

Zero Emission Repowers

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Bus Working Group

Document prepared by Zemo Partnership

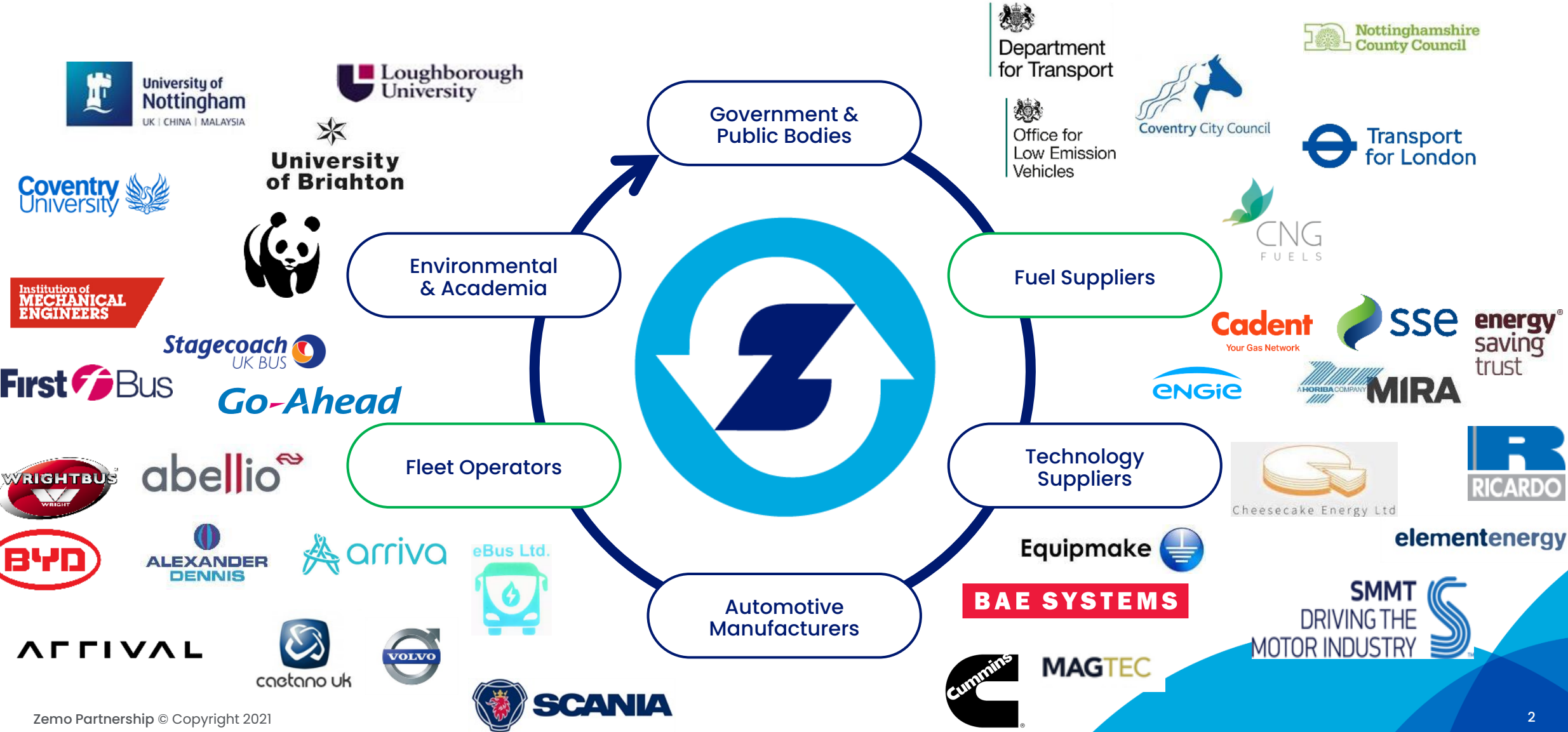
Bus Decarbonisation Workshop

2nd February 2022



**Zemo
Partnership**
Accelerating Transport to Zero Emissions


We are a **public-private partnership** between UK Government and industry helping to **accelerate the shift to a net zero transport system in the UK** through policy development



Our working groups





Working Groups are at the heart of our member action on buses, passenger cars, fuels, commercial vehicles and energy infrastructure.



Buses

Action programmes to speed the introduction of zero emission buses in the UK by working with passenger transport companies and local authorities



Daniel.Hayes@zemo.org.uk



Cars

Working with manufacturers, fleet operators, environment and consumer groups to accelerate the adoption of zero emission cars.

Alexander.Thomson@zemo.org.uk



Fuels

We explore measures to increase the adoption of sustainable low carbon fuels such as biofuels and renewable hydrogen.


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Commercial Vehicles

For manufacturers, freight transport operators, technology suppliers, technical expert and others interested in accelerating the transition to cleaner, greener road freight.

Brian.Robinson@zemo.org.uk



Energy Infrastructure

Formed to make suggestions to Government and industry to ensure that the GB energy system is ready for and able to facilitate and exploit the mass take up of electric vehicles.

Jonathan.Murray@zemo.org.uk



Collaborative Initiatives

Joint working group projects where content crosses over, overseen by the members' council.

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UK Zero Emission Buses Uptake

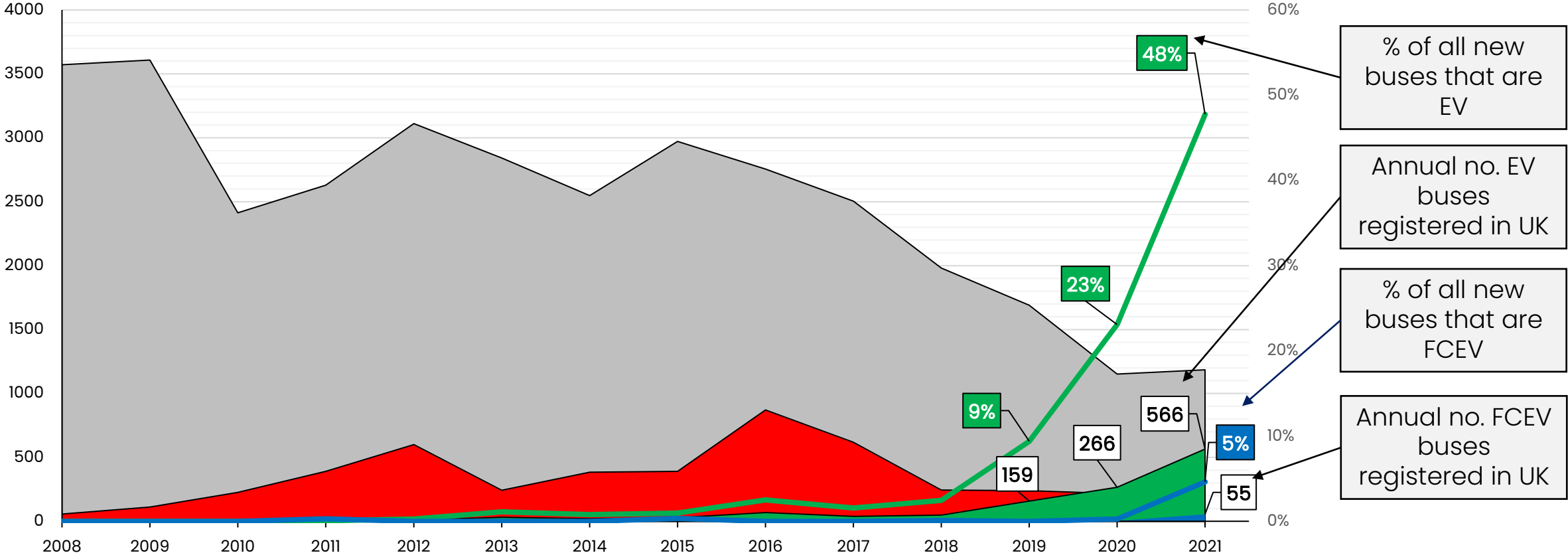


Average of 350 new ZEBs per year over last 3 years (2019-2021)

621 ZEBs in 2021. This equated to 53% of total bus uptake in the UK in 2021.

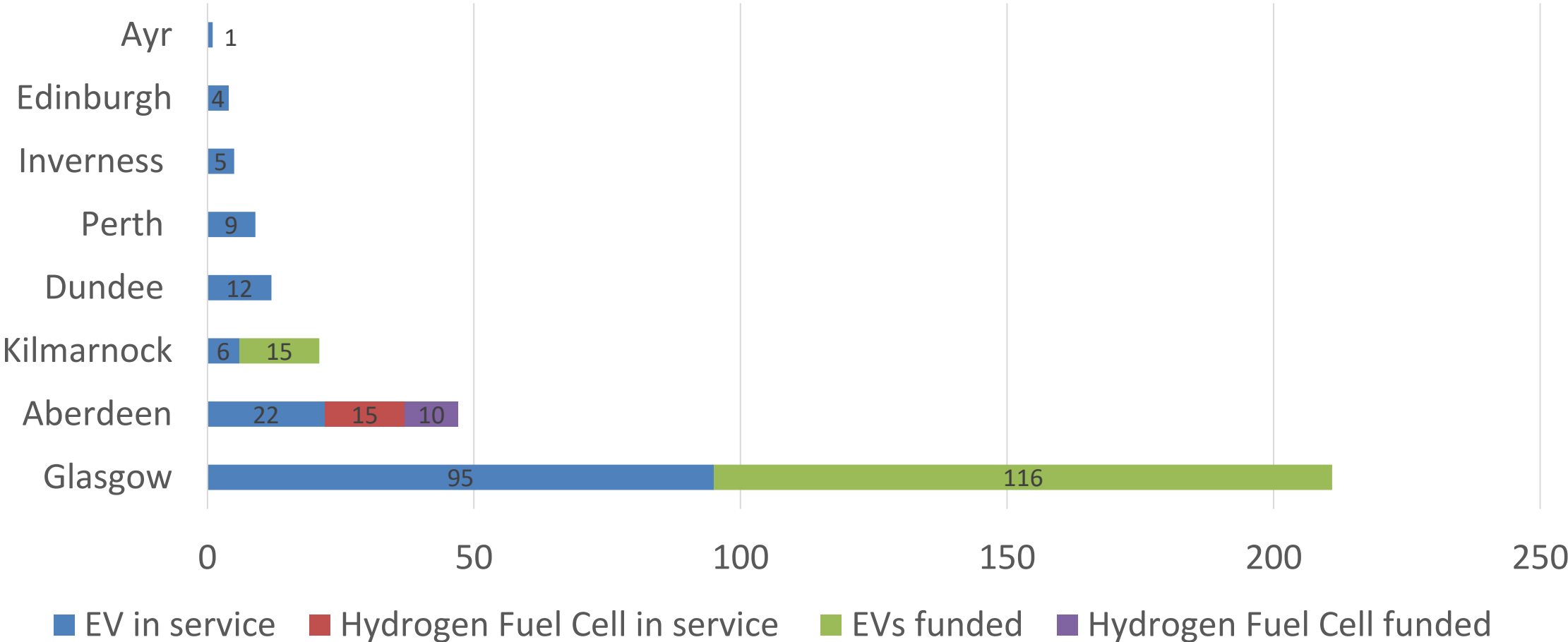
New Bus Registrations inc. Hybrid, EV and Hydrogen

Total no. new buses
 Hybrid
 EV
 Hydrogen
 % EV
 % Hydrogen



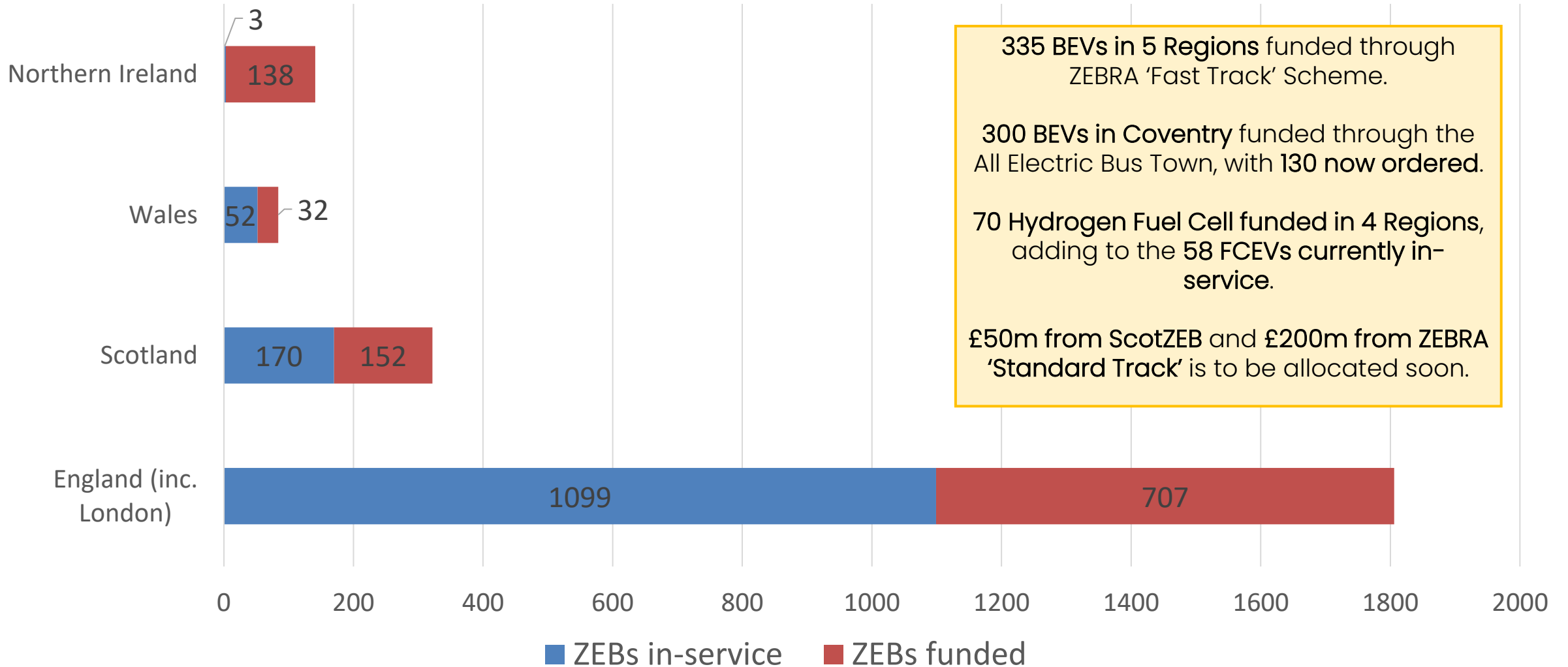
Scottish Zero Emission Buses

170 ZEBs in service, 152 ZEBs with funding



In-Service and Funded ZEBs in the UK

1,324 ZEBs in service, with a further 1,029 ZEBs funded



What role can Zero Emission Repower play in achieving net-zero ambition ?



ZE Repower could accelerate UK transition to net-zero emission bus fleet

- UK governments investing heavily in shift to zero emission bus fleets & supporting infrastructure.
- Operators have a **large number of mid-life diesel vehicles** with declining residual values following introduction of Euro VI requirements for Clean Air / Low Emission Zones.
- However, existing ZEB funding and incentive schemes **available to new buses only**, which is a challenge for smaller operators who cannot afford to buy new even with grant support.
- At **a lower CAPEX investment**, Repower offers an opportunity to potentially reduce costs for operators & reduce emissions from existing fleet.

Following information taken from Zemo's paper on Zero Emission Bus Repowers

[Available via zemo.org.uk](https://zemo.org.uk)

What is a Zero Emission Repower ?

Moving on from air quality retrofits to zero emission repowers

Retrofit – SCR Exhaust Aftertreatment for reducing tailpipe emissions to Euro VI

Zero Emission Repower – Replacement of diesel powertrain with ZE powertrain



Complete removal of diesel powertrain to be replaced with ZE powertrain

The advantages of Zero Emission repowers

Accelerate AQ improvement & Decarbonisation; Infrastructure & Skills



Advantages for Governments:

- Accelerate decarbonisation of existing fleet & reduce direct tailpipe emissions.
- Supports development of UK supply chain.
- Driving zero emission skills development of technicians, installers and integrators.
- Reduce upfront grant payments, enabling deployment of private finance

Advantages for Operators:

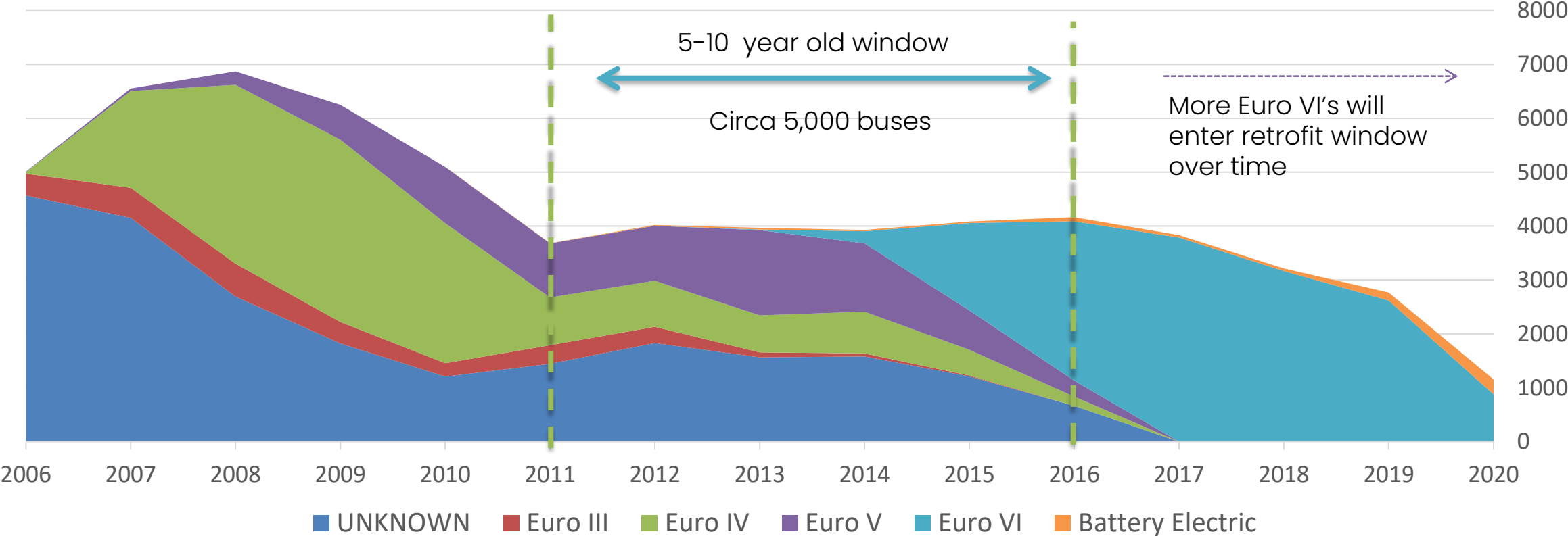
- Lower CAPEX investment vs new bus and OPEX due to lower running costs & maintenance .
- Improves residual value of second hand buses.
- Compliment future proofing of depots and improves economies of scale for hydrogen refuelling.
- Enables exposure of smaller operators to zero emission technologies.

Potential Market for ZE repowers in UK

Around 5,000 buses are in the right age profile to warrant investment



New Bus and Coach Registrations by Euro Standard (2006-2020)



Estimated potential 500-1000 diesel buses in the right age profile in Scotland

UK Repower Suppliers

Zemo identified 6 EV and 2 HFC repower suppliers for the UK.



Battery Electric (BEV)	Hydrogen Fuel Cell (FCEV)
Equipmake	Ricardo
Horiba-Mira	Arcola Energy / Ballard Motive Services
Magtec	
Mobiletron UK	
KleanBus	

Limited ZE repower experience to date



Existing ZE bus repowers have been sparse and ad hoc

Year	Operator	Funding	Vehicle Type	Repower Tech	No. Buses	Supplier	Battery Capacity	Estimate d Range (miles)
2015	Transdev & York CC	CBTF 2013-15	Euro II Dennis Trident	EV	6	Magtec	133kWh	76
2017	Big Lemon	Self-funded	Optare Solo	EV	2	Magtec	132kWh	100
2017	Oxford Sightseeing (Go-Ahead) & Oxford CC	CBTF 2017-19	Dennis Trident	EV	3	Magtec	160kWh	80
2019	Rotala/Diamond Bus & TfWM	CBTF 2017-19	Euro IV MAN Plaxton Centro	EV	5	Magtec	200kWh	130

- Main challenges include integration with existing systems, space for energy storage, vehicle availability. Key learning around balance between replacing older parts and maximising cost effectiveness of ZE repower.
- Technology has significantly improved since early repowers were deployed.
- Historic schemes were not designed to foster development of repower technology.

Future ZEB repowers projects

At least 3 suppliers with vehicles set to go into service in 2022.



Year	Operator	Funding	Vehicle Type	Repower Tech	Quantity	Supplier	Battery Capacity	Estimated Range (miles)
2021/22	N/A	Self-Funded	Single Deck	EV	1	Equipmake	271 kWh	150
2021/22	Stagecoach	Tees Valley R&D	Double Deck	HFC	1	Ricardo	TBC	TBC
2021/22	N/A	Self-Funded	Double Deck	EV	1	Equipmake	434 kWh	150-200
2021/22	N/A	Self-Funded	Single Deck	EV	1	KleanBus	TBC	TBC
2021/22	N/A	Self-Funded	Double Deck	EV	1	KleanBus	TBC	TBC

- Despite limited experience to date, strong interest still remains in repowers, particularly from smaller operators.
- Hybrids are attractive option for ZE repower due to maintenance and cost challenges.
- Zemo believe that minimum standards are required to ensure operators are protected and future repowers match same criteria as new buses e.g. exclusion of diesel heaters.

Summary



- ZE Repower experience is limited to date but remain attractive option, particularly for smaller operators
- Zemo believe Repowers can contribute to net-zero fleet should right conditions be in place.
- Zemo have proposed to DfT to build on CVRAS scheme and include additional requirements to create ZEVRAS scheme on such as:
 - Meet ZEB definition for new bus (e.g. no diesel heaters & certify over UK Bus Cycle)
 - Clear process for repower registration and support evidence package
 - Protection for operators and government such as providence of parts warranties

Thank you



**Zemo
Partnership**
Accelerating Transport to Zero Emissions

Any questions? Please get in touch

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Interested in joining the Partnership?

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