

Consultation on the End of New Diesel Sales In England

Bus Working Group

7th April 2021

Document prepared by Zemo Partnership



**Zemo
Partnership**

Accelerating Transport to Zero Emissions

www.zemo.org.uk

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Contents



1. Background, Assumptions & Zemo Partnership Proposal
2. The definition of what should be phased out?
3. When should that phase out date be?
4. What will be the impact of the phase out date?
5. What are the necessary conditions for a successful transition to a full green bus fleet?
6. What are the barriers to achieving the proposal?
7. What will the impacts be on different sectors of industry and society?
8. What measures are required by government to support this phase-out?

Starting Assumptions



- Zemo Partnership submission will be from the secretariat and will not seek to represent any single members views, we encourage members to submit their own views to DfT.
- Consultation relates to buses in **England only**.
- Coaches and minibuses are not included in these discussions.
- Phase out of diesel **is to encourage uptake of zero emission vehicles**, in line with government targets, rather than increase uptake of an alternative combustion technology.
- End of sales of new diesel buses **will not restrict the use of existing diesel buses** on local bus routes, or retrofitting of diesel buses with zero emission powertrains.

Existing Ambitions

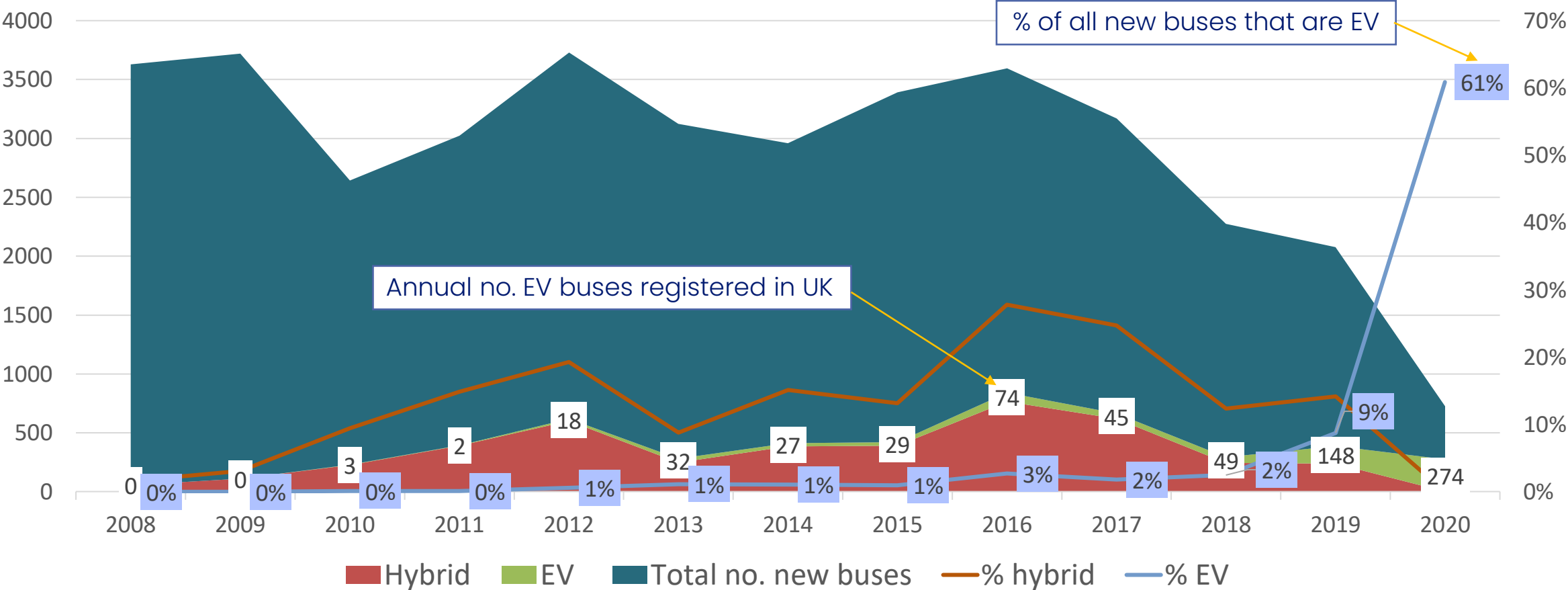


Already a number of declared existing commitments in UK

- Transport for London – Fully ZE fleet by 2037 at the latest (effectively an end of diesel purchase by 2022) – London key driver of UK market
- National Express – ZE bus fleet by 2030
- First Group – no new diesel buses after 2022
- CPT – All members purchase ULEBs from 2025
- Clean Air Zone – Minimum standard is Euro VI
- Zero Emission Zones likely to drive ZE uptake in future. (Oxford commences ZEZ in August, Mayor of London proposed central ZEZ in 2025)

UK Zero Emission Buses Uptake

Average of 157 ZE per year, over last 3 years



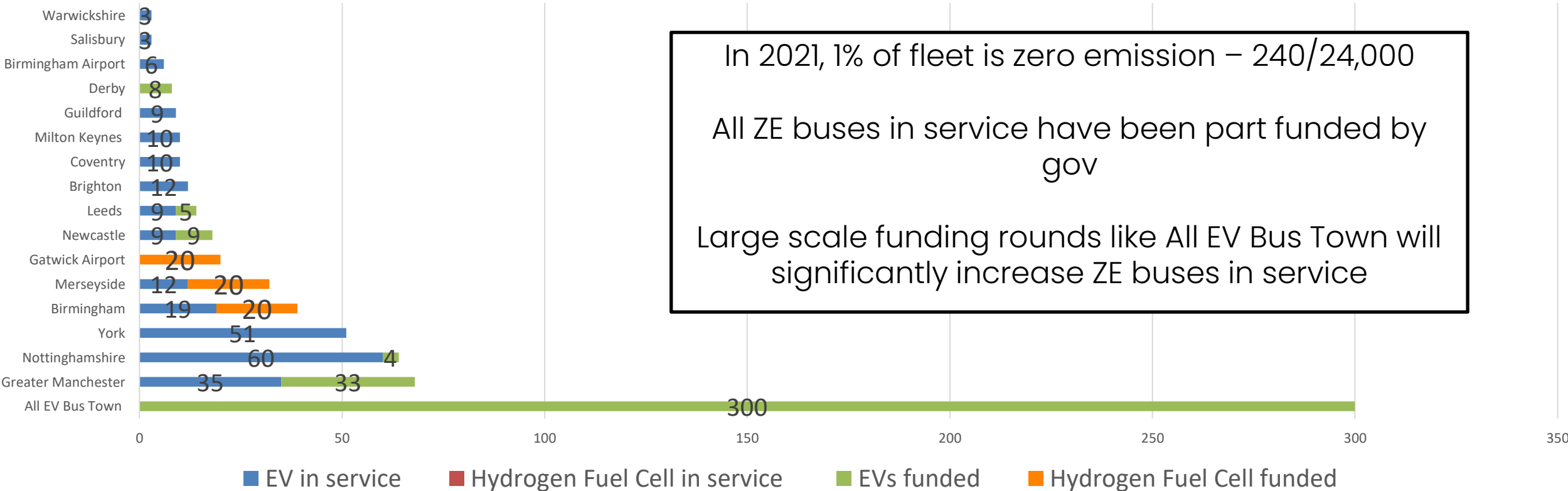
Existing ZE buses in England (excl London)



1% of fleet is Zero Emission end of 2020

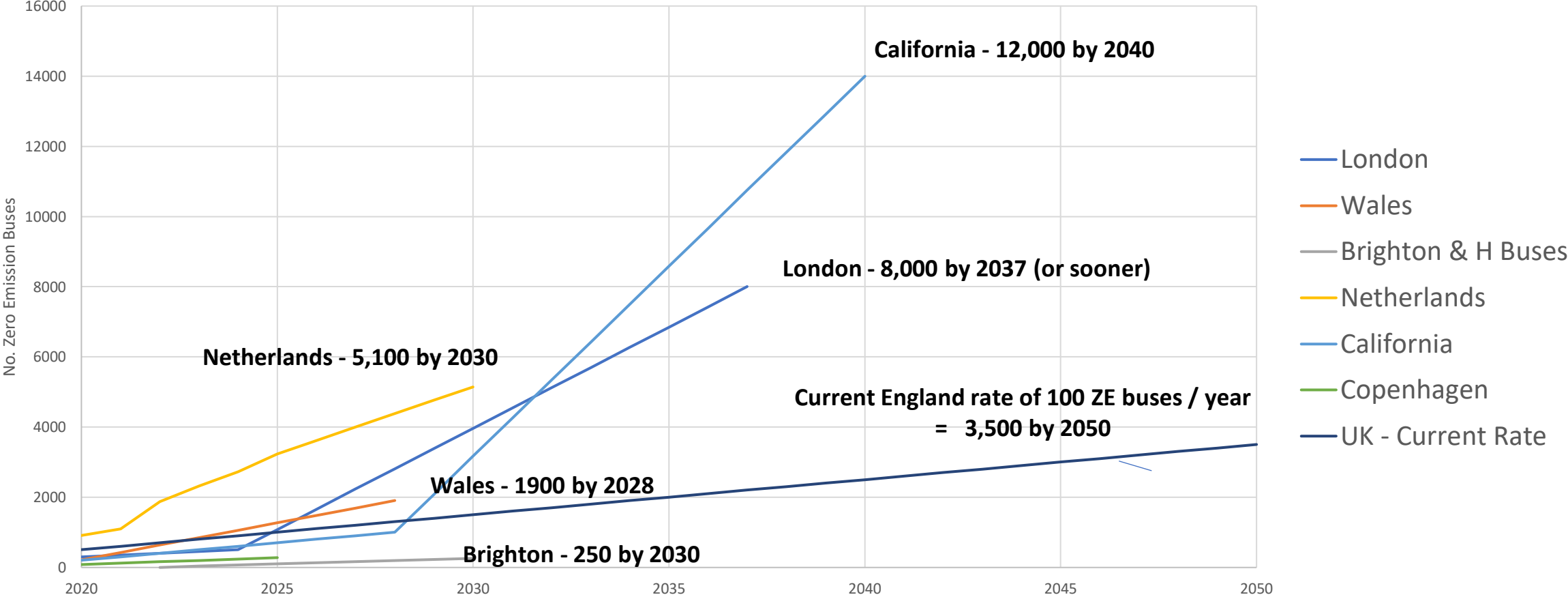
240 ZE buses out of 24,000 in England, outside London

Zero Emission Buses in England



Zero Emission Bus Fleet Targets

Examples from different fleets around the world

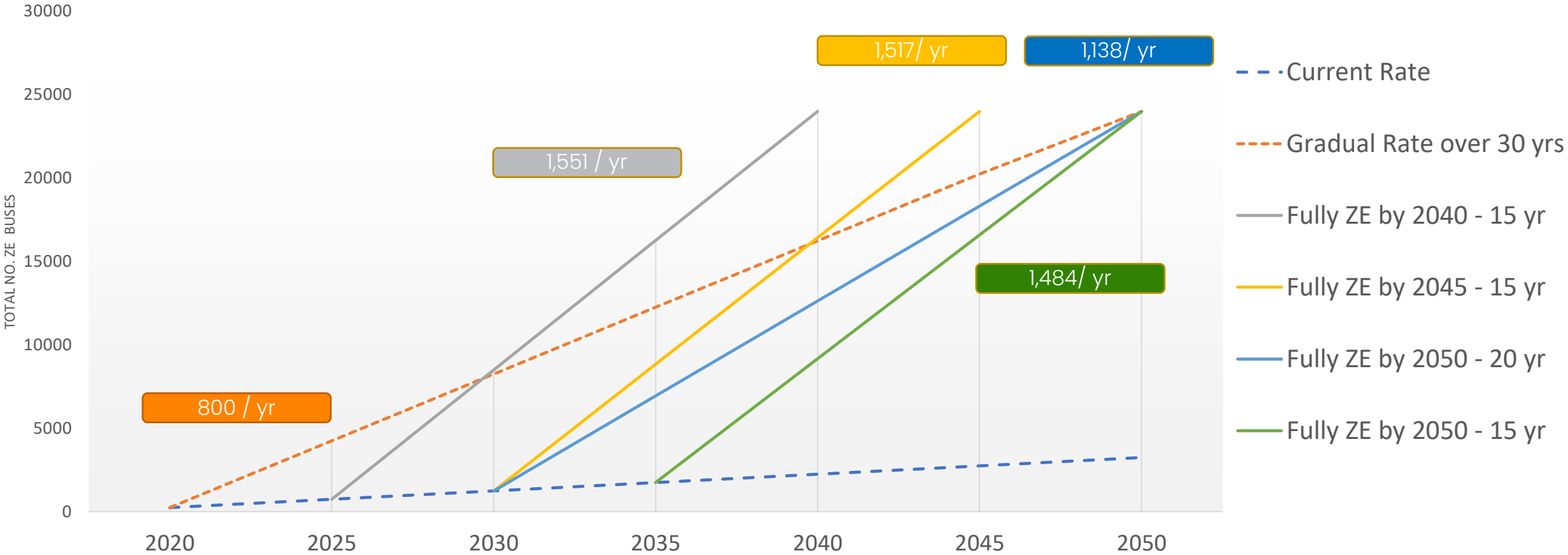


Fully Zero Emission Bus Fleet by...



Assume current rate for England is ≈ 100 ZE buses per annum

Fully ZE fleet by 2050 would require between 800 – 1,551 buses / year – subject to start date



Zemo Partnership Proposal

Positive and ambitious approach around potential of UK market



- Zemo Partnership propose that there should be no new diesel buses after 2029.
 - End of sale applies to all combustion engines, not just diesel
 - New urban buses (routes daily distance <200 kms) should be zero emission by 2025
 - New interurban /rural routes (routes greater than 200>kms) should be plug-in hybrids or fully zero emission after 2025.
 - All new buses from 2030 should be fully zero emission

Enablers



What needs to be true for this ambition to be delivered?

- Many aspects need to be in place to enable the shift:
 - Infrastructure
 - Capital grant funding to support with CAPEX
 - BSOG must incentivise ZEBs ahead of diesel (currently the opposite)
- Zemo response will aim to highlight these as critical precursors to enable the Diesel/ICE phaseout ambition.
- Members identified capital grant support as key to support transition, ZE buses & infrastructure are much more expensive (see cost paper attached with submission).
- Improving experience of bus users to increase patronage and change image of bus to current non bus users.
- Healthy bus market with increased bus patronage essential for subsidy free commercial operation of ZE bus fleet

The definition of what should be phased out?



Definition of what should be phased out?



- The DfT should phase out all internal combustion engine technologies, not just diesel.
- Euro VI standards that are currently in place for all ICE heavy duty vehicles, not just diesel, providing very low levels of tailpipe air pollutants.
- A end of sale of new diesel buses may drive operators to other combustion technologies, rather than zero emission.
- Euro VII is still in early stages of development and is not expected to demand a greater reduction in regulated air pollutants, rather a reduction in CO2 from tailpipe. i.e. will not drive significantly greater AQ improvements vs Euro VI
- There is a place in short term for hybrids with plug-in capability to drive infrastructure deployment (future proof) and “plug-in culture” where routes cannot be serviced by fully ZE buses.

Considering small vehicles as buses



Increasing interest in smaller buses for rural routes and urban demand responsive travel services

- There is growing demand for smaller vehicles, to support new innovative services such as DRT, as well as routes with smaller patronage e.g. rural services
- Currently only buses a passenger capacity of 22 or above are eligible for ZEBRA capital grants as well as BSOG support.
- Zemo believe that future grants should look to support these smaller vehicles in by extending the existing certification process to include these vehicles. Zemo have a proposal which would include testing smaller comparative diesel vehicles to ensure a clear understanding of impacts on GHG emissions and zero emission capability.
- There is also the option to scale existing support for smaller vehicles in the 9-22 seat range which could be explored.

**When should that phase out
date be?**



Phase out date



All new buses in 2030 to be zero emission / no new diesel after 2029

- All new buses should be ZE starting in 2030, 2025 for urban buses.
- ZE market for bus is still developing but market is moving from trials to full depot & fleet deployment of ZE buses.
- At least 8 different EV suppliers to UK currently (8 SD, 2 DD) increasing to 10 by 2022.
- New business models being deployed using green finance, however increased capital support still required at least 2025 as tech is still developing.
- Clear phase out date will support OEMs focus R&D on ZE solutions.
- The latest phase out date should be 2029, to ensure that all new buses from 2030 will be zero emission at the at the tailpipe.

**What will be the impact of the
phase out date?**



What will be the impact of the phase out date?



Clarity & Opportunity

- Sets clear ambition for market, driving investment and removes uncertainty
- Skills – opportunity to reskill engineers to work with HV bus fleets.
- R&D – OEMs will focus investment on ZE technologies
- Working conditions – improvements for drivers and staff (AQ, Noise, depot etc)
- UK market reputation on world stage as place for developing ZE models.
- Buses will leverage wider electrification of other vehicles through grid reinforcement and opportunities for 3rd party charging.
- Challenges around value of existing diesel buses assets which will likely affect smaller operators with smaller cash reserves

GHG savings & AQ savings

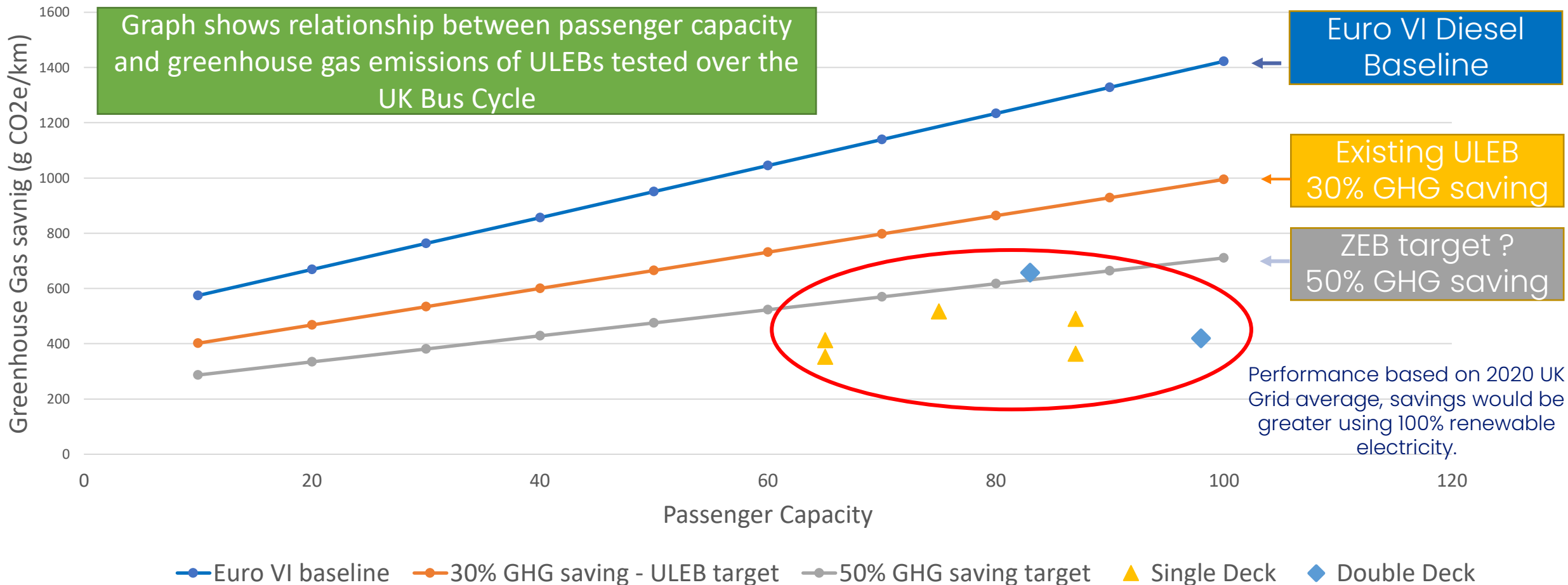


Clear benefit to AQ with zero emission at tailpipe, **however GHG savings are not guaranteed for all technologies**

- Zemo Partnership has supported DfT's funding rounds with testing and certification of buses to ensure robust products and to guarantee well-to-wheel (WTW) GHG savings compared with existing diesel fleet.
- Low Emission Bus (LEB) = 15% WTW GHG saving vs Euro V
- Ultra Low Emission Bus (ULEB) = 30% WTW GHG saving vs Euro VI
- Zemo now developing definition of an ultra low emission bus, consulting with Bus Working Group as to target of 30-50% WTW GHG saving
- Zemo have also started investigating LCA with an internal model to understand the embedded carbon of batteries and other new components with ZE technologies
- [See more info on website for certification and testing info.](#)

Greenhous Gas Saving from Electric Buses

Through the Ultra Low Emission Bus scheme testing requirements we know that all electric buses tested provide between 49%-70% GHG saving using UK grid average electricity – **No hydrogen buses tested to date.**



Estimating Hydrogen Fuel Cell Performance



No hydrogen bus tested to date over UK Bus Cycle, however some early trial data is available for fuel consumption

- Single Deck HFC fuel consumption – 6.5kg / 100km – 7.8 MJ/km
- Double Deck HFC fuel consumption – 8kg / 100km – 9.6 MJ/km

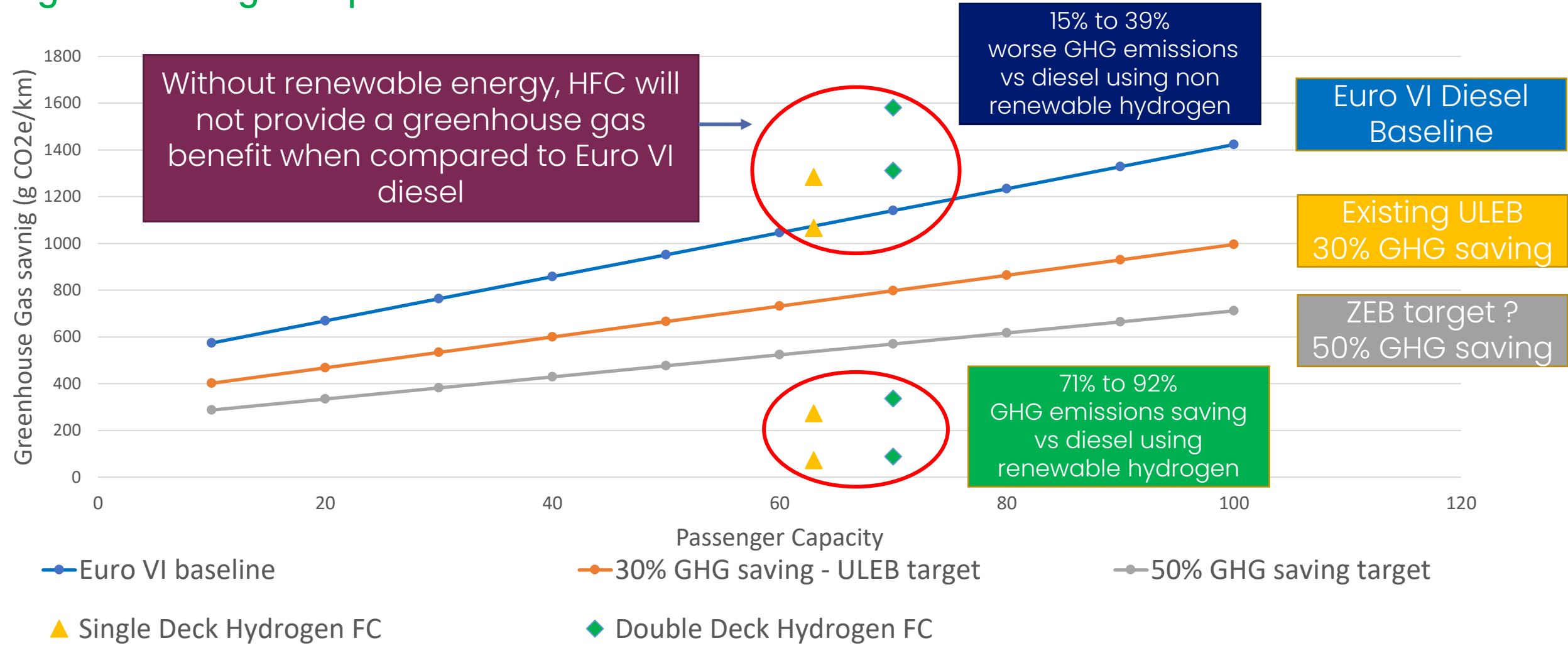
Zemo Partnership have calculated GHG emissions from different hydrogen production pathways:

Hydrogen Production method	<u>Zemo Partnership calculated</u> Greenhouse Gas Emissions per unit of energy (g CO ₂ e/MJ)
Electrolysis – UK Grid	164.6
Electrolysis – Renewable Tariff	9.1
Steam Methane Reformation – Fossil Gas	136.5
Steam Methane Reformation – Green Gas + Carbon Capture and Usage/Storage	35

No UK emissions factors for hydrogen produced by BEIS to date – expecting one sometime in 2021

Renewable energy essential for GHG benefit for hydrogen Zemo Partnership

Encouraging use of renewable fuel will ensure both air quality and greenhouse gas improvements from ZE fleet



Estimated GHG savings from Electrification and role for high-blend biofuels



Zemo Partnership modelled impact of high blend on cumulative GHG emissions of bus and coach market

- Zemo modelled the impact of B30 in bus and coach fleets in opportunities to decarbonise HGVs report (B30 is effective limit for FAME biofuel without significant changes to bus engine and fuelling system)
- Model assumed fully ZE bus fleet by 2035, with fully ZE coach fleet by 2040.
- Model estimated that by 2050, electrification will have reduced cumulative well-to-wheel greenhouse gas emissions from the bus and coach fleet by 43%
- High blend biofuels could contribute a further 16% GHG savings at a blend level of 30%.
- Deploying HVO at 100% replacement rate with fossil diesel could contribute significantly more GHG savings



[Report available here via Zemo website](#)

Modelling impact of electrification and B30



Table below indicates cumulative GHG emissions from both UK bus and coach fleet.

WTW GHG (MTCO ₂ e)	2030	2040	2050
Do nothing baseline	47	87	126
Electrification without HBRF	45	66	72
Electrification with HBRF	42	52	54
HBRF savings	3	14	17
Electrification savings %	5%	24%	43%
Further HBRF savings %	7%	16%	14%
Combined savings %	12%	40%	57%

[Report available here via Zemo website](#)

**What are the necessary
conditions for a successful
transition to a full green bus
fleet?**



What are the necessary conditions for a successful transition to a full green bus fleet?



Driving modal shift so industry can support itself!

- Fast transition will require greater support from government – slow transition will be dependent on healthy bus market.
- **Short term** support for purchase, especially with infrastructure will be needed till 2025 at least, while business models adapt.
- Gov has both capital grants and BSOG at disposal – ZE must be more attractive financially through all incentives.
- **Long term**: Government needs to develop holistic policies which drive increase in bus patronage and away from car so industry can support itself. **Right vehicle for the journey**: Public should be encouraged away from private cars in cities e.g. park and ride

**What are the barriers to
achieving the proposal?**



What are the barriers to achieving the proposal?



Barriers to ZE vehicle adoption are well known, grants are essential

- Bus patronage has been falling consistently over last half century, less money for operators to reinvest in new technology.
- Covid messaging has damaged public transport image and balance sheets.
- ZE buses are a better product vs diesel but require increased investment compared with existing business models.
- Diesel vehicles and fuel remains lower cost vs new technology (no new ZE buses without gov support to date).
- Culture – industry is confident with diesel, not so with new technologies (however Zemo P does not believe the technology is a barrier itself, rather cost and supporting infrastructure).
- Infrastructure – new additional costs for grid upgrade & charging /refuelling
- Risk around technology obsolescence – hesitancy from operators as cost & performance of new tech over 15 year lifetime not proven

Costs

Increased CAPEX & battery replacement major barriers

- Major barrier as with all new ZE technologies is higher upfront cost of vehicles, cost of battery replacement at mid life & cost of infrastructure
- ZEBRA scheme can support with upfront cost & BSOG could be structured to support battery replacement at mid life – BSOG could be tailored to support ZE retrofit also
- Investment in infrastructure should drive opportunities for 3rd party charging at/near depots to support other vehicle types. Large depots will need £1m+ of investment
- Zemo have submitted a cost paper alongside this submission to provide greater insight into up front costs of ZEBs and infrastructure.

**What will the impacts be on
different sectors of industry
and society?**



What will the impacts be on different sectors of industry and society?



Buses will leverage wider rollout of ZE vehicles

- Infrastructure rollout will support other ZE vehicles
- Towns and cities will benefit from air quality improvements
- New jobs created through manufacturing & aftermarket skills
- Users benefit from improved bus experience – bus priority measures are essential to support this.
- Any target ahead of 2030 will give positive modern perception of bus compared with other vehicle sectors
- Provide confidence to other markets that transition to ZE technologies is achievable.

Legacy market and ZE retrofit



An end date will likely cause a spike in diesel registrations – ZE retrofit could be a solution to increase rate of transition to fully ZE fleet

- There is a significant portion of services operated using older diesel buses, with many small operators only ever purchasing second hand vehicles.
- An end date is likely to cause a spike in the sale of diesels. Once no new diesels are available there may be a rise in the cost of second hand vehicles, both from upfront cost and with maintenance (spare parts become rarer).
- There is concern within the market about how smaller operators will be able to afford either more expensive second hand diesels or zero emissions technologies and infrastructure.
- There may be a role for government to support this second hand market through zero emission retrofit scheme – something Zemo Partnership has proposed to develop with the Green Bus Policy Team and JAQU, building on previous retrofit schemes.

**What measures are required
by government to support
this phase-out?**



What measures are required by government to support this phase-out?



Clear & consistent messaging and incentives to support investment certainty and confidence in market and new technology

- Positive public messaging campaign around bus use
- Incentive structure for bus must support shift away from diesel to bus.
- Role for high blend biofuels in short-medium to decarbonise legacy diesel fleet.
- Clear and consistent incentives between now and end date of new ICE buses.
- Wider incentives for shift away from car into bus for city centre travel
- Broader definition of “bus” to embrace smaller DRT solutions within the ZEB mandate
- Ambitious ZEZ policy environment (ZE Taxis policies etc)



Zemo Partnership

Accelerating Transport to Zero Emissions

Thank you

Any questions? Please get in touch

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