

What are the Challenges to Transitioning to a Zero Emission Coach Fleet?



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the UK
forward



WHAT ARE THE CHALLENGES TO TRANSITIONING TO A ZERO EMISSION COACH FLEET? CONFEDERATION OF PASSENGER TRANSPORT

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Foreword from the chair of the Zero Emission Coach Taskforce

CPT established the Zero Emission Coach Taskforce at the end of 2021 to identify the challenges the coach sector must overcome to achieve net zero and to inform the industry's response to the government's call for evidence on how the industry can meet the government's target to phase out all diesel road transport by 2040.

As the Chair of the taskforce, I'd like to personally thank all the industry experts, including colleagues from the Department for Transport (DfT), Welsh and Scottish governments, who gave up their valuable time to participate in the discussions.

I'm pleased to confirm that our response has been submitted and warmly received by DfT, who are grateful for the input given by CPT and its members. It is clear they are keen to listen and take guidance from the industry to ensure they can develop the appropriate policies to enable everyone to begin transitioning to zero emission alternatives.

It's been a fascinating time, and I for one have learned a great deal about the challenges facing not just the coach industry, but also those in the manufacturing, finance and infrastructure worlds. I find it extremely heartening to see the level of enthusiasm shared amongst us, we all accept the challenge that a zero emission coach fleet brings and want to work together to ensure the solutions put in place are the correct ones.

The most significant barrier facing the industry is the lack of clarity over the direction of zero emission technology and the hesitancy that has resulted, preventing the industry from moving forwards. This report outlines the impact this fundamental barrier has had on operators and the additional, resulting challenges.

I am very much looking forward to the next phase of work for the taskforce, when we will begin to identify potential solutions to the barriers outlined in this document. We will hold meetings over the coming months and will be closely liaising with government to ensure they understand the challenges and can develop the policies needed to ensure the industry can begin its journey to zero emission.

Sincerely,

Ian Lockett
Lockett's Coaches



Executive summary:

About CPT:

We help a dynamic bus and coach industry to provide better journeys for all, creating greener communities and delivering economic growth.

We do this by representing around 900 members from across the industry be they large or small, bus or coach, operator or supplier. We use our influence to campaign for a supportive policy environment, give our members practical advice and support to run their businesses safely, compliantly, and efficiently and bring the industry together to share ideas and best practice. We are ambitious to make things better for passengers, inclusive in seeking out different perspectives and we are always there when our members need us.

Coaches provide a sustainable and environmentally friendly travel option and can significantly reduce congestion. The latest Euro VI coaches emit less nitrogen oxides than the latest diesel cars. Nonetheless, the sector recognises that the future of road transport is with zero emission vehicles, however there are multiple challenges facing the industry that must be overcome before operators can begin their transition.

The Zero Emission Coach Taskforce (ZECT) was established in December 2021 at CPT's *Decarbonising Coach Conference* and brings together coach operators, manufacturers, government observers, infrastructure and finance providers¹. Members were tasked with identifying the barriers for the coach sector, the outcomes of these discussions are outlined in this report.

The most significant challenge for the sector is the lack of certainty over which zero emission technology will be most suited to their operations - hydrogen, electric or a combination of both. This lack of direction impacts all further challenges outlined in this document;

- **Vehicles** – the few zero emission coaches available currently do not deliver sufficient range to cover all services provided by coach
- **Infrastructure** – a reliable network of recharging and refuelling infrastructure is needed to reduce range anxiety and moveable recharging/refueling depot solutions are needed
- **Operational** – drivers and workshop staff may require additional training to drive the new vehicles efficiently and to service and refuel the vehicles safely

¹ Appendix 1



- **Finance** –zero emission coaches are significantly more expensive than diesel coaches and require additional investment in supporting infrastructure. Additionally, the unknown residual value makes developing an affordable business case difficult
- **Manufacturers** – coaches deliver a wide range of services, manufacturers therefore need to develop a solution that is flexible and applicable to a global market

The industry is ready and willing to find a zero emission solution that will enable coach operators to continue to provide the multitude of services that deliver economic, social and environmental benefits. The taskforce will continue to work with government and other key stakeholders to determine a pathway to zero emission that is workable and realistic for the industry.



About the coach sector

Coaches provide a convenient, accessible and sustainable travel option, help people to access education, holidays and combat social exclusion. They are capable of transporting huge numbers of passengers and provide a wide multitude of services including rail replacement during engineering works, aviation support, vulnerable group transport including elderly, children and people with disabilities and trips to sporting events and concerts. Coaches also transport 600,000 children to school every day.

Coaches play a vital role in supporting the UK's tourism industry; 23 million visits to tourist attractions and locations were made by coach in 2019 which contributed £14 billion to the UK economy².

There are circa 2,500 coach operators in the UK, 81% of which are family or individually owned, often with multiple generations working for the business and deeply embedded in their communities. Together these businesses provide 42,000 jobs across the country.

Coach travel is already one of the most sustainable and environmentally friendly ways to travel, with average carbon dioxide emissions per passenger per journey around 1.5 times lower than rail, 5 times lower than air and 6 times lower than car travel³. The latest Euro VI coaches emit less NOx per vehicle than the latest diesel cars, with just one coach-load of people able to remove up to 50 cars off the road.

² CPT Research 2020

³ BEIS/Defra greenhouse gas conversion factors 2019



What are the challenges to transitioning to a zero emission coach fleet?

1. Technology uncertainty

The most significant barrier which overarches all the challenges outlined in this document is the lack of certainty over which technology solution will be best suited to coach operations. There is currently no clear direction over whether zero emission coaches will be powered by an electric battery, hydrogen fuel cell, a combination of both technologies, or something else yet to be developed.

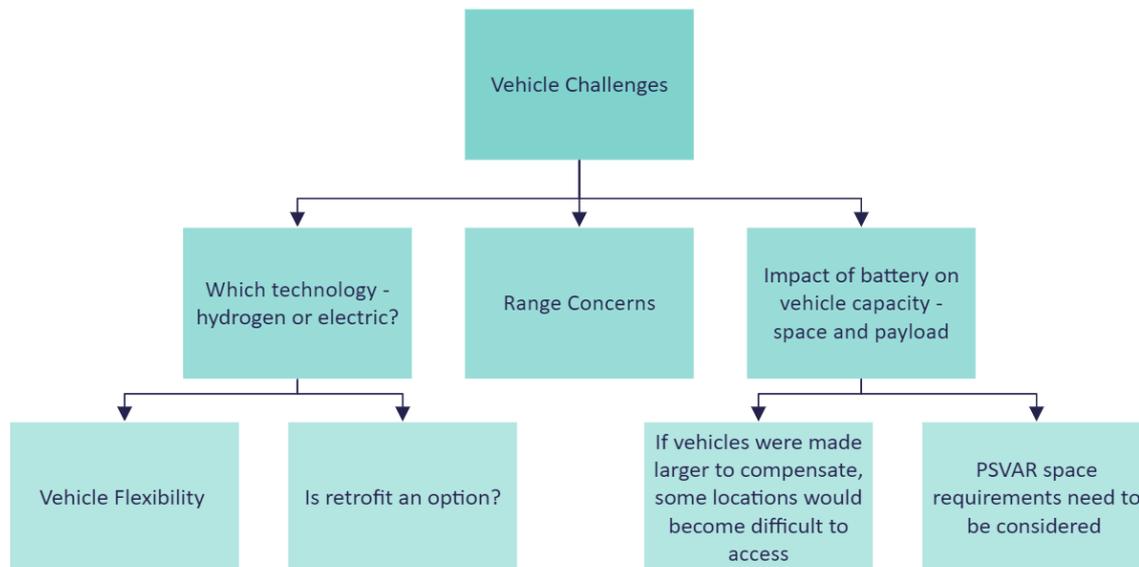
The lack of certainty over technology is a huge challenge for vehicle manufacturers who need to develop a vehicle solution that is applicable for as many services as possible and suitable across a global market.

Clarity over technology is also vital for the successful installment of recharging and refuelling infrastructure in strategic locations across the road network.

It is possible that a combination of solutions will be needed, at least in the beginning, with shorter routes being delivered by electric coaches and longer routes delivered by hydrogen. It is therefore essential that the government back both solutions and ensure that both technologies are available.

A clear roadmap is needed which sets out how the sector can decarbonise in a realistic and workable timeframe. To help progress this, we will continue to work this through with the Zero Emission Coach Taskforce and our members to provide a specification of what the future coach needs to be able to deliver and ensure vehicle suppliers have the data needed to develop a versatile, zero emission coach.

2. Vehicle challenges



Range anxiety: insufficient range of battery

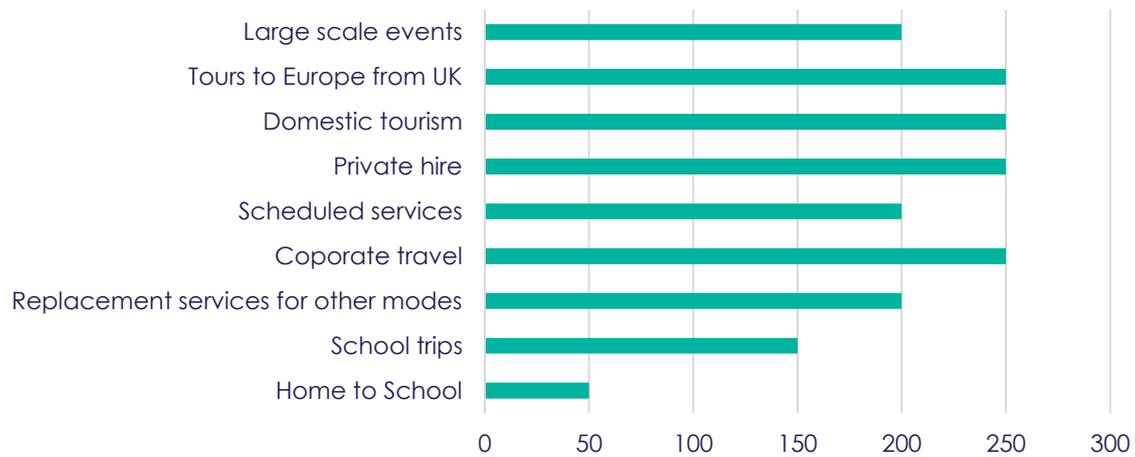
Battery range is one of the most significant barriers facing operators when considering transitioning to zero emission vehicles. Currently there is a reliable diesel refuelling network in place which enables operators to confidently travel anywhere and know they can refuel when required. To deliver the same level of confidence in zero emission coaches and remove range anxiety there needs to be a reliable zero emission refuelling network in place, or vehicles need to have sufficient range to enable operators to continue to deliver their services and be able to return the vehicle to depot before needing to refuel.

Coaches deliver a wide multitude of services of varying distances. The chart below shows the average range covered by coach for each service type they provide⁴.

⁴ CPT Coach Operator Survey 2022



Average range of services provided by coach in miles



Home to School services and school trips account for just 28%⁵ of coach operators' revenue, meaning the rest of their revenue comes from services that cover higher mileages.

The battery electric coaches that are available currently will not deliver the range required for longer distance services, with a single charge currently delivering between 160-200 miles. The off-depot infrastructure required to make longer services viable is not currently in place.

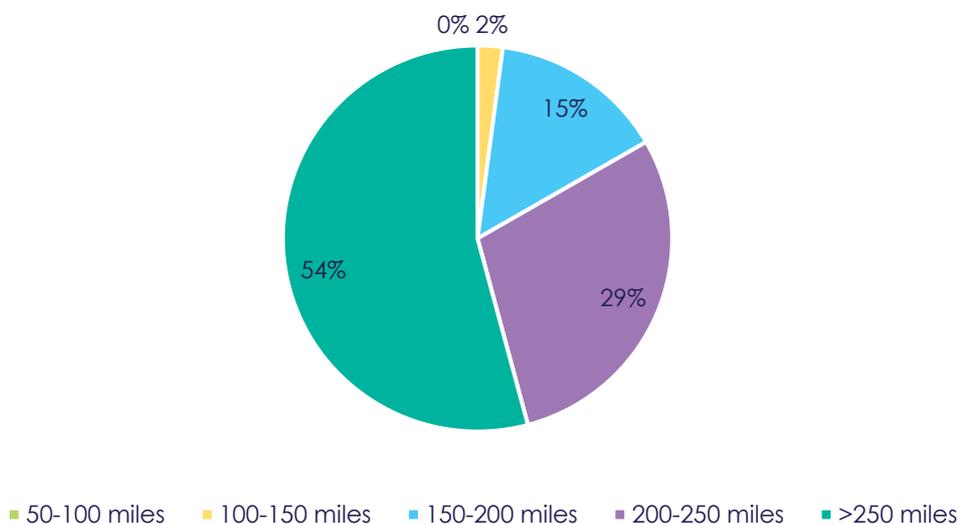
There is an additional concern that the expected range of the battery will be further reduced by on board entertainment, heating and passengers charging their mobile devices. We already know that the weather can have a significant impact on the range achieved, with heating consuming more energy than air conditioning, meaning the range achieved will be less during colder weather. In a CPT survey of coach operators, 54% confirmed that an electric battery would need to deliver a range of over 250 miles to give them the confidence to invest in zero emission vehicles⁶.

⁵ CPT Coach Operator Survey 2020

⁶ CPT Coach Operator Survey 2022



Required battery range that would give operators confidence to invest in zero emission coaches



Hydrogen can deliver the required range, however the high cost of producing hydrogen is making it difficult to offer hydrogen at a price that is cost effective to the operator and is thus preventing the uptake of these vehicles.

Vehicles need to be versatile

It is possible that the future fleet consists of a mixture of technologies, with shorter distances carried out by electric vehicles and longer distances carried out by hydrogen vehicles. However there is a concern that this will lead to zero emission vehicles being developed that are too operation specific. On average a coach is operated over 5-10 years, but this can be extended to 10-15 years if they are cascaded down through the fleet and used for different types of operations, with the older vehicles doing shorter, more urban services. Zero emission coaches are expensive assets and it is therefore vital that regardless of how they are powered, they are as versatile as possible to extend their lifespan and make them accessible to the secondhand market.

Retrofit could provide an interim solution whilst Zero Emission technology develops and the range is increased. We recommend that their environmental benefits and installation costs are fully explored to understand if they could provide a viable option.

Increased weight of the battery negatively impacts the vehicles payload capacity

Zero emission coaches will be significantly heavier than standard diesel vehicles due to the increased weight of the powertrain. This has the potential



to reduce the vehicles payload capacity which in turn could reduce the number of passengers and luggage the vehicle is able to carry. This will mean more zero emission vehicles would be required to undertake the same journey as one standard diesel vehicle, which not only increases operators running costs but makes the journey less efficient as it is able to carry less passengers.

Increased space requirements of the battery reduces luggage capacity

In addition to increased weight, an electric battery also requires additional space and must be fitted underneath the floor of a coach to ensure the weight is equally distributed. A trial of electric coaches carried out by National Express found that the space for luggage was reduced from 10.5m squared to 3.5m squared, a reduction of two thirds. Whilst this was an early generation electric coach and improvements have since been achieved, there is still a way to go before an electric coach has the same capacity as a diesel coach⁷.

PSVAR considerations

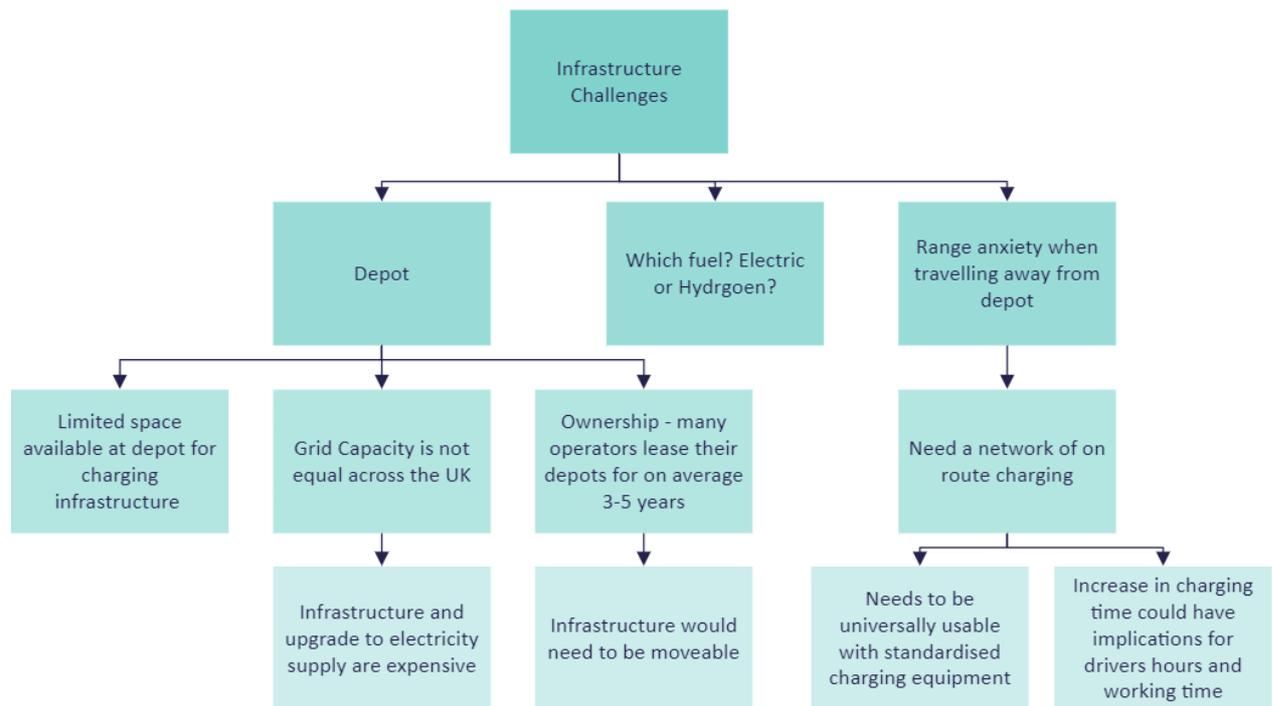
A PSVAR ramp also reduces some of the space capacity allocated for luggage and adds significant weight. Making coaches longer to compensate could mean they lose the ability to access many roads to popular destinations.

Coaches may also struggle to board ferries and park at various sites due to constraints on size⁸.

⁷ National Express Electric Coach Trial

⁸ CPT Coach Operator Survey 2022

3. Infrastructure challenges



Range anxiety: lack of infrastructure

To operate their fleet confidently and efficiently, operators need depot charging solutions and a reliable network of charging infrastructure on the strategic route network. To give confidence to operators to begin investing in these vehicles, the roll out of infrastructure needs to be aligned with the deployment of zero emission vehicles.

There is a need for rapid fast chargers at on route locations such as motorway service stations but also at some end of route destinations. In the event a coach full of passengers needs to recharge on route, the time taken to reach sufficient charge needs to be kept to a minimum. If the time to charge is too long, this risks making the journey unviable as passengers will opt for a quicker transport mode, especially if they are travelling to a time sensitive event such as a sporting event or concert. An extended stop could also have implications for drivers' hours and working time regulations.

Locations that require operators to wait for long periods of time after they have dropped off their passengers and are waiting for the return journey could have slower, less intensive chargers.

Universal technology

It is important that the infrastructure is fitted with universal connectors to ensure all drivers, regardless of vehicle model, will be able to plug in and recharge their vehicle.



Depot charging infrastructure

In addition to refueling and recharging infrastructure on the road network, operators will also require depot solutions.

a) Depot ownership

Whilst many coach operators own their depots, there are others who lease their depots and these contracts typically last for 3-5 years, which could make installing recharging and refuelling infrastructure problematic. These operators would need to negotiate their contract with the owner of the land to get permission to install the infrastructure. The infrastructure would also need to be moveable, in the event the coach operator relocated.

b) cost of infrastructure

Installing electric or hydrogen infrastructure is expensive and will significantly increase the upfront cost of transitioning to zero emission vehicles. The costs will vary depending on the location of the depot and the number of vehicles, the existing infrastructure and capacity in the grid. Operators will need to work with their Destination Network Operators to discuss the best solutions available to them and discuss the costs involved. Whilst these are difficult to estimate, we anticipate them to cost millions of pounds.

It may be more likely that hydrogen refuelling stations are developed that allow multiple vehicles to refuel instead of a depot based solution.

c) space limitations at smaller depots

Available space at depots is often limited, which will make it difficult to allocate enough space for multiple vehicles to be charging at the same time whilst also allowing enough space for manoeuvres.

The space required for hydrogen refuelling infrastructure is dependent on the technology; a typical liquid refuelling station requires approximately 25mx25m square for the equipment plus additional space for the dispensers and vehicle maneuvering. A gaseous refuelling station would require 1.5 -2 times more space.

The space needed for electric coaches is unclear but we know that electric buses require around 25% more space at depot than a diesel bus, with additional space allowed for manoeuvres. Our expectation is this would be similar for coach.

d) Grid Capacity

The grid capacity is not equal across all areas in the UK and many operators could be required to pay large sums of money to upgrade their supply to ensure they are receiving sufficient capacity. This is an asset they will not own or be able to take with them in the event they need to relocate.

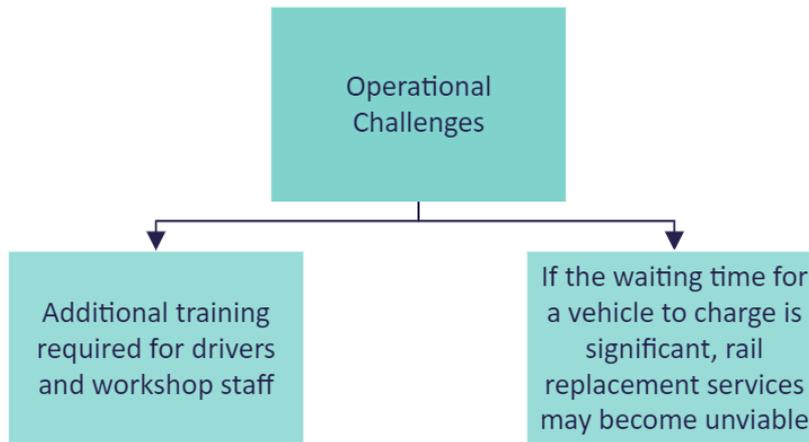


For operators in rural areas (61% of those in a recent CPT survey⁹), the grid connection challenges are even greater. These depots are located further away from grid connections, in areas that may be already heavily utilised with no spare capacity, meaning operators may require additional power cable to reinforce the energy supply which will result in higher costs.

⁹ CPT Coach Operator Survey 2022



4. Operational challenges



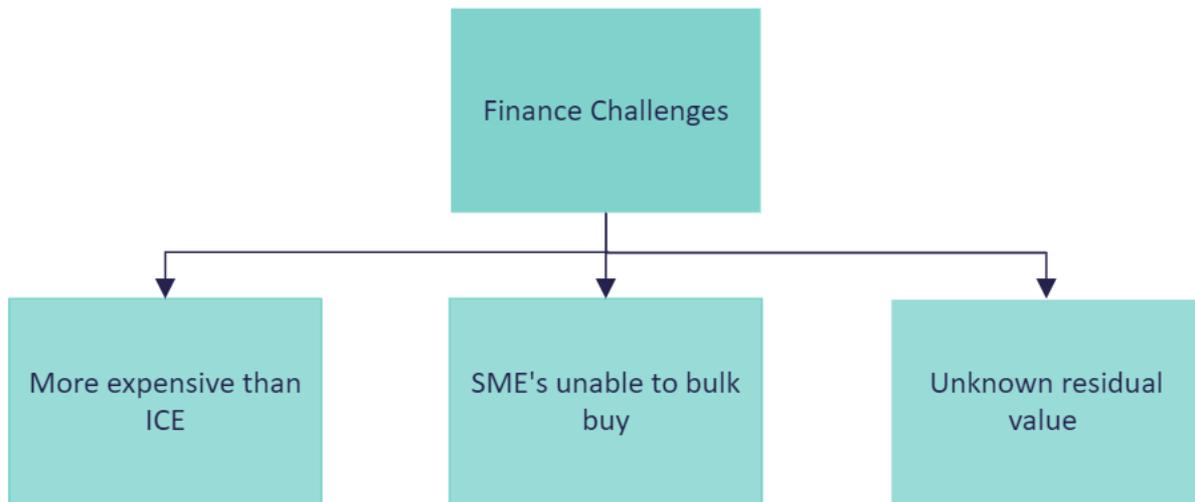
Training required for drivers and workshop staff

There will be a need to train both drivers and workshop staff to operate zero emission vehicles. The range achieved by an electric vehicle is heavily dependent on the driving style, and inspection and refueling practices will be significantly different to diesel vehicles.

Reactive services may be reduced or unviable

Coach services often need to be reactive, particularly if required to run a rail replacement service when there is a disruption. Recharging requirements could reduce the ability of coaches to respond quickly to such demands.

5. Financial challenges



Significantly higher upfront purchase prices

Zero emission coaches are significantly more expensive than ICE vehicles. The unknowns around battery life and residual value of zero emission vehicles will also make investment decisions difficult and can increase the costs of leases.

Electric coaches typically cost over 70% more than diesel coaches and hydrogen coaches are estimated to be 120% more expensive than diesel coaches.

Hydrogen is also significantly higher to run due to current market conditions and the high cost of energy. We are unclear of the exact cost, however we have been told it ranges from between £8-£10 and £15-£20 per kg.

Unknown residual value of the vehicle

One of the main factors determining the cost of an electric vehicle is the current uncertainty over the residual value of the vehicle. The residual value of a vehicle assists in determining the monthly payments and the price of purchase at the end of the contract should the operator decide to purchase the vehicle. The uncertainty makes financing options for the vehicles unaffordable to most operators.

SME operators

Smaller operators will find it even more difficult than larger operators to access the funding to be able to invest in bulk economies of scale and secure affordable lease options.

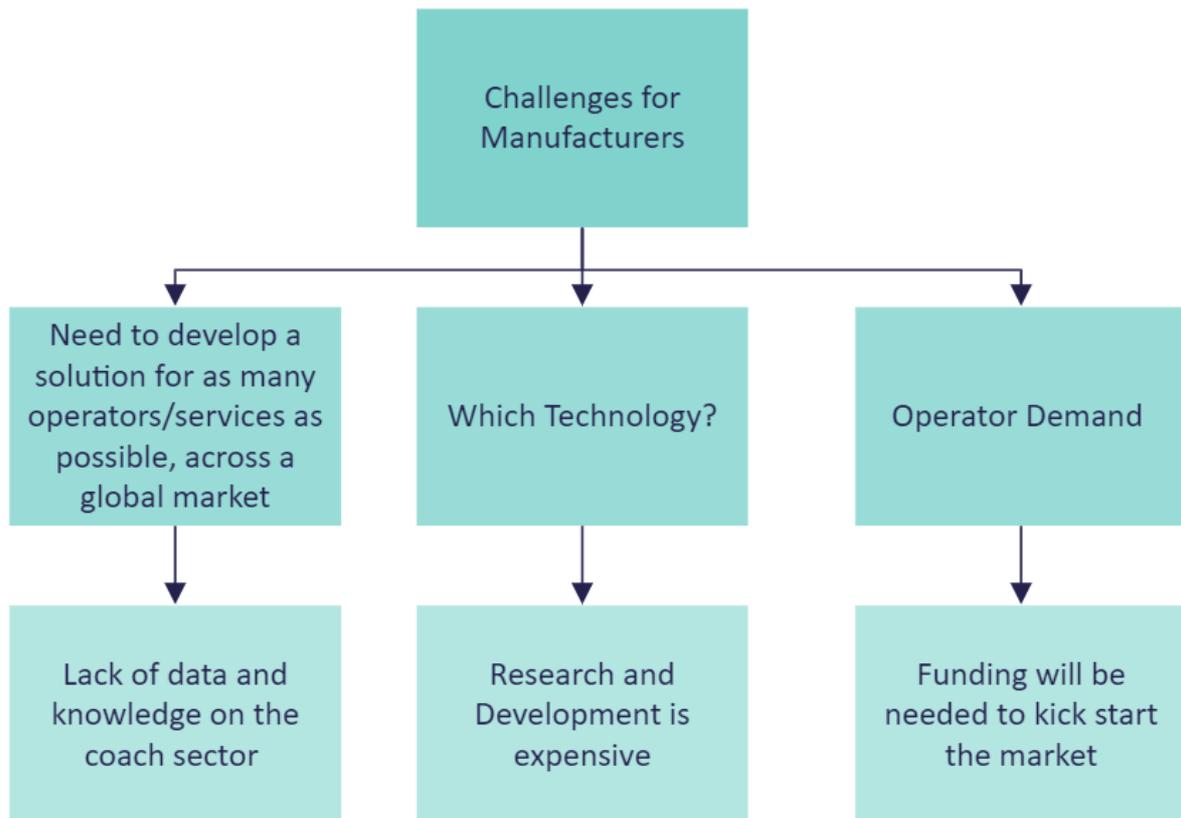


Lack of grants and funding from government

The government has so far provided funding support to multiple other transport sectors to enable them to begin transitioning to zero emission alternatives and help cover the significantly higher purchase costs.

Cars, vans, motorcycles, taxis and trucks were offered support through plug in grants which offered an amount towards the upfront purchase price of the vehicle. Buses have been able to access support through the ZEBRA scheme which provides support to both the cost of the vehicle and the cost of installing infrastructure, and from April the amount received through the Bus Service Operator Grant has increased if using a green fuel. However, to date no fiscal support has been provided to coach operators.

6. Challenges for manufacturers



Lack of data on the coach sector

Coach operators deliver a multitude of services which vary greatly in range, passengers and space requirements. Therefore the product must deliver a solution to as many of these services as possible. To develop a product that spans across multiple operations, manufacturers need to understand how a coach runs and what it needs to do. CPT would like to collaborate with members, government and other key stakeholders to assist in gathering the information that manufacturers need to make progress in delivering suitable zero emission coaches.

Need to develop a solution for the global market

Many manufacturers will produce vehicles for the global market so the end product they develop and produce must meet the needs of different markets and comply with the variety of relevant legislation applicable to those markets.

Research and development

Research and development into zero emission technology is time consuming and costly. Manufacturers cannot afford to carry out research into both hydrogen and electric solutions and therefore need to decide which



technology will provide the best solution for the industry. There is therefore an opportunity here for government to help with research and development costs.

Demand

There is a huge amount of uncertainty in the market for operators which means the demand for zero emission vehicles is low. Clarity over market direction, funding and provision of reliable infrastructure could help kick-start market demand.



Next steps

The Zero Emission Coach Taskforce will now start outlining a workable and realistic pathway to net zero for the coach sector that will deliver a sustainable supply chain for both manufacturers and operators. This work will begin with specifying what a zero emission coach needs to deliver in order for operators to continue providing a wide range of services across varying distances.

Using the barriers identified in this document, the taskforce will continue to engage with key stakeholders, including government, to begin identifying possible solutions and opportunities for collaboration with other key stakeholders that will enable the sector to begin decarbonising. The work of the taskforce has already identified some potential avenues and collaborations with other key stakeholders to explore;

Lessons to be learnt from the freight sector - Whilst coaches transport passengers, operationally they are more akin to heavy goods vehicles (HGVs) than they are to buses. In June 2021 the government committed £20 million of funding to support zero emission vehicle trials for the freight sector; trials like this could help provide clarity over which technology(ies) will be best suited to coach operations. There may also be opportunities for the coach sector to align with some of the trials and learn from any technological developments.

Expanding Project Rapid - The government launched Project Rapid in March 2020 and provided £500 million to install electric vehicle charging infrastructure across motorways and major A roads to support cars and vans. The scope of this project could be expanded to ensure that the infrastructure and capacity is in place for when heavier vehicles make the transition to zero emission technologies. Future proofing the infrastructure will reduce the time and costs involved in the installation and will help reduce range anxiety, one of the barriers that is currently preventing operators from investing in zero emission coaches. The taskforce will engage with the government is calling for the project to be expanded.

Hydrotreated Vegetable Oil (HVO) could provide a valuable transition option - HVO can reduce an operator's greenhouse gas emissions by 85-95% and would enable the coach sector to significantly reduce its carbon emissions whilst it waits for a zero emission solution to become a viable option. Currently, HVO costs around 20% more than diesel and has a slightly lower energy content which means more fuel is needed to cover the same distance as a diesel. Fiscal incentives that reduce the cost of low carbon fuels to lower than, or in line with, diesel would help encourage operators to make the switch and would reimburse for the lower energy content of the fuel.



The government has been complimentary and supportive of the work the taskforce has achieved so far and CPT will continue to collaborate with it to ensure that the any zero emission targets are achievable for industry and that the right supportive measures are in place to enable operators to transition successfully and efficiently.

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Disclaimer

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Appendix 1

Zero Emission Coach Taskforce – List of Members

Company	Contact	Position
Ian Lockett	Locketts Travel Group	Taskforce Chairman Passenger Transport Consultant
Ryse	Buta Atwal	CEO, managing director
Yutong	Ian Downie	Head of Yutong Bus UK
ADL	Mark Ballam	Commercial Manager
National Express	Richard Ball	New Vehicles Director
National Express	Dharel Patel	Environment Strategy Manager
Alpine Travel	Chris Owens	Managing Director
Flixbus	James Carroll	Senior Operations Manager
Flixbus	Niclas Bohn	Project Manager
Watts Way Travel	Mark Watts	Owner
Coach Commission	Duncan Aspinall	Chair of Coach Commission, Director of Holmeswood Coaches Ltd
Zenobe	Ben Hinchliffe	Senior Business Development Associate
SMMT	Sukky Choong	Environmental Manager – Air Quality and Ultra Low Emission Vehicles
SMMT	Nigel Base	Commercial Vehicle Manager
UKCOA	Stephen Telling	Chairman, UKCOA
Logistics UK	Denise Beedell	Public Policy Manager
CPT	Alison Edwards Rebecca Kite	Head of Policy Policy Manager



	Phil Smith John Taylor	Coach Manager Operational Technical Executive
DfT (observer)	Victor Rushton	Head of Zero Emission Bus and Coach Policy
DfT (observer)	Prabhjeet Rai	Senior Policy advisor – Zero Emission Bus and Coach policy
DfT (observer)	Bob Moran	Head of environment strategy
DfT (observer)	Livia Higgins	Zero Emission Coach and Bus
DfT (observer)	Matthew Bentley	
DfT (observer)	Yann Holzapfel	Senior Policy Adviser
Welsh Government	Robin Beckmann	Lead official on decarb for bus and coach sector
Mistral Group	Steve Low	Group Managing Director
Zemo Partnership	Daniel Hayes	Programme Manager
Zemo Partnership	Timothy Griffin	
National Grid	Russell Fowler	Senior Project Manager
Transport Scotland	Sara Grainger	Head of Accelerator Unit
Transport Scotland	James Goodall	Policy Official – Decarbonisation Pathways
Irizar	Julie Hartley	Sales Director
Stanley Travel	Andrew Scott	Director
Barnes Coaches	Luke Barnes	Director
Coatham Coaches	Mark Hodgson	Managing Director
Zeelo	Barak Sas	Head of Corporate development
Radical Travel	Graeme Ward	Managing Director
Daimler Buses	Jonathan Prime	Sales Director
Air Products	Jon Roper	Mobility Marketing Manger
York Pullman Bus	Tom James	Managing Director