (DfT), 2021, 'Vehicle licensing statistics', Tables VEH0453 and VEH0253). Similarly, the average miles per year are assumed to remain constant for cars and vans, as per 2019 figures (DfT, 2020, 'Vehicle mileage and occupancy' and DfT, 2020, 'Road traffic estimates: Great Britain 2019'). Therefore, we assume there is no growth in traffic over the next decade.

Emission factors for average fleet tailpipe emissions of conventional petrol, diesel and hybrid cars are based on emission factors for passenger vehicles and vans, as reported by Defra (Defra, 2021, 'UK government GHG conversion factors for company reporting'), assuming that emissions decline by about 12 per cent by 2030 as a result of efficiency improvements, in line with the CCC's assumption in its sixth carbon budget advice (CCC, 2020, *The sixth carbon budget*).

Real world estimates are used for plug-in hybrid cars' tailpipe emissions, equal to 117 gCO_2/km (based on Transport & Environment, 2020, *The plug-in hybrid con*), with no improvement expected to 2030, while indirect emissions from electricity generation are based on CCC data, adjusted for a lower share of electric miles. We assume the uplift value for real world emissions from plug-in hybrid vans is comparable to that for cars and we take the same approach as outlined above for plug-in hybrid cars.

Indirect emissions associated with battery electric car and van use of electricity are based on the CCC's data used in their sixth carbon budget advice (CCC, 2020, *The sixth carbon budget*).

Total cost of ownership analysis

This analysis was conducted by Element Energy. The total cost of ownership (TCO) compares vehicles beyond their purchase price to assess the real cost for consumers over the course of successive ownerships of a vehicle. This includes: vehicle pricing and component costs; efficiency measures required by regulation; market depreciation; fuel or electricity costs and consumption; taxes (VAT, registration tax, annual tax) and subsidies; insurance and maintenance costs.

The analysis followed the approach adopted in a similar study at EU level (see Element Energy, 2021, *Electric cars: calculating the total cost of ownership for consumers*), with some specific adjustments for the UK context, including: plug-in car grant available until March 2023 (up to £3,000 in 2020, up to £2,500 from March 2021 until March 2023, with no further purchase subsidies after that); current tax incentives and CO_2 banding for vehicle excise duty remain constant; no VAT for used cars; price of energy based on UK average residential electricity price (22p/kWh); fuel price assumes fuel duty and VAT remain constant at 2020 levels; UK car purchase prices are forecast based on Element Energy's bottom up cost and performance modelling.

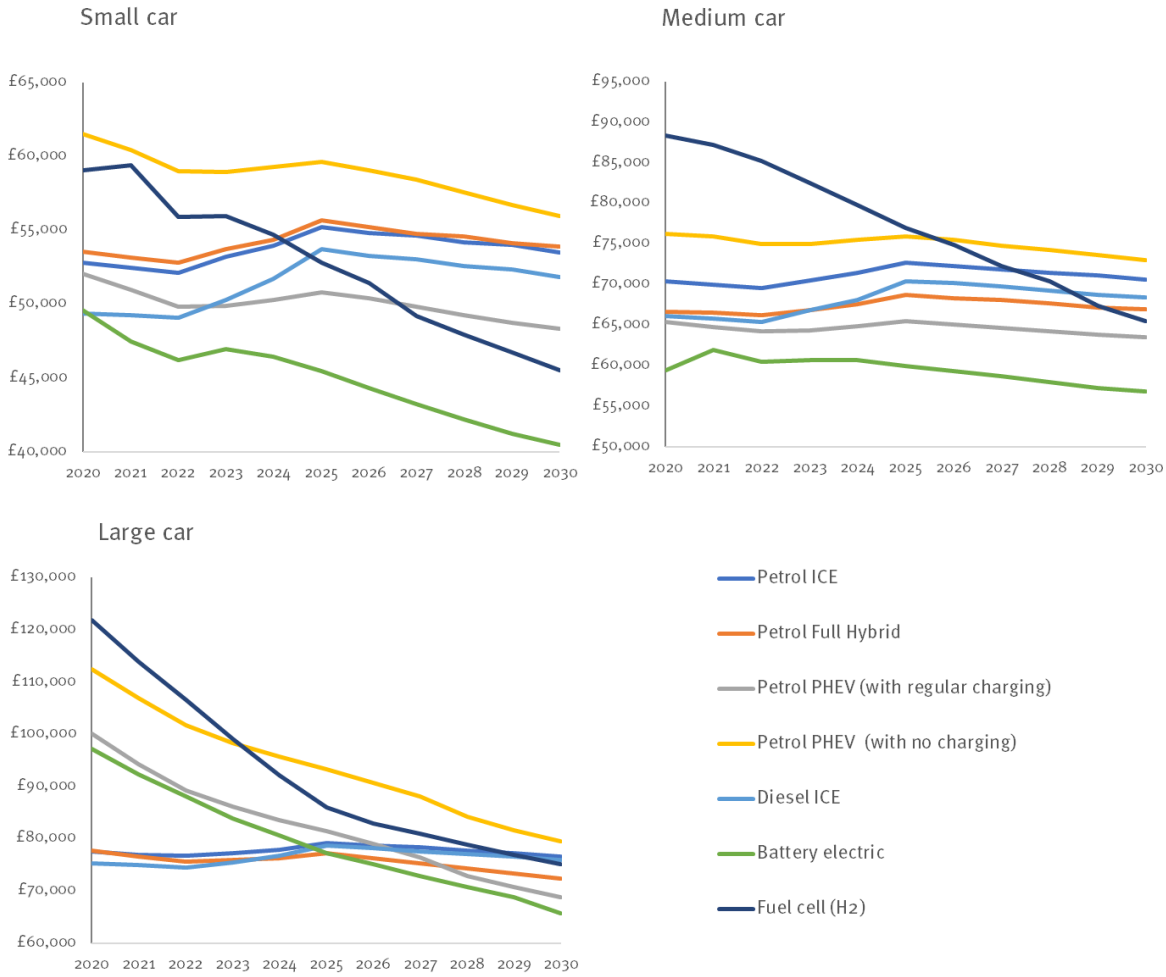
Note that, with regards to the potential introduction of road pricing charges, it is reasonable to assume that these charges will either be differentiated by tailpipe emissions (in the case that they entirely replace fuel duty) or applied equally across all vehicle types (in addition to fuel duty). Therefore, we argue that it is unlikely to significantly affect the relative difference in cost between vehicle types.

Below, we outline some additional findings from this study.

Small and medium battery electric cars are already the cheapest option, on a lifetime total cost of ownership (TCO) basis

For medium and small cars bought today, battery electric vehicles are already cheaper than any other type of car on a total cost of ownership over their entire lifetime (first, second and third hand owner). Large cars will become the cheapest option by 2025.

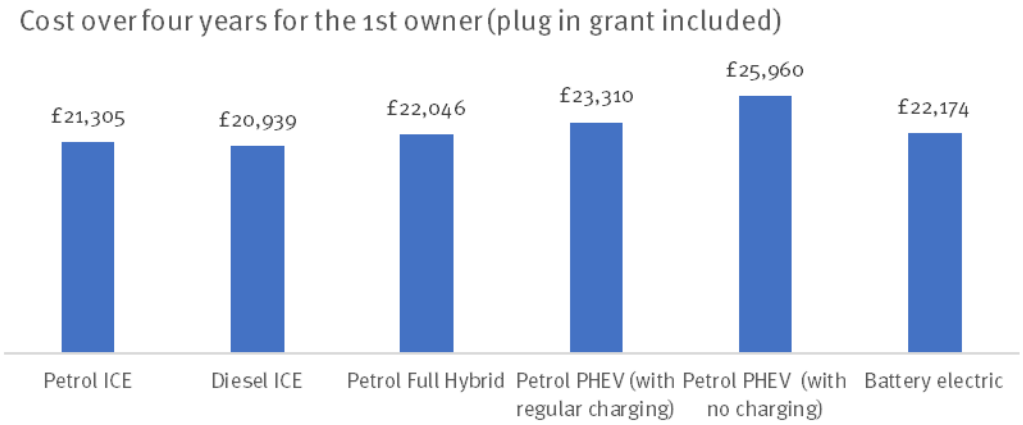
Lifetime TCO (years one to 16, £)

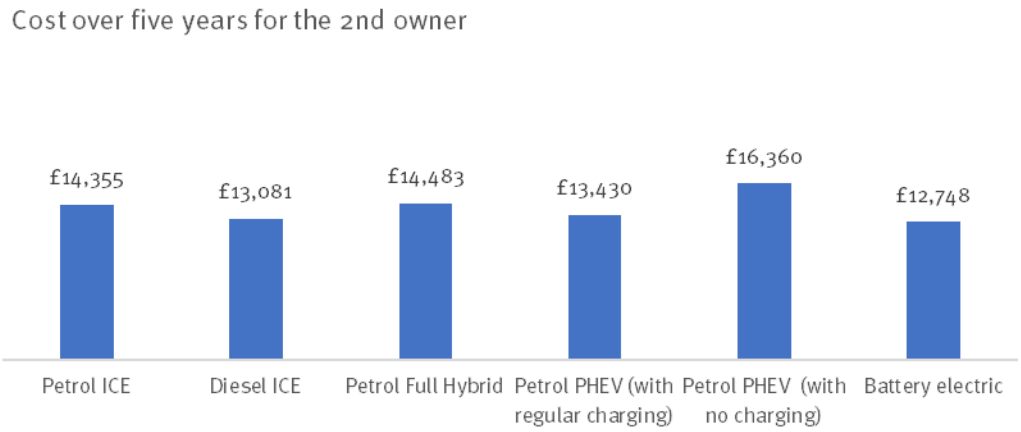


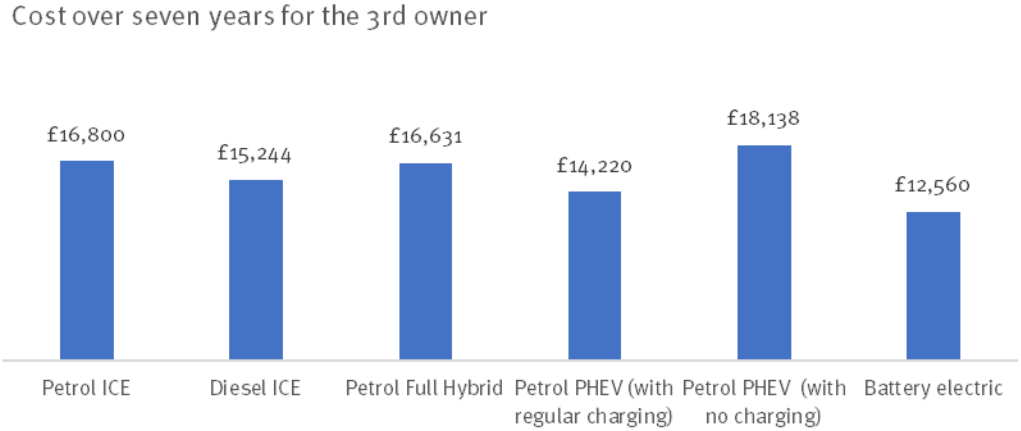
New small battery electric cars sold today will already save thousands to their second and third hand owners.

Small battery electric cars, bought today, will save their second hand owner between £300 and £1,600 compared to diesel and petrol equivalents, respectively, on a total cost of ownership basis. And they will save their third hand owners between £2,700 and £4,200.

TCO for a small car first bought in 2021



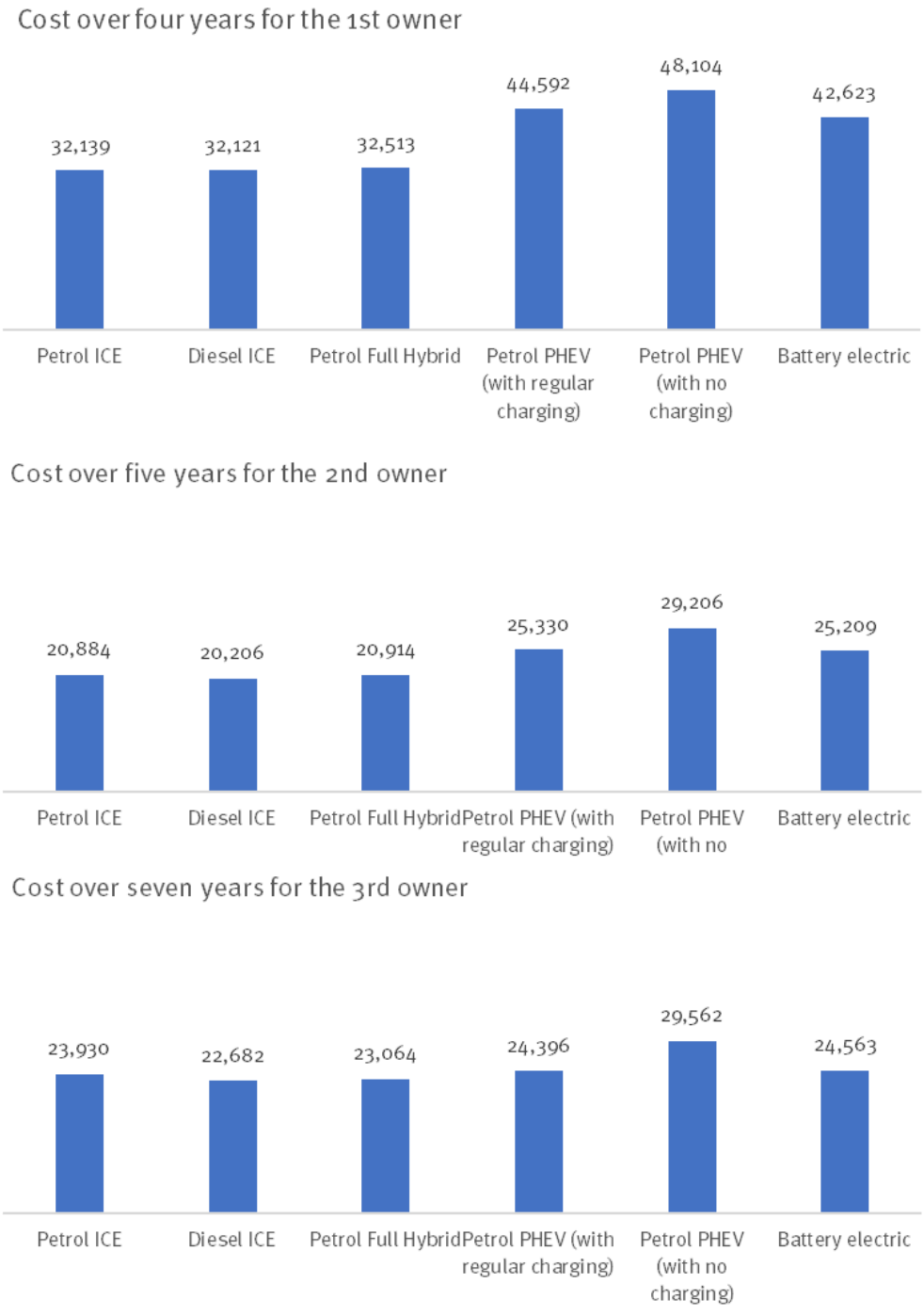




Large cars will become cost competitive in the coming years

Large battery electric cars bought new in 2021 are not yet cost competitive with petrol and diesel equivalents. For first hand owners, they will become cheaper than other types of vehicles later in the 2020s, on a total cost of ownership. But for used cars, cost competitiveness will be achieved sooner: large cars first bought in 2025 will already be the cheapest option for their second owners, and those first bought in 2023 will be the cheapest type of car for third hand owners.

TCO for a large car first bought in 2021 (£)



Battery electric cars will get cheaper

As the upfront cost of battery electric cars is expected to drop in the coming years, cost competitiveness of battery electric cars is estimated to grow, leading to significant savings for second and third hand owners of cars first sold in 2025. (Note that TCOs for battery electric cars first bought in 2025 do not include the plug-in car grant.)

TCO for medium size cars compared to the TCO of a conventional diesel car equivalent first bought new in 2021 or 2025