Decarbonising surface transport in 2050

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The Climate Change Act and the Committee on Climate Change

- The Committee on Climate Change (CCC) is an independent statutory body established under the Climate Change Act (2008) to advise UK and devolved administration governments on setting and meeting climate change targets, and preparing for climate change.
- The Climate Change Act requires that:
  - the net UK carbon account for the year 2050 is at least 80% lower than the 1990 baseline
  - a carbon budgeting system that caps emissions over five-year periods, to help ensure policies required to meet the 2050 target are put in place
- The CCC advised on the level of
  - the first three carbon budgets (2012-2022) in December 2008
  - The fourth carbon budget (2023-2028) in December 2010

Overview

- Aim and approach
- Fuel consumption, capital cost, total lifetime costs
- Ranking of powertrain technologies by cost-effectiveness
- Deployment scenario and results

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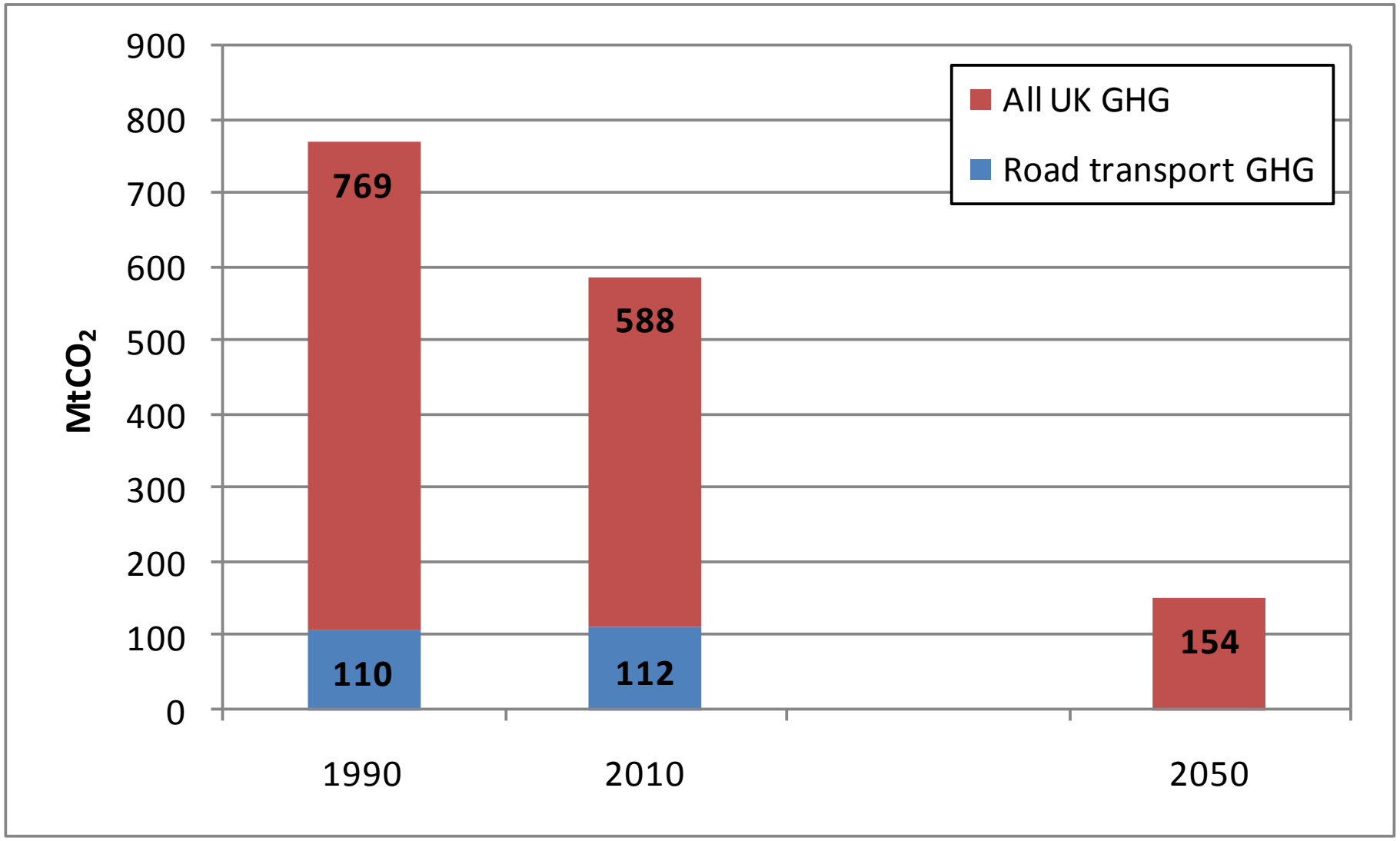
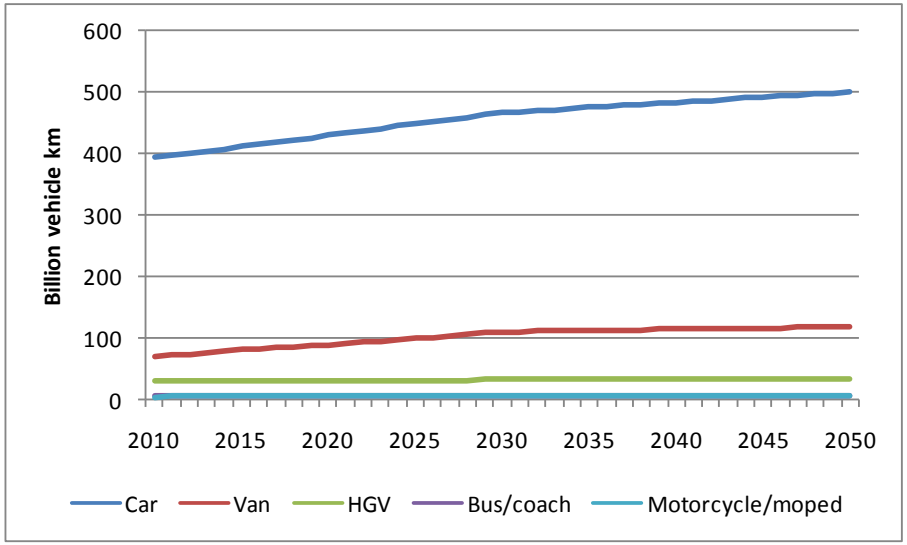
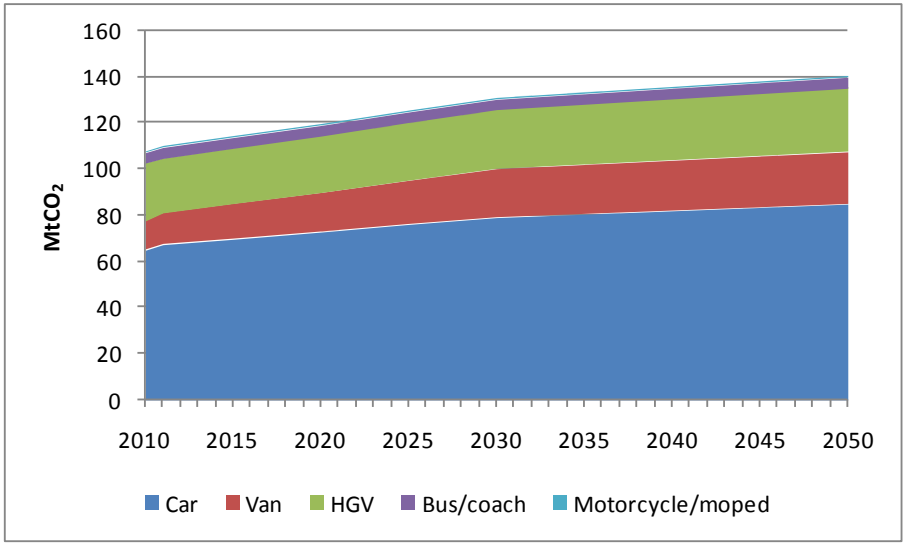
Aim: to identify the appropriate contribution of the road transport sector to achieving the UK's 2050 emissions target.



Forecast vehicle km and transport CO_2 emissions (business as usual)





Source: DfT National Transport Model; ONS population forecasts

Approach

- Ensure that the economic burden of meeting the 2050 emissions target is as low as possible by prioritising cost-effective technologies and policies
- Some sectors will reduce emissions more than others
- Opportunities considered:
  - technologies that improve fuel efficiency
  - lower- or zero-emitting powertrain technologies
- Biofuels are not assumed to be available over the longer term: scarce resource with most valuable uses outside road transport sector (see CCC Bioenergy Review)
- Behaviour change could further reduce CO2 emissions and deliver a range of additional benefits (reduction in congestion, improved air quality, reduced noise levels, improved health outcomes, etc.)

Evidence base

- AEA (2012): A review of the efficiency and cost assumptions for road transport vehicles to 2050.
  - spreadsheet tool to calculate fuel consumption and capital cost of vehicles with different powertrain technologies, for each major road transport mode
- Element Energy (2012): Cost and performance of EV batteries.
  - investigated the future trajectory of cost and performance of electric vehicle batteries
  - developed assumptions on battery costs for battery electric and plug-in hybrid electric cars and vans
  - used in the AEA (2012) spreadsheet model

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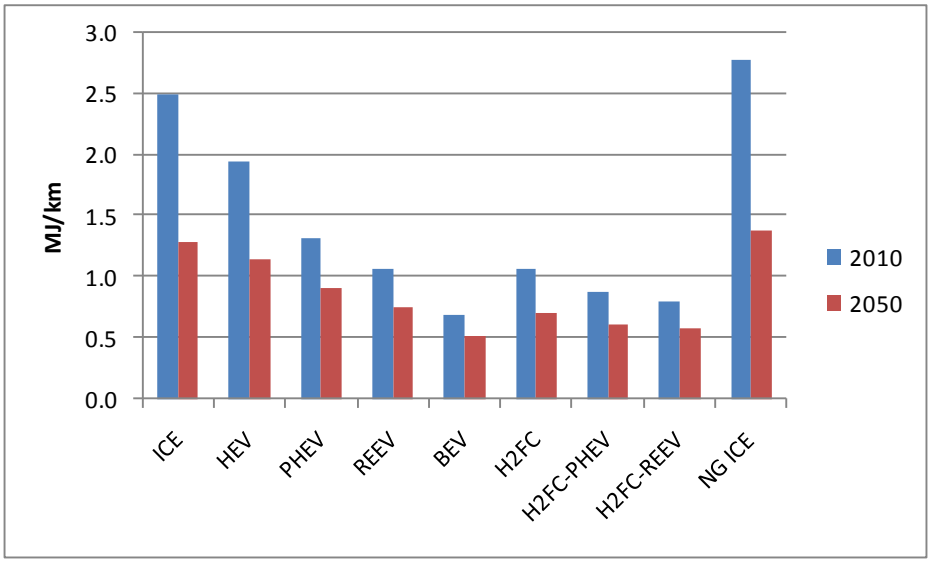
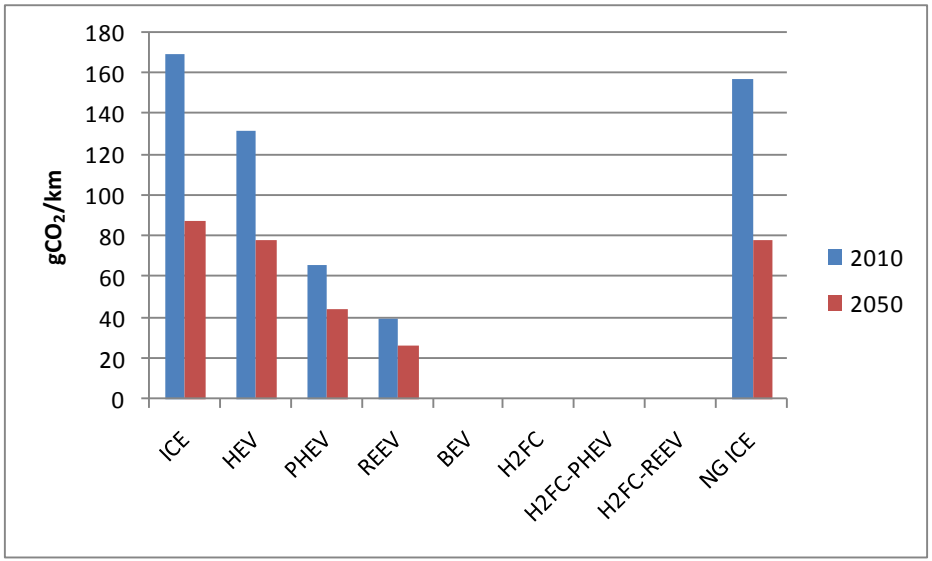
Car fuel consumption and CO_2 emissions

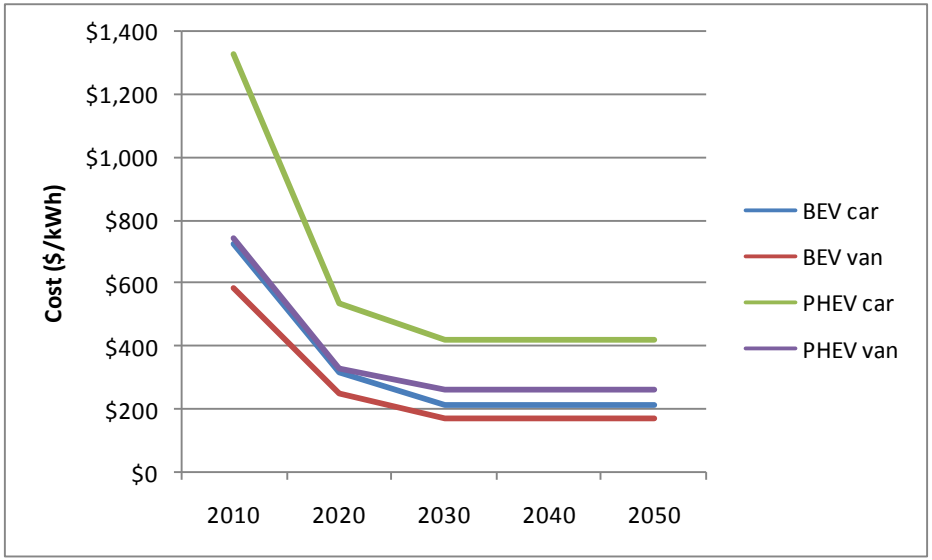




Source: AEA (2012): A review of the efficiency and cost assumptions for road transport vehicles to 2050.

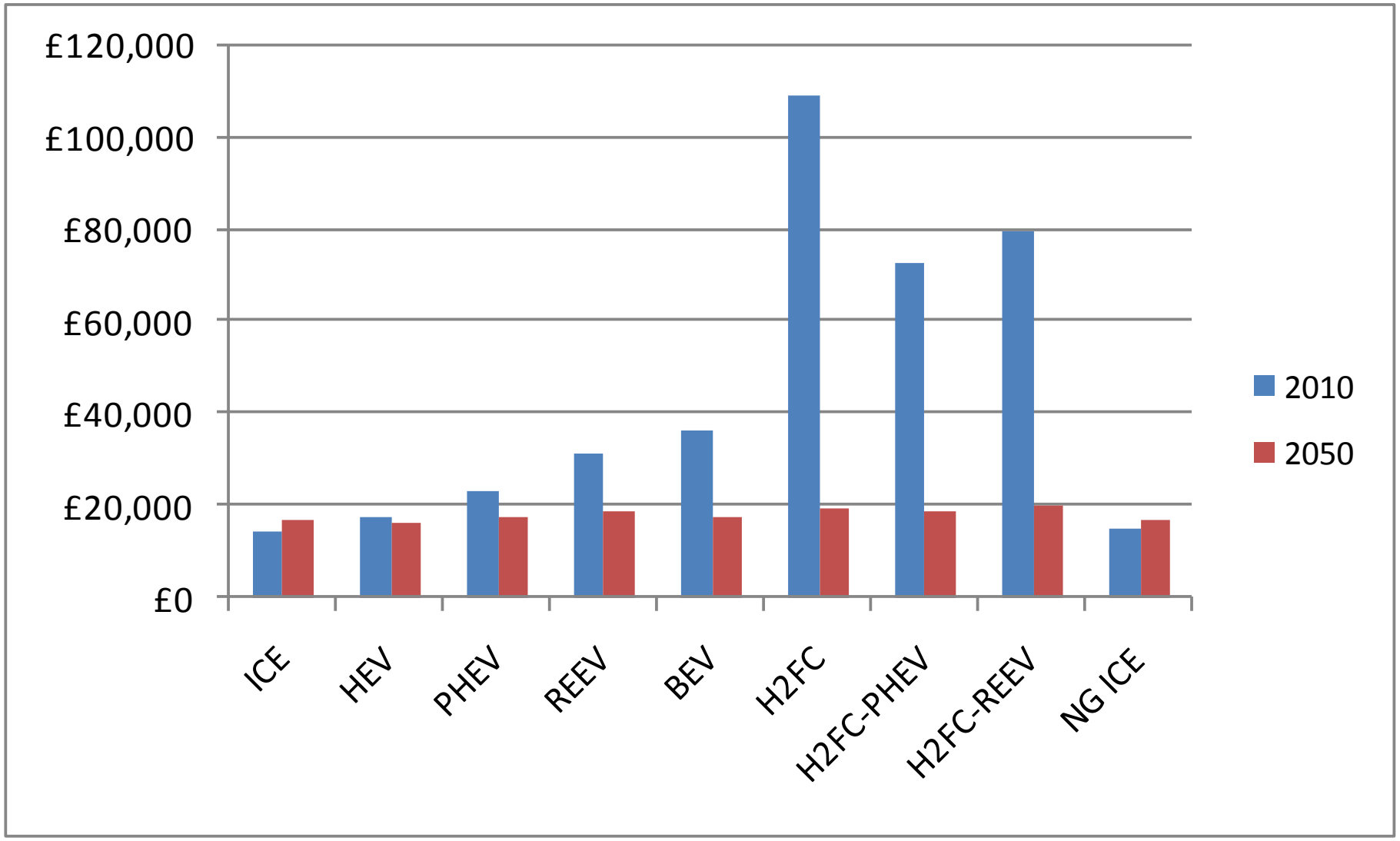
Electric vehicle battery cost forecasts

- Cost forecasts assume
  - sufficient R&D to develop chemistries with greater energy density (reducing materials costs)
  - and economies of scale in production of battery packs
- Battery pack costs for PHEV cars likely to be more expensive per kWh as higher discharge rate requires
  - different chemistry with likely lower energy density
  - more costly liquid cooling system
- Cost differential lower for PHEV vans as larger battery pack allows lower discharge rate
- Not further cost decreases forecast beyond 2030



Source: Element Energy (2012): Cost and performance of EV batteries.

Car capital costs



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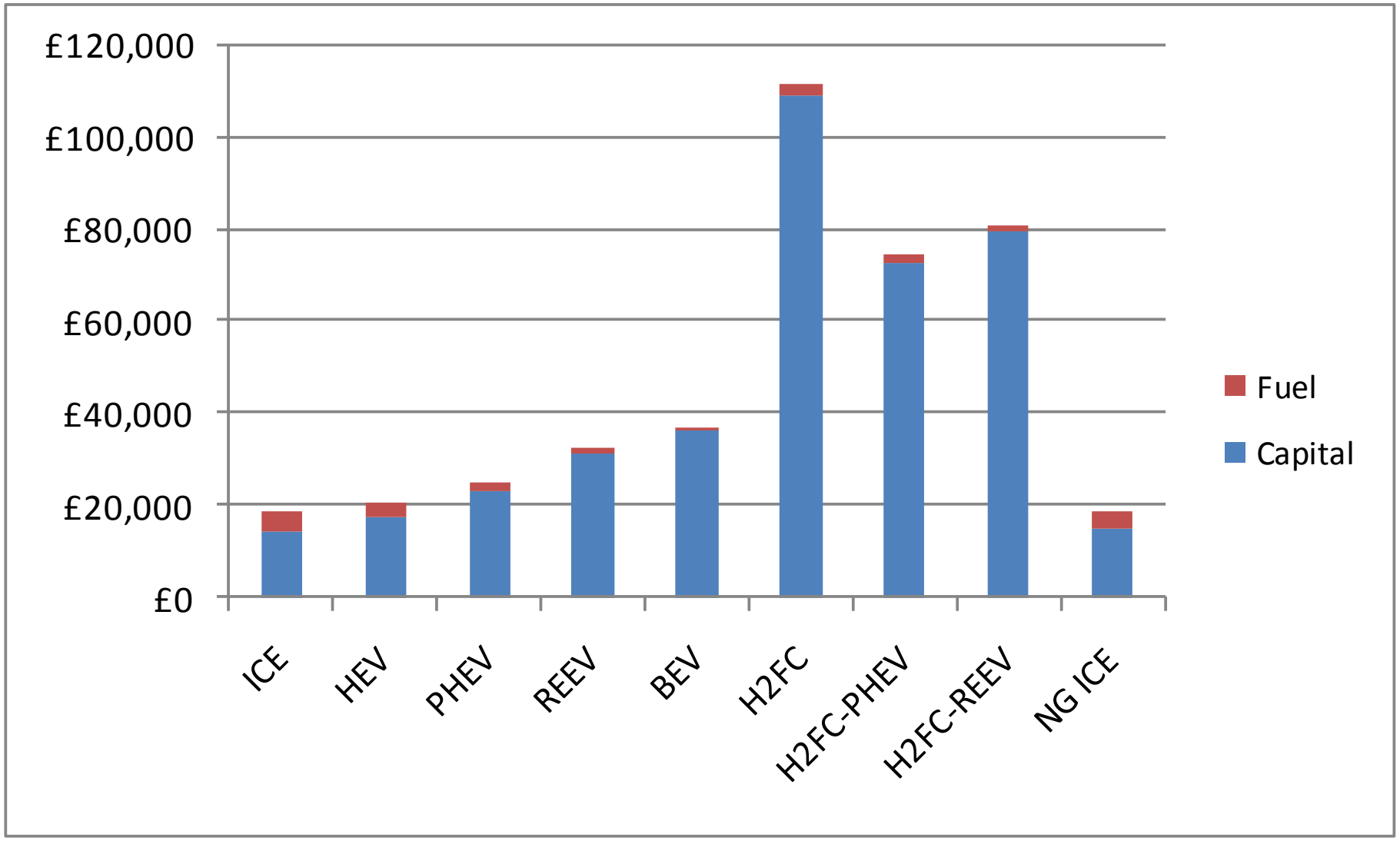
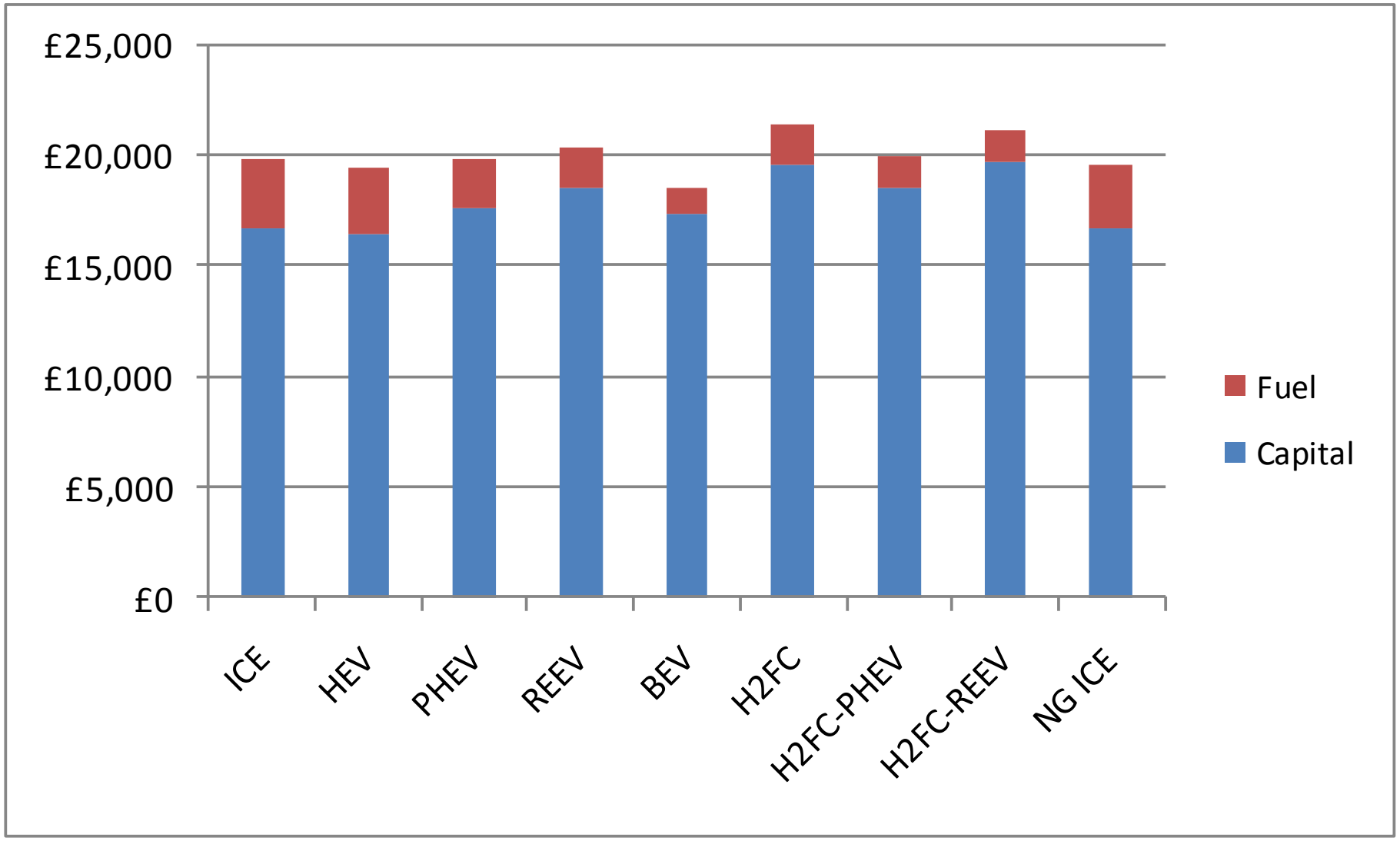
Car lifetime costs (2010)



Car lifetime costs (2050)



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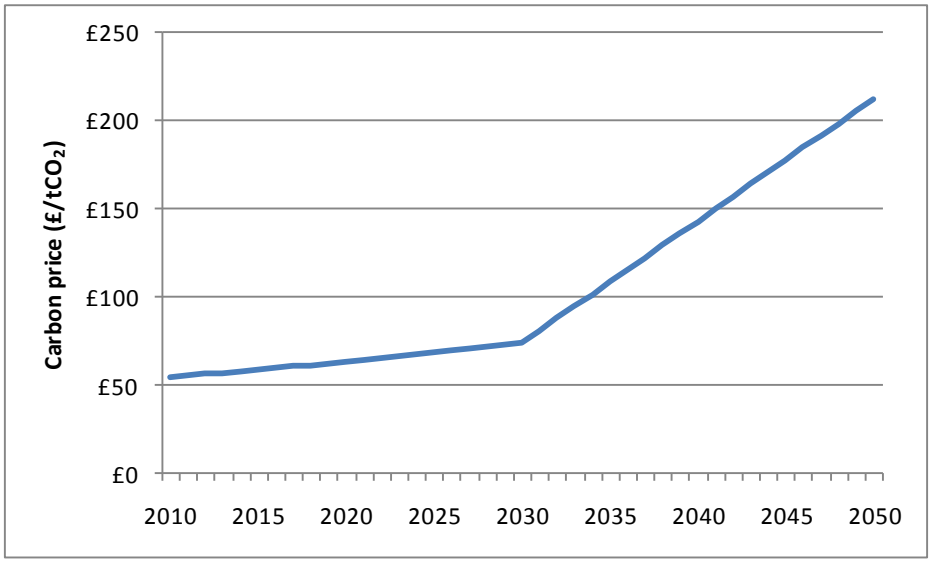
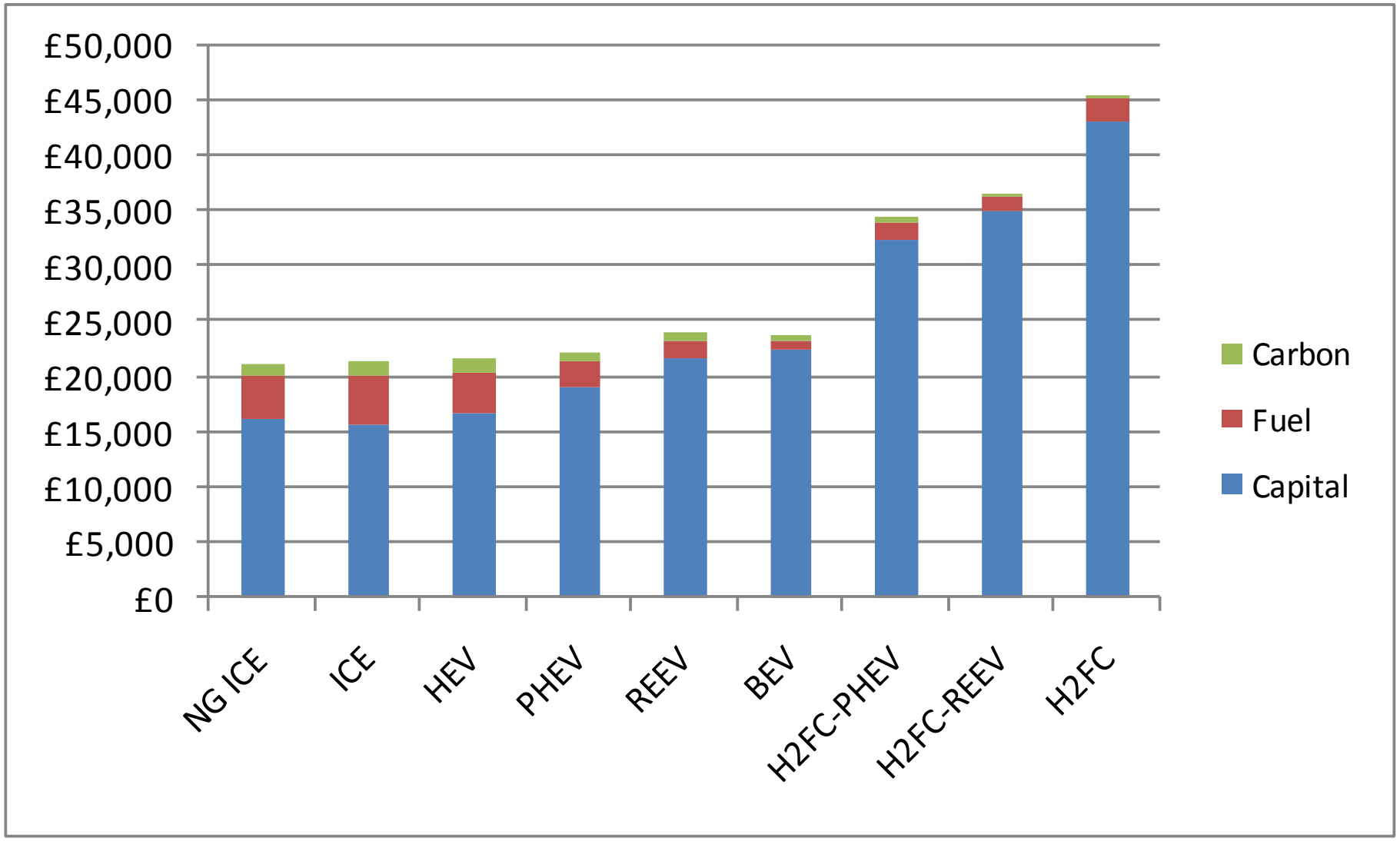
Approach to evaluating cost-effectiveness

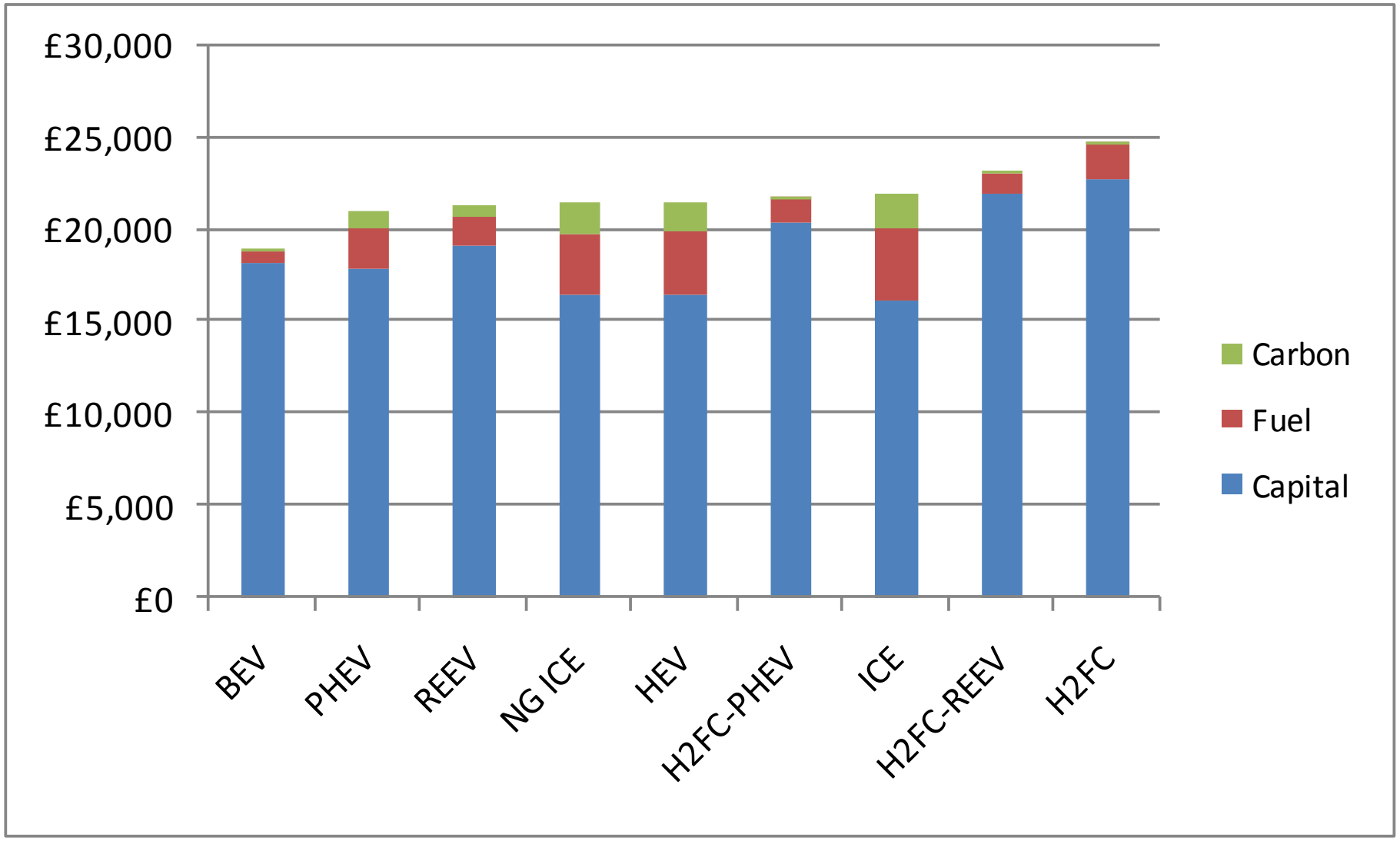
- A range of powertrain technologies, with different levels of CO2 emissions and lifetime costs, could be deployed over the period to 2050
- Need to prioritise those that achieve emissions reductions at lower economic cost
- To meet an emissions target in a given year, any CO2 emitted must be offset by a compensating reduction in CO2 elsewhere
- DECC's carbon prices represent the cost of this compensating reduction
- For two substitute technologies, the technology with the lowest total social cost (i.e. the sum of lifetime and carbon costs) is the most cost-effective



Car social costs (2020)



Car social costs (2030)



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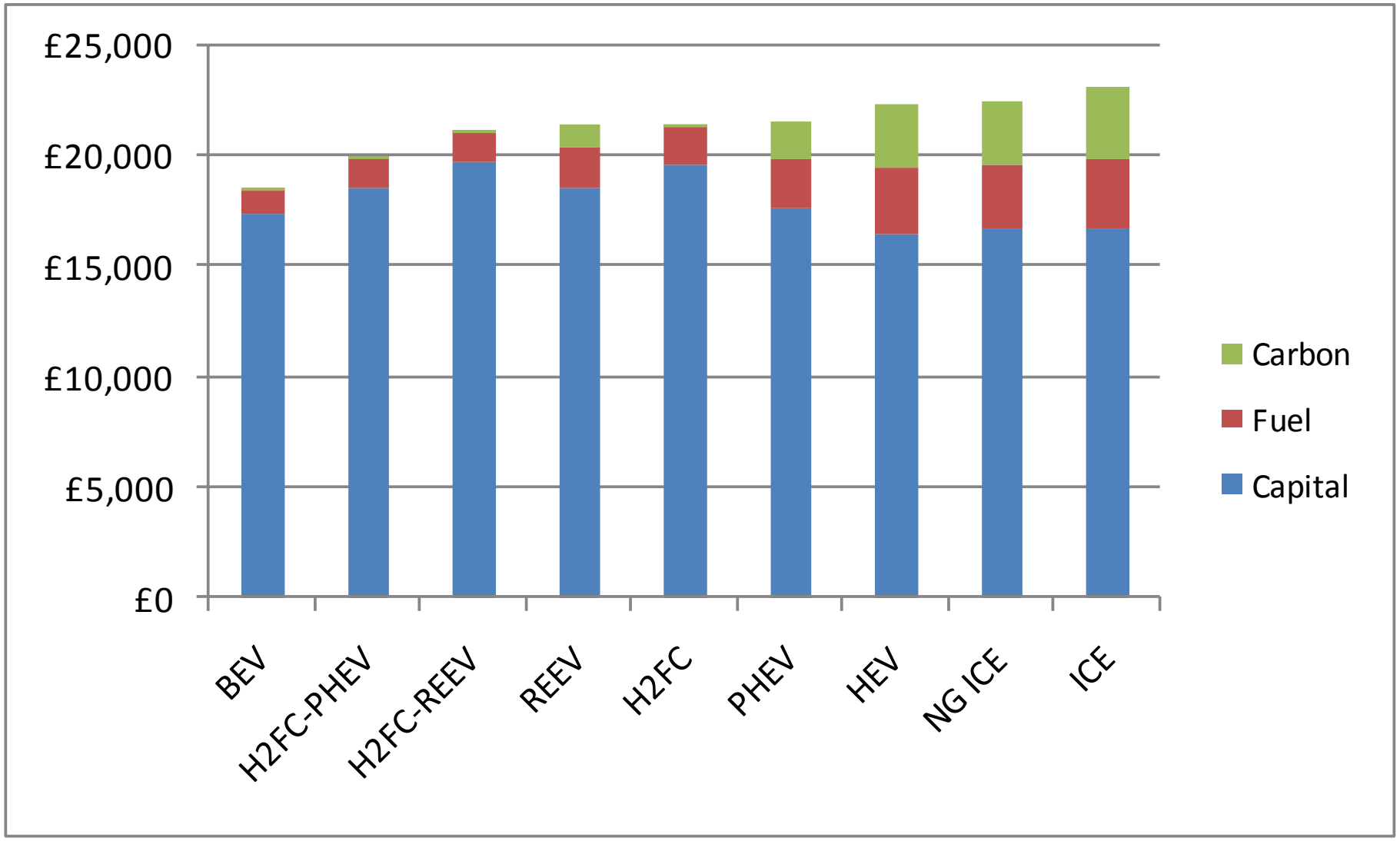
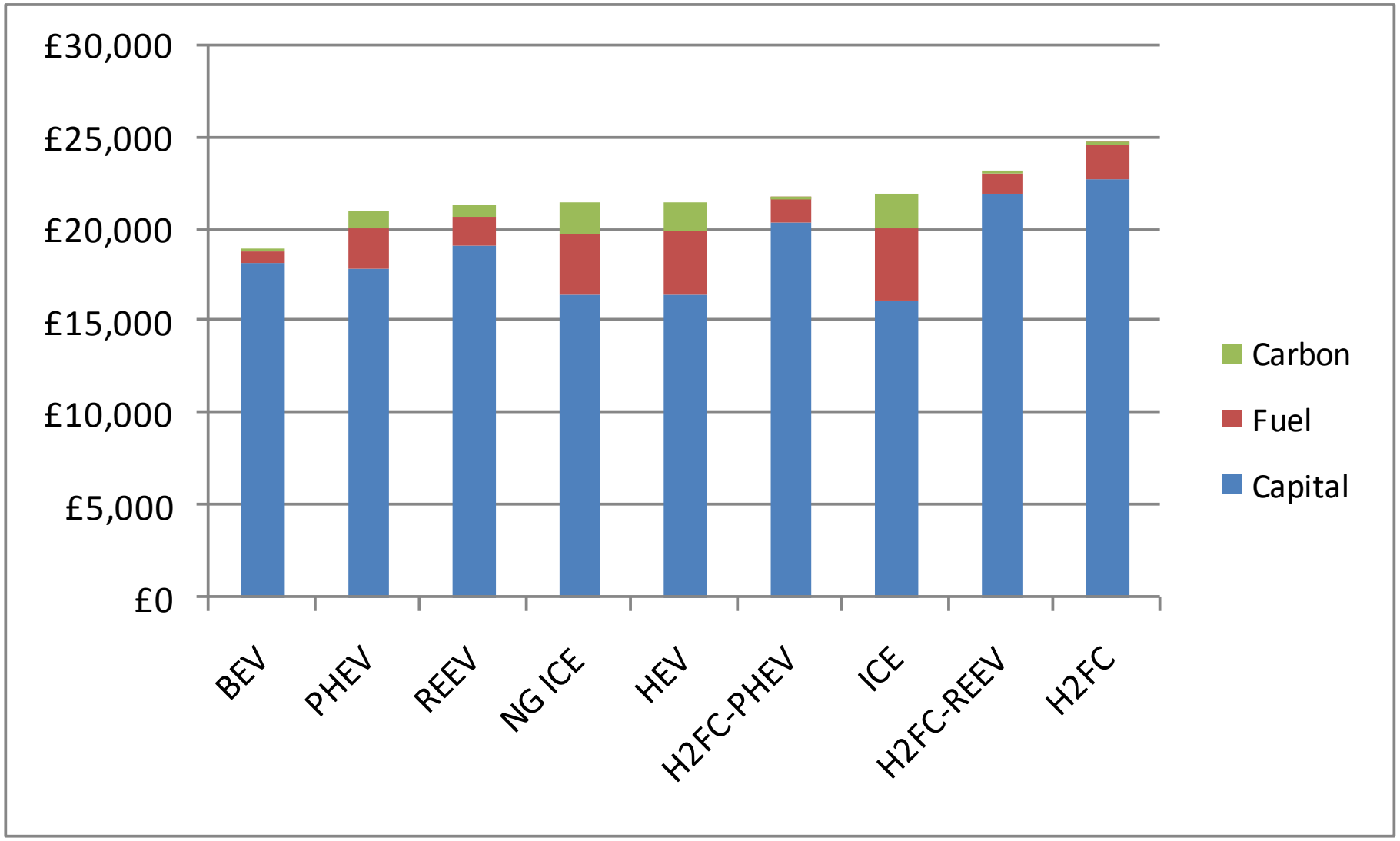


Car social costs with longer range BEVs (2030)



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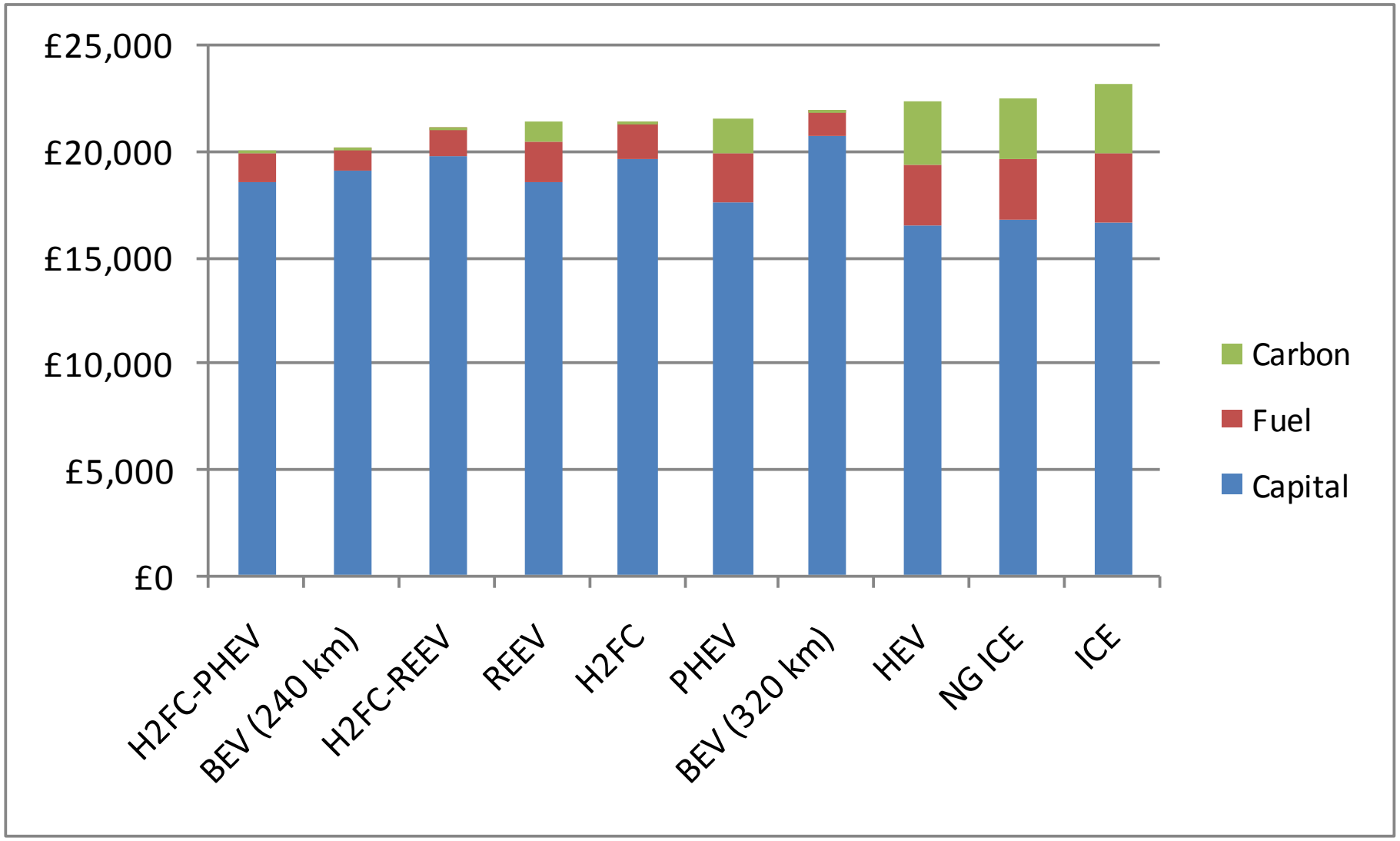
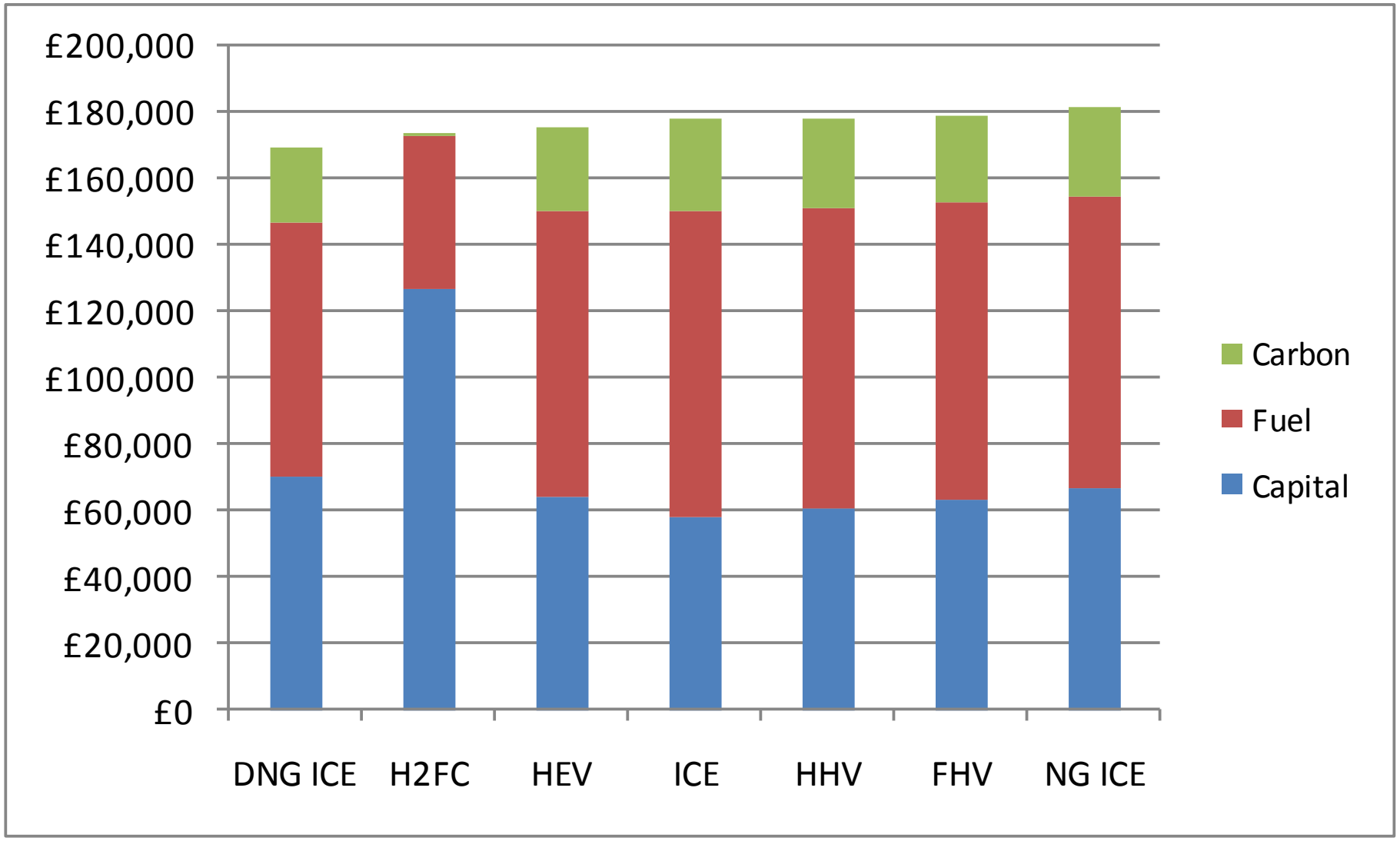


Large rigid HGV social costs (2020)



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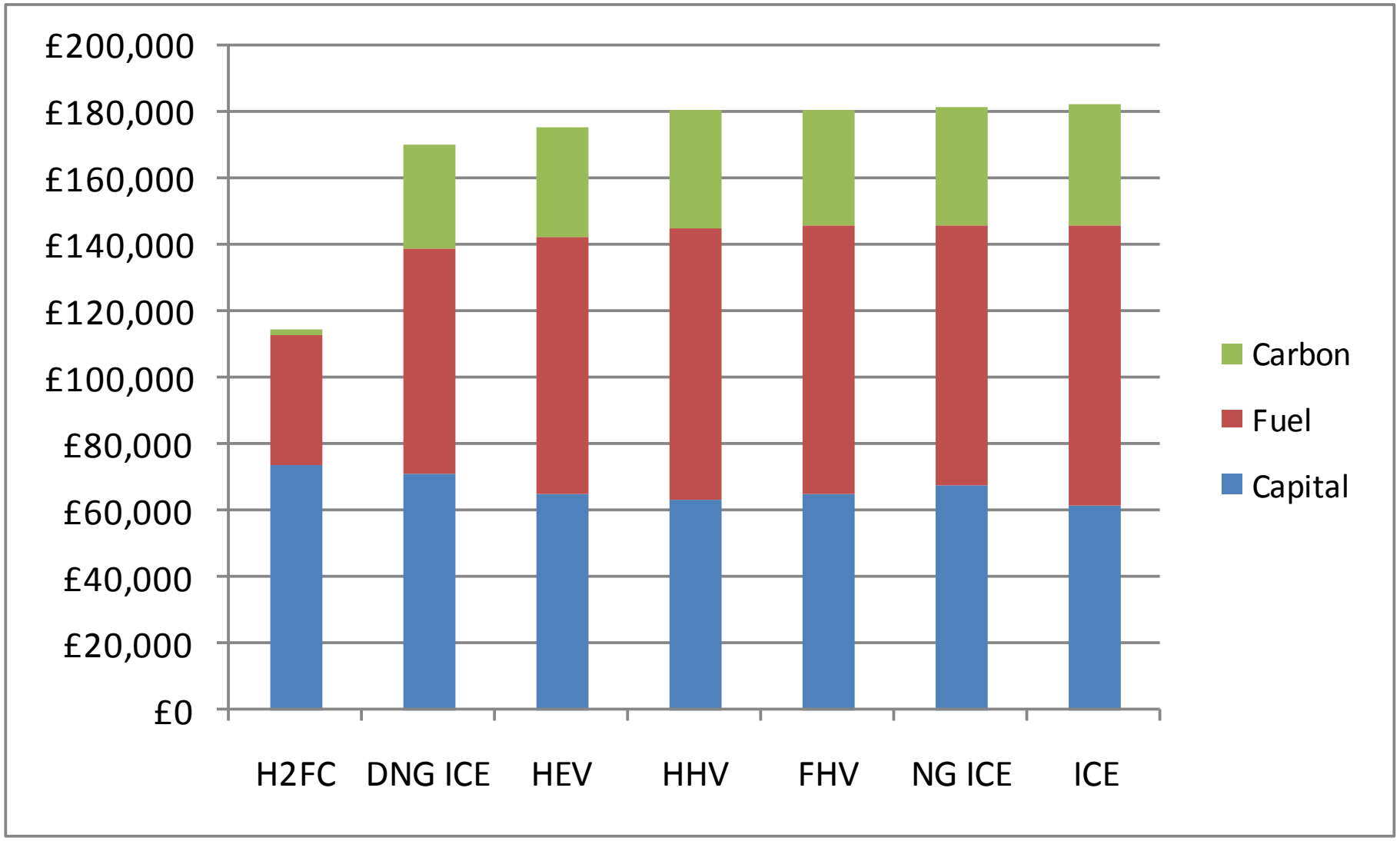

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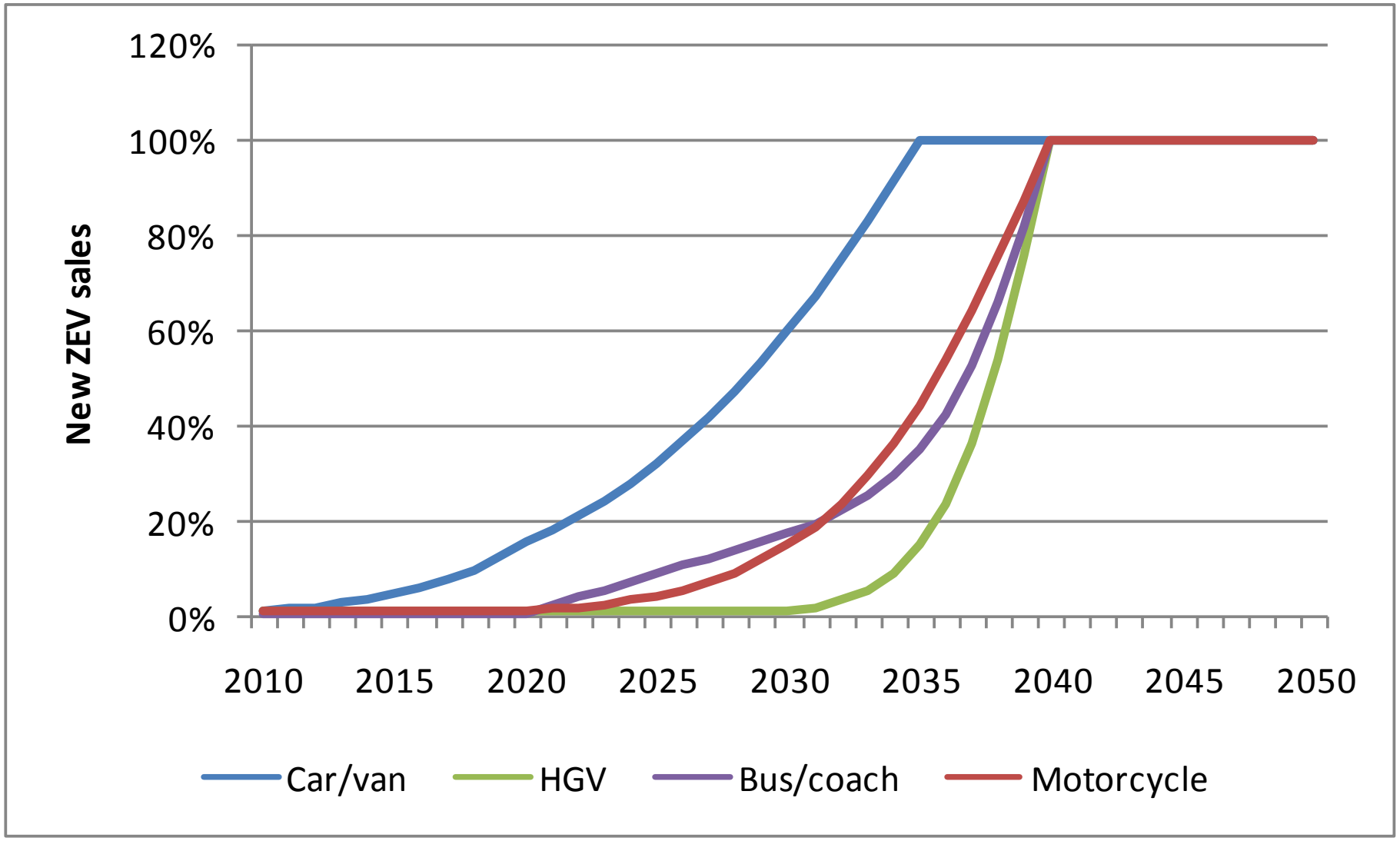
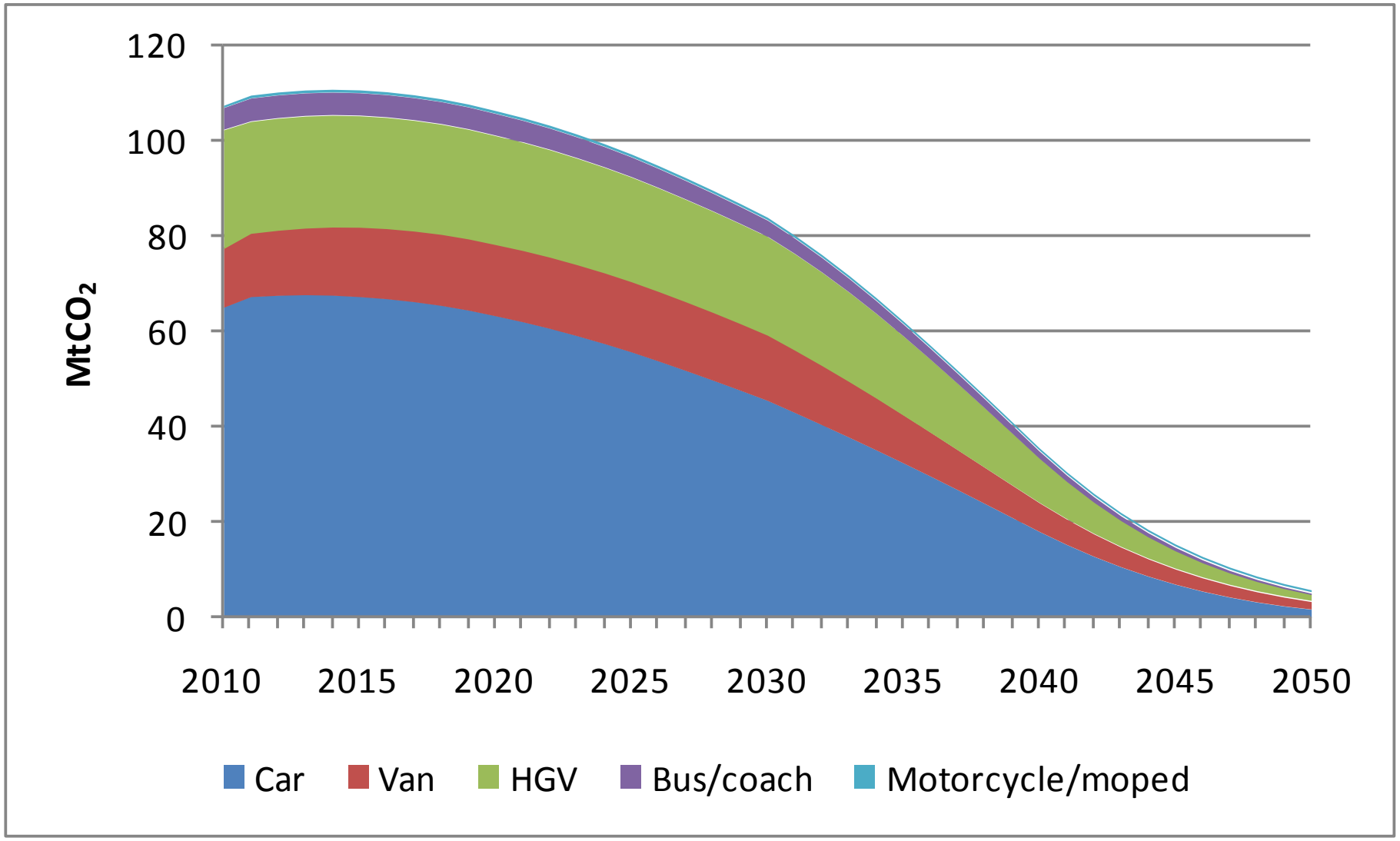
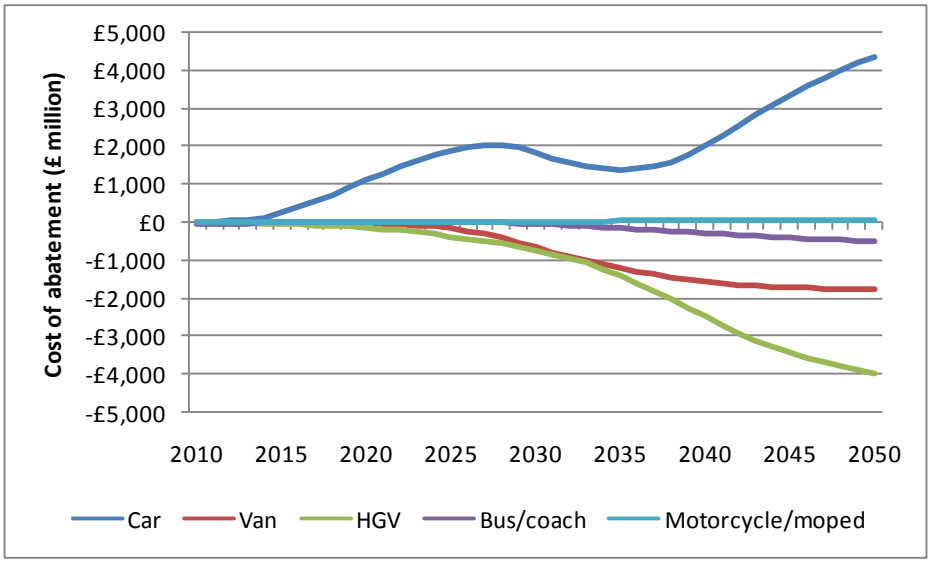
Deployment of zero-emitting vehicles

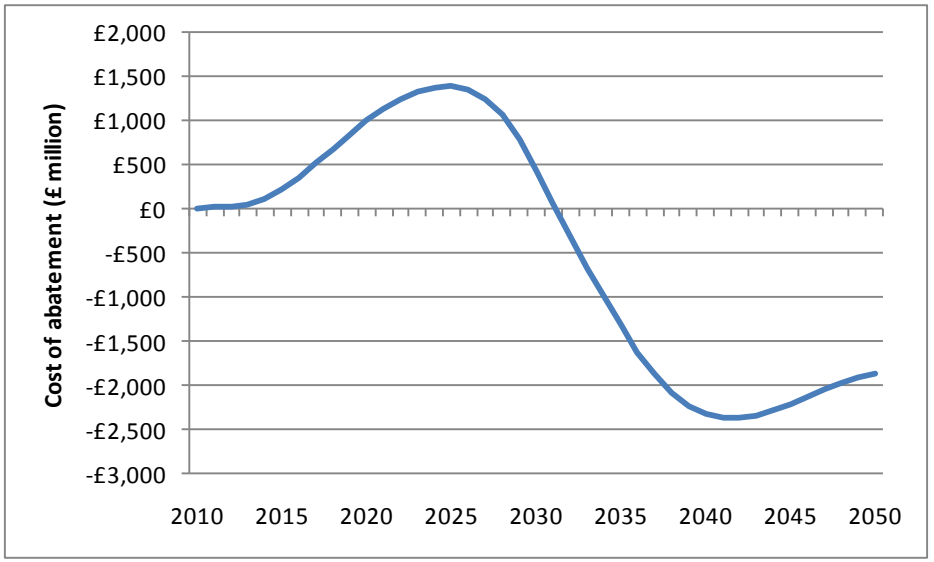


Road transport CO_2 emissions

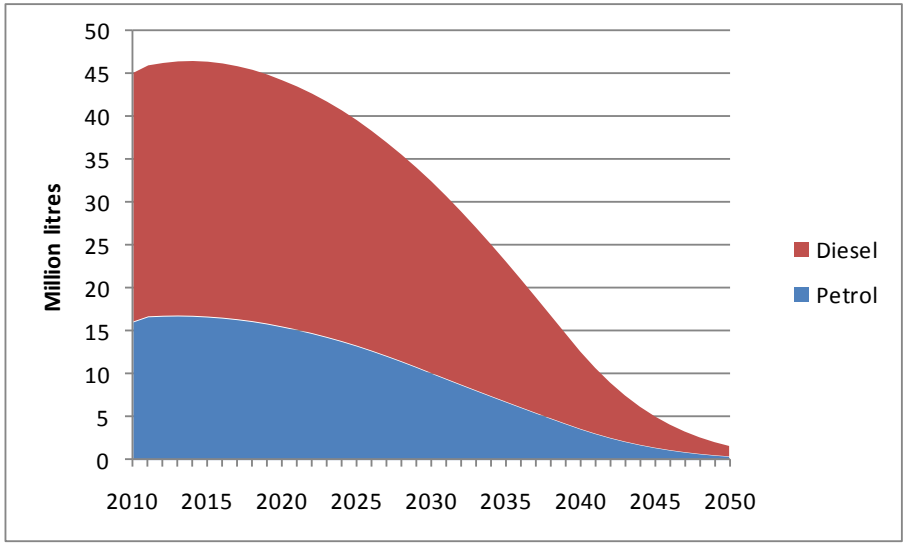


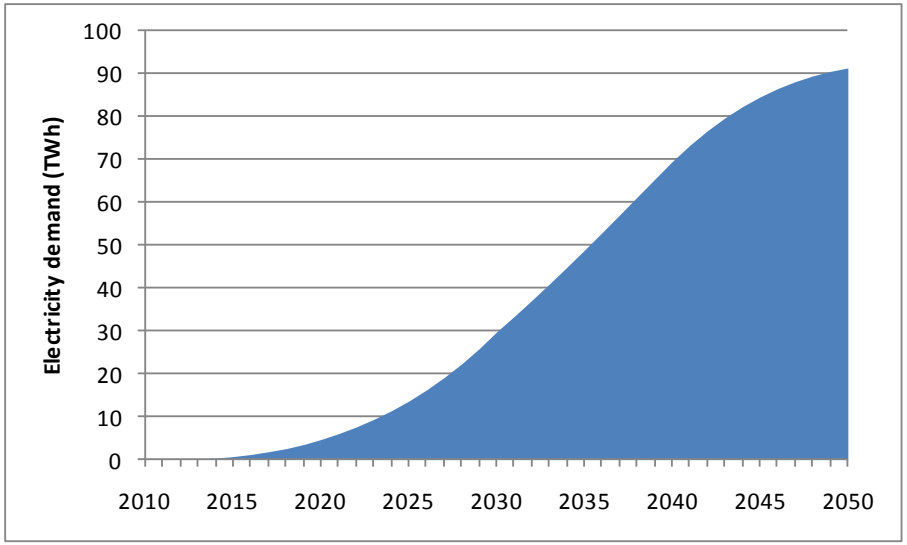
Road transport abatement cost

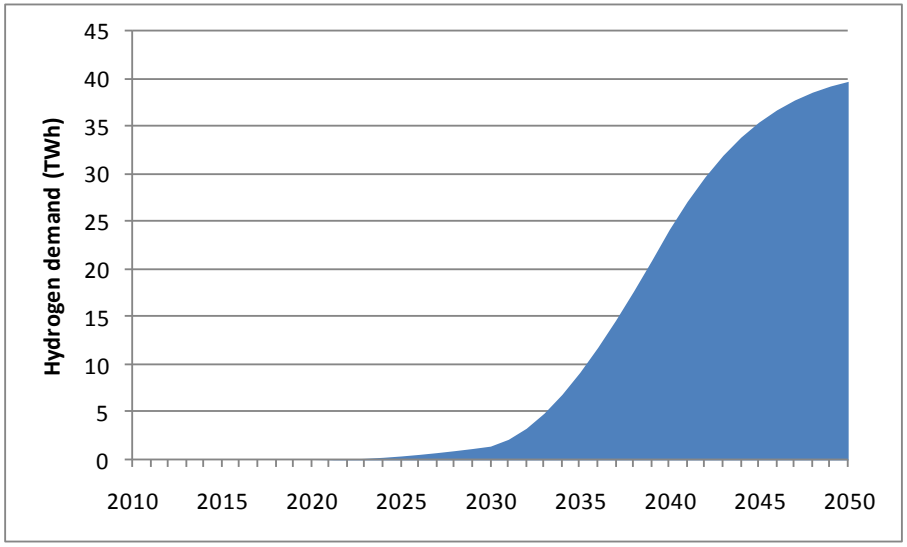




Road transport energy demand

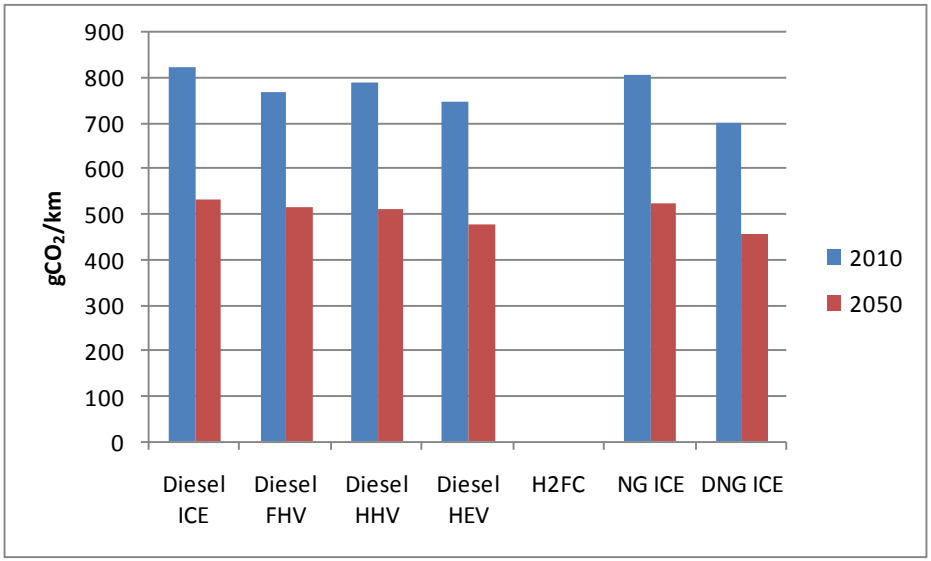


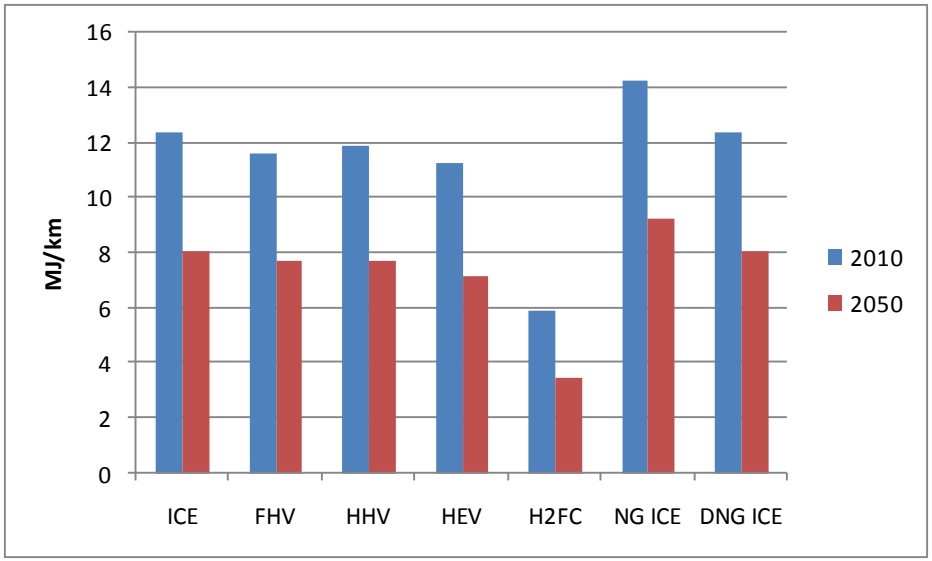




Annex: large rigid HGV data

Large rigid HGV fuel consumption and CO_2 emissions





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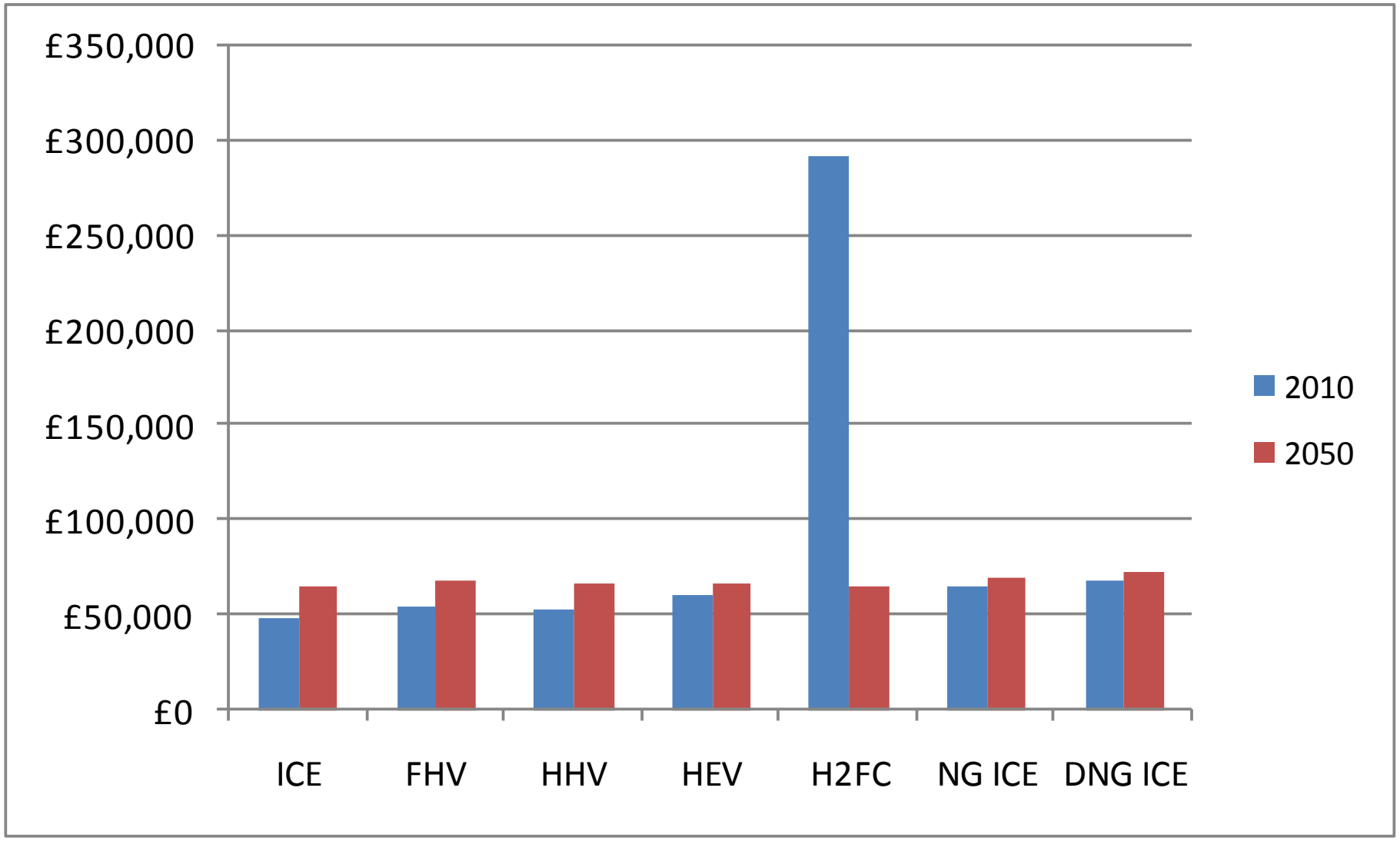

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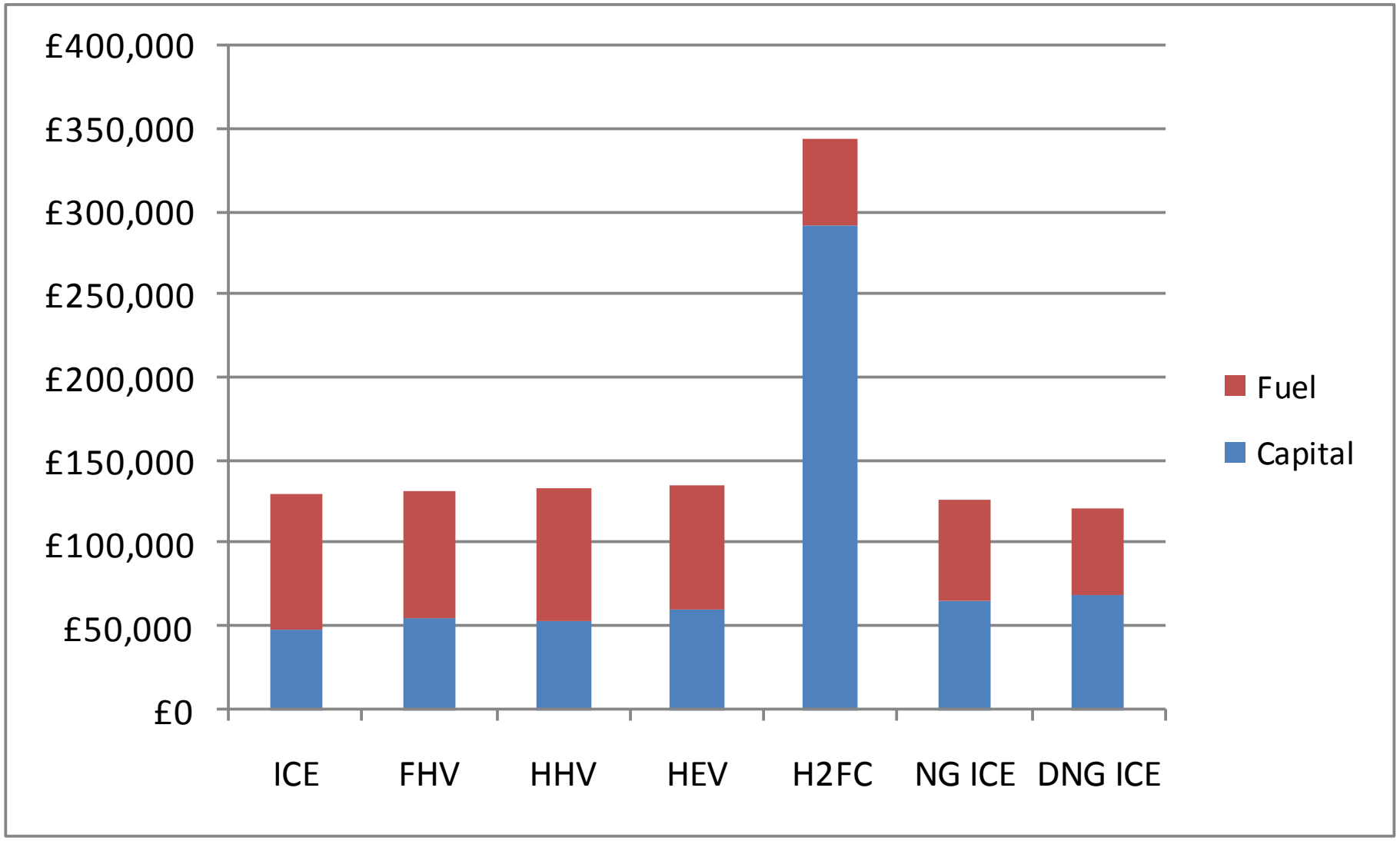
Large rigid HGV lifetime costs (2010)



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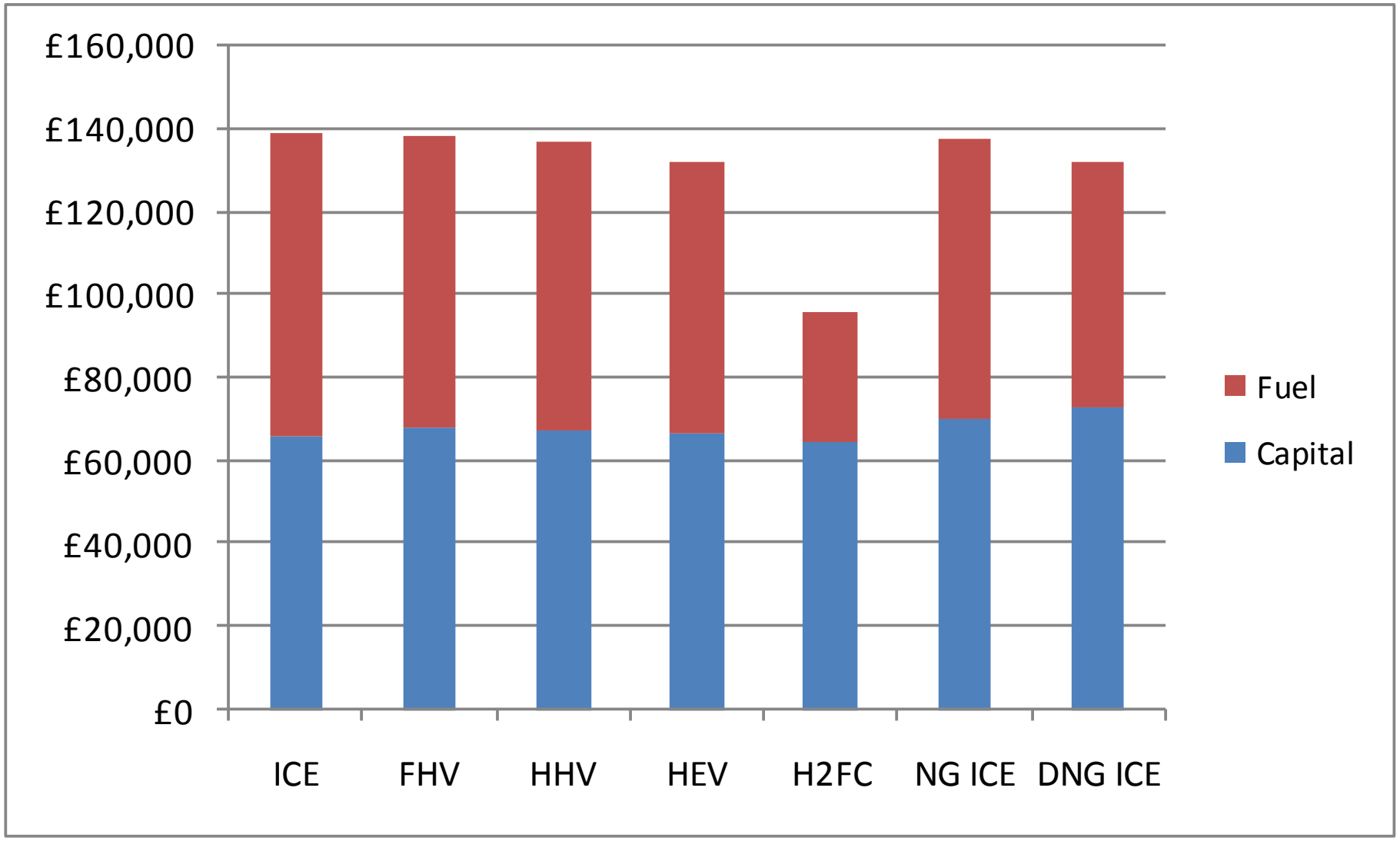
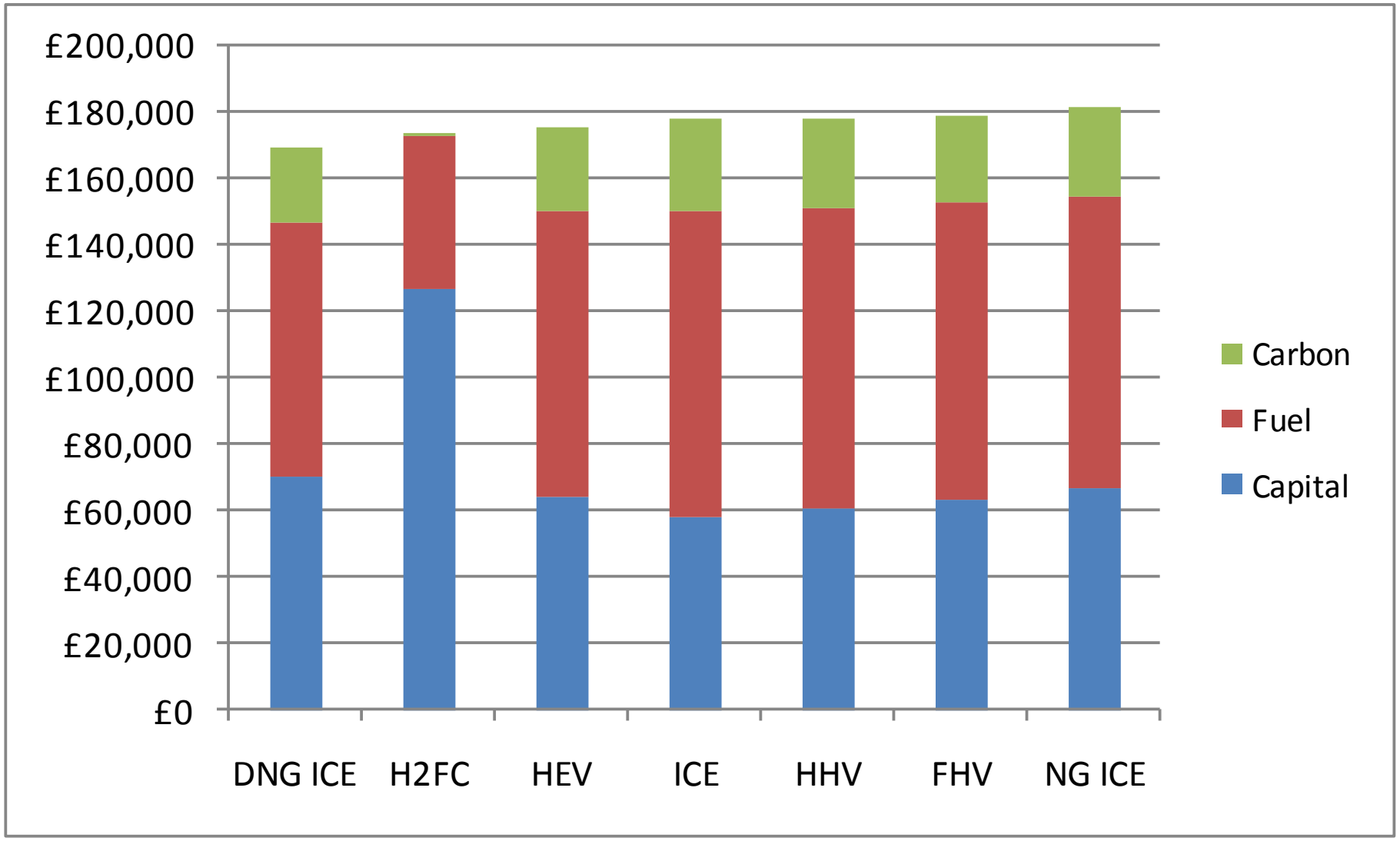


Large rigid HGV social costs (2020)



Large rigid HGV social costs (2030)