

# Zero Emission Vehicle Repower Accreditation (ZEVRAS) for Buses and Coaches

Launch Webinar

26<sup>th</sup> March 2024



**Zemo  
Partnership**  
Accelerating Transport to Zero Emissions

**energy  
saving  
trust**

# Meeting Etiquette

- ⌚ Other than presenters, we request that webcams be switched off to save bandwidth for those with less stable broadband connections.
- ⌚ Mics will be muted while the main presenter talks, but there will be regular dedicated breaks to allow for comments and questions.
- ⌚ If you do have a question, type it using the chat feature and the presenter/moderator will be able to read your comment and respond accordingly.
- ⌚ Alternatively, please use the raise hand feature to make it known to the moderator, who will then invite you to unmute your mic.



# Competition Law Statement



Commercial decisions must be taken independently by individual companies.

**All participants must be aware that exchange of commercially sensitive information or intimation of intended commercial decisions, directly or indirectly, can result in competition law infringement.**

## **Member conduct at meetings and teleconferences:**

There must be no communication of the following information:

1. Individual company or industry prices, including differentials, discounts, rebates, allowances, price levels or changes, mark-ups, terms of sale and credit terms.
2. Company plans as regards development, design, production, distribution or marketing of products/services, divestments, closures or expansion.
3. Rates for production or transportation of products.
4. Bids for contracts or procedures for responding to bid invitations.
5. Matters relating to individual suppliers and customers/potential customers, progress on negotiations or content of negotiations.

If at any point during a meeting discussion appears to be breaching policy guidelines, the Chair or a participant should immediately raise their concern and close the discussion.

# Agenda



## 1. Welcome and Introduction

## 2. Scheme Overview

- Company and Product Approvals
- Technical Code of Practice

## 3. Department for Transport

## 4. Supplier Showcase

- Equipmake
- KleanDrive
- ZEEBus

## 5. Q&A

## 6. Closing remarks

# Introduction

## Proposal Development



In January 2022, Zemo Partnership with the support of Bus Working Group members published a paper ['Exploring the Role of Zero-Emission Repower for Buses in the UK'](#) to highlight the potential benefits of repowering diesel buses to zero emission.

### **Zemo Partnership presented a range of recommendations to Government including:**

- Incentives should be made available to support zero emission repower of buses to help accelerate wider zero emission bus uptake in the UK and support cross sector skills and supply chain development.
- Government should build on the existing Clean Vehicle Retrofit Accreditation Scheme (developed for Euro VI retrofit systems) to ensure appropriate performance testing and robustness/reliability requirements are placed on zero emission repowers.
- Any incentive scheme should encourage best practice and seek to place the same requirements that are made of new buses where appropriate e.g. minimum 5-year warranties.
- Develop best practice guidance documentation for operators and local authorities that clearly sets out requirements for any repower to access funding and encourage best practice.

# Introduction

## Proposal Development



- Based on the successful experience of developing the Clean Vehicle Retrofit Accreditation Scheme (CVRAS) scheme for retrofit technologies, **Zemo Partnership proposed the development a Zero Emission Repower Vehicle Accreditation Scheme (ZEVRAS)** aimed at accrediting fully zero tailpipe emission repower technologies (something CVRAS wasn't specifically set up to do).
- Zemo Partnership **proposed to use the bus industry as a pilot for the wider development** of ZEVRAS scheme into other sectors in future, given recent growth in the uptake of zero emission buses across the UK.
- The **“Developing ZEVRAS for Buses” project funded by the Department for Transport** would look to identify the existing gaps in the CVRAS scheme and develop minimum standards for zero emission repower buses, helping to drive innovation and support robust engineered solutions.
- Repowered buses fully accredited through ZEVRAS would become eligible for the newly announced 22p/km BSOG ZEB incentive in England, which had previously only been available to new zero emission buses. Accreditation would also enable access to Clean Air, Low and Zero Emission Zones.

# Introduction

## Scheme Development



- Building on the successful CVRAS approach, Zemo Partnership worked closely with Energy Saving Trust on the delivery of an operational ZEVRAS.
- As with CVRAS, Zemo Partnership convened a Steering Group to support the development of technical aspects of the scheme. Members of the Steering Group included:
  - **Government Agencies** including Department for Transport, International Vehicle Standards (IVS), Driver & Vehicle Standards Agency (DVSA), Driver & Vehicle Licensing Agency (DVLA), Vehicle Certification Agency (VCA, Welsh Government and Transport Scotland.
  - **Local Authorities** including Transport for London and Transport for West Midlands.
  - **Repower Suppliers** including Equipmake, KleanDrive, Magtec, ZEEBus, along with other technology suppliers including Allison Transmission, Cummins, EminoX, Lunaz and Mobiletron.
  - **Technical Service Providers** including UTAC, HORIBA Mira and Ricardo
- Through out the process, Zemo Partnership endeavored to work collaboratively with industry to ensure the scheme developed had widespread support and engagement.

# Scheme Overview





# Scheme Overview

## Product and Company Approval Process



- **Energy Saving Trust will manage the operation of ZEVRAAS**, conducting both company and product approvals processes, supported by Zemo Partnership in a technical capacity.
- The principle of ZEVRAAS is that a repower manufacturer will first need a company approval issued by the Energy Saving Trust in accordance with the requirements in the document **'ZEVRAAS Company Approval Guidance'** available online via the [Energy Saving Trust website](#).
- Once approved as a company, the repower manufacturer may then apply for an accreditation of their repower solution for a particular vehicle type(s) in line with the document **'ZEVRAAS Code of Practice'** available on the EST website.
- It should be noted that the obligation for vehicles to go through the **DVSA Notifiable Alteration process (known as VTP5) remains and is the obligation of the vehicle operator to complete**. The vehicle operator may direct the repower manufacturer to complete the VTP5 process on their behalf during ZEVRAAS accreditation.
- As part of the VTP5 approval process the normal requirement of DVSA is to inspect every vehicle that is to be approved. However, DVSA may agree to inspect a limited number of vehicles approved as a batch but reserve the right to periodically inspect selected vehicles based either on volume or duration of batch production.

# Scheme Overview

## Product and Company Approval Process



The following documentation is required to be completed by repower suppliers for ZEVRAS accreditation:

Company Approval	Product Approval
<ul style="list-style-type: none"><li>Application for ZEVRAS Company Approval</li></ul>	<ul style="list-style-type: none"><li>Application for ZEVRAS Product Approval</li><li>ZEVRAS Information document</li></ul>

- Once the ZEVRAS process is complete, the repower supplier will be provided with certification, which the operator can then use to be able to claim the Bus Service Operator Grant (BSOG) 22p/km ZEB incentive in England.
- Approved companies and products will also be uploaded to the [ZEVRAS Register](#).

Documents issued following ZEVRAS approval:	Required documentation for BSOG incentive claim:
<ol style="list-style-type: none"><li>ZEVRAS Company Approval Certificate</li><li>ZEVRAS Product Approval Certificate</li><li>Zero Emission Bus Certificate</li><li>Vehicle Summary Sheet/Repower Record</li></ol>	<ol style="list-style-type: none"><li>Zero Emission Bus Certificate</li><li>Vehicle Summary Sheet/Repower Record</li><li>BSOG Application Form for Zero Emission Buses</li></ol>

All documentation for applications and guidance can be found on the ZEVRAS Webpage

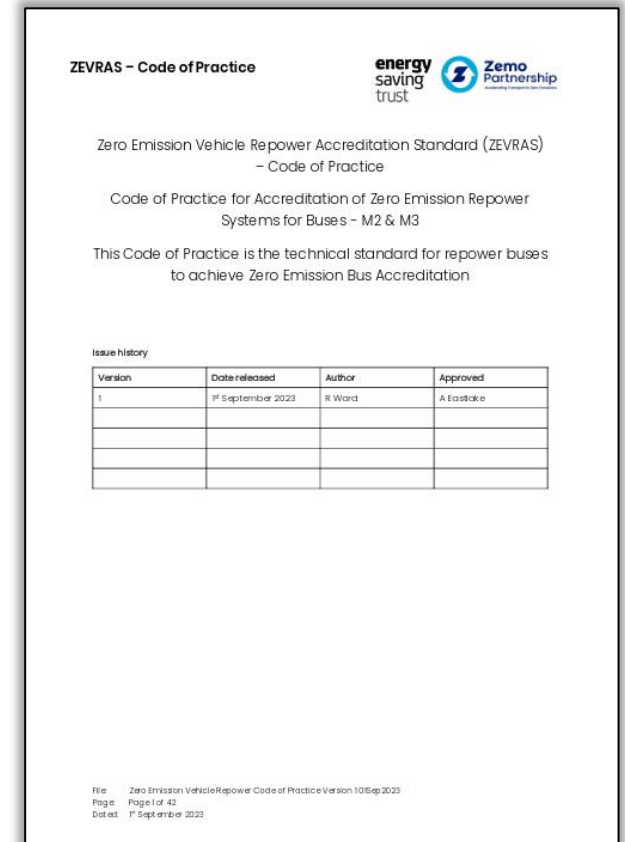
[ZEVRAS Webpage](#)

# Scheme Overview

## Technical Standards – Code of Practice



- The Code of Practice defines the technical requirements for accreditation under ZEVRS.
- The **technical requirements do not replace or change any of the legal requirements** outlined in the DVSA VTP5 process.
- This **requirements apply to all M2 and M3 vehicles**, which includes buses and coaches with either a battery electric and fuel cell electric drivetrain.
- This requirement applies only to vehicles that are **already registered for use on UK roads**.
- The objective of the requirements within the Code of Practice is to establish a **base level of performance for vehicles** that are to be granted some level of government funding before or during their use in service.
- In order to reduce cost and complexity, this technical requirement will use **worst casing and model report approaches wherever possible**.



**Code of Practice**

# Scheme Overview

## Technical Standards – Code of Practice



Item	Subject	Requirement	Applicability	
			M2/M3 Battery Electric	M2/M3 Hydrogen Fuel Cell
1	Brakes	Annex 1	X	X
2	Static Stability (Tilt)	Annex 2	X	X
3	Acoustic Vehicle Alerting System (AVAS)	Annex 3	X	X
4	Steering Effort	Annex 4	X	X
5	Masses and Dimension	Annex 5	X	X
6	Power / Torque	Annex 6	X	X
7	Identification of Controls	Annex 7	X	X
8	HVAC Systems	Annex 8	X	X
9	Defrost / Demist	Annex 9	X	X
10	Speedometer and Reverse	Annex 10	X	X
11	Speed Limiter	Annex 11	X	X
12	Lighting Installation	Annex 12	X	X

# Scheme Overview

## Technical Standards – Code of Practice



Item	Subject	Requirement	Applicability	
			M2/M3 Battery Electric	M2/M3 Hydrogen Fuel Cell
13	Electromagnetic Compatibility (EMC)	Annex 13	X	X
14	Electrical Safety	Annex 14	X	X
15	Hydrogen and Fuel Cell Safety	Annex 15		X
16	Charging	Annex 16	X	X
17	Statutory Plates	Annex 17	X	X
18	Telematics	Annex 18	X	X
19	End of Life	Annex 19	X	X
20	Fire Suppression	Annex 20	X	X
21	Bus Safety Information Standard	Annex 21	X	X
22	Labelling of Fill Ports	Annex 22	X	X
23	Energy Efficiency and Range	Annex 23	X	X

# Department for Transport

Patrick Malone





Department  
for Transport

# **ZEVRAS and BSOG**

# Context

- Transport is currently the largest contributor to UK domestic greenhouse gas (GHG) emissions
- Since February 2020, >5,000 zero emission buses (ZEBs) have been funded across the UK, however there are tens of thousands of buses to still transition
- Repowering offers an opportunity to achieve carbon savings from the existing fleet, without the additional embodied carbon of new vehicles





# Bus Service Operators Grant (BSOG)

## ZEB BSOG

Given the government's commitments relating to zero emission buses (ZEBs), we have increased the rate at which operators can claim the Bus Service Operators Grant (BSOG) for ZEBs to 22p per kilometre

This is a temporary uplift ahead of the planned reform of BSOG and aims to support and further accelerate the take up of ZEBs.



*The take up of zero emission buses is crucial to improving the carbon footprint of the sector, and the imbalance between the existing support provided to diesel buses through BSOG against that provided to zero emission buses needs to be addressed.*



Transport Decarbonisation Plan



# BSOG eligibility

## Existing standards

All buses which meet the normal BSOG rules, can demonstrate zero tailpipe emissions and have no internal combustion engine (e.g. battery electric and hydrogen fuel cell buses), are eligible.

This is verified by certification. Operators claiming the ZEB incentive will be able to claim for any kilometres that would ordinarily be payable under BSOG rules for conventionally-fuelled vehicles.

Proof of vehicle certification will need to be supplied alongside any claim to receive the uplift.

**A ZEB is defined as a bus which:**

- **Has no combustion engine on board.**
- **Has no tailpipe that emits any regulated air pollutants.**
- **Achieves 50% GHG savings target vs Euro VI diesel bus over UK Bus Cycle.**

# ZEVRAS

# ZEVTRAS

A ZEVTRAS-approved solution will result in a zero emission repower bus that:

- Is legally registered on the road
- Has passed an independent assessment of whole vehicle system and components
- Has robust in-service operation
- Is fully zero emission at the tailpipe

This will support our climate ambitions, improve transport for local communities and support high quality green jobs

**Vehicles accredited through this process will be able to receive ZEB certificates, and thus claim the BSOG ZEB rate.**

# Supplier Showcase

# Equipmake

Ian Foley





# An introduction to Electric Repower Solutions for Coach & Bus

# Who are we?

## A BRITISH MANUFACTURER

Electric Powertrain & Components

## USP

Vertically Integrated, in-house design and manufacture of motor, inverters, battery packs, HVAC, system integration and support

## EXPERIENCE

Experience 20+ Years

Staff 100+



Bus



Supercar



Aerospace



Bus



Supercar



Aerospace





# Repower

## WHATS INVOLVED?

**Feasibility Study of the Bus / Coach:** This includes detailed analysis of mass, weight of existing and simulation of replacement systems

**Conversion:** Removal of existing systems, if required reinforcements, refurbishment and upgrades of existing structure/interior, fitting of zero emission components.

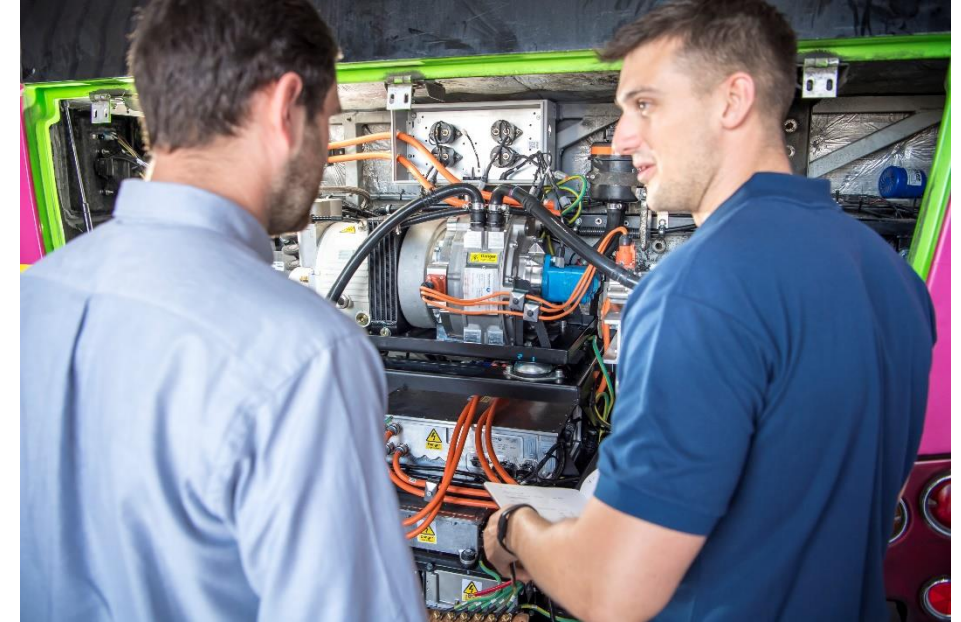
**Support:** In-house technical aftersales, remote and on-the-road team.

## SAVE:

**Capacity:** Unchanged interior. Maintain passenger and luggage space

**Money:** Approximately ½ the cost of an equivalent new electric vehicle – conversion & kit pricing is dependent on vehicle specification and requirements.

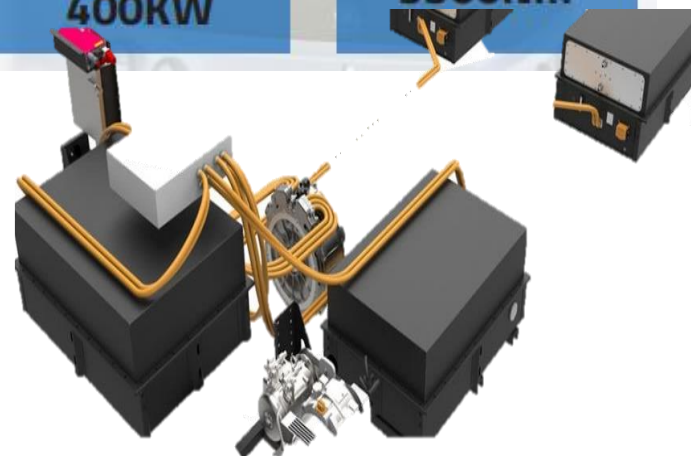
**Emissions:** 90 tonnes of CO<sub>2</sub>-eq (Ref: <https://www.sciencedirect.com/science/article/pii/S1361920919302792?via%3Dihub>)



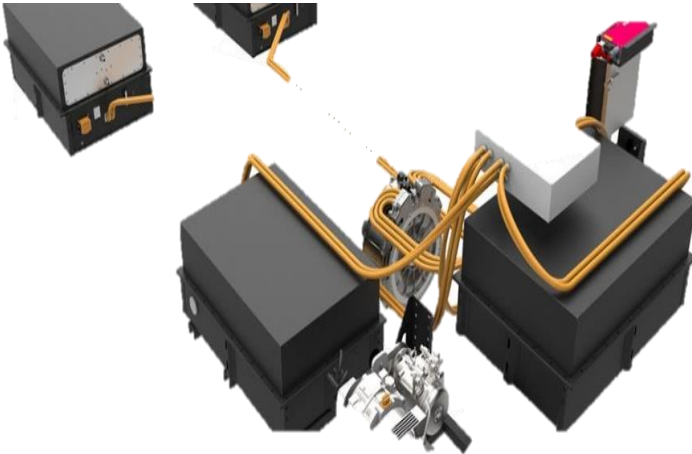
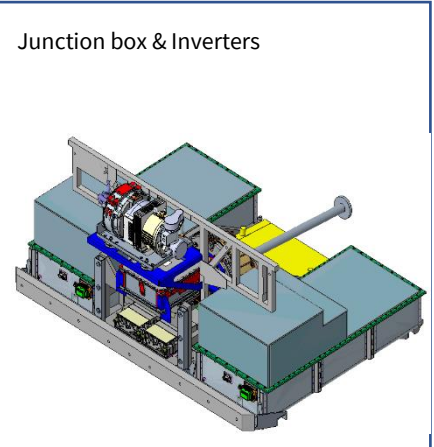
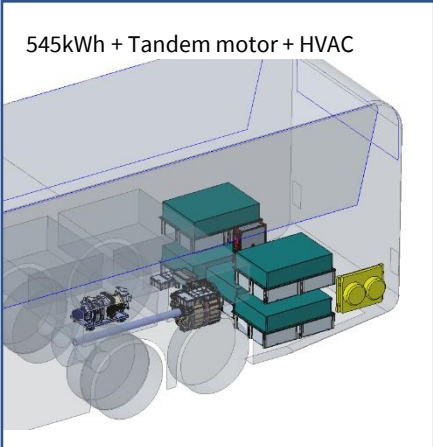
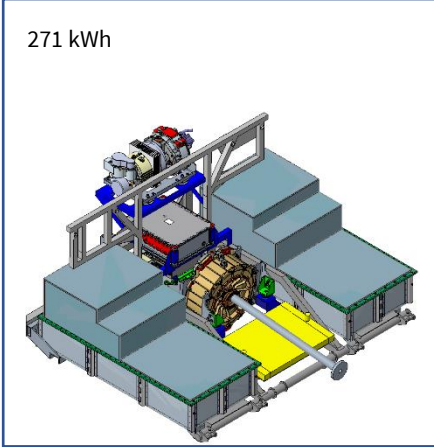
# ZED – Zero Emission Drivetrain

## Specification:

1	Motor Mass (HTM-3500)	195 Kg
2	Motor Mass (Coupled HTM-3500)	390 Kg
3	Maximum Power	400 kW
4	Battery Power Options	78 - 648kWh
5	Total Battery Weight	2,080 kg*
6	Maximum Speed (motor)	3,500 rpm
7	Maximum Torque (motor)	3,500Nm
8	Inverter (Semikron)	SKAI
9	Inverter Weight	15 Kg
10	Charging	CCS DC off board



# Repower Examples



# Contact Us

Phone: 01953 661200

Email: [enquiries@equipmake.co.uk](mailto:enquiries@equipmake.co.uk)

Web: [www.equipmake.co.uk](http://www.equipmake.co.uk)

Social: @equipmake   

Oliver Knights

Head of Technical Sales

[Oliver.Knights@equipmake.co.uk](mailto:Oliver.Knights@equipmake.co.uk)

07399 345527



# KleanDrive

Joe Tighe





# KLEANDRIVE

TRANSFORMING TRANSPORT



QUALITY MANAGEMENT

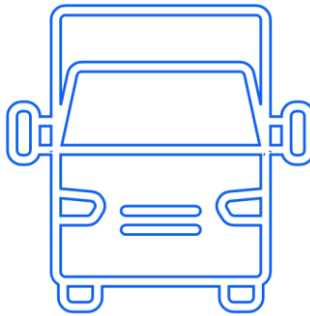
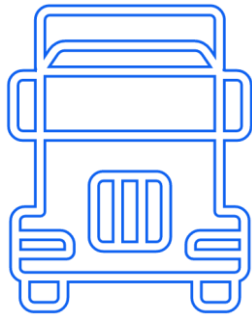
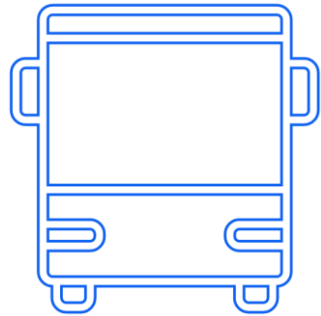


ENVIRONMENTAL MANAGEMENT





**KLEANDRIVE**  
TRANSFORMING TRANSPORT



**The Smart Way To  
Electrify Your Fleet.**

**To accelerate the transition  
to zero emission vehicles  
for the health of our planet and all  
its inhabitants.**

...we support fleet operators in removing expensive-to-operate and heavily polluting diesel vehicles quicker.

...in alignment with the political drive to improve city air quality, particularly addressing diesel buses.



# Why **Buses** first?

LONDON ONLY



**8,500 BUSES**

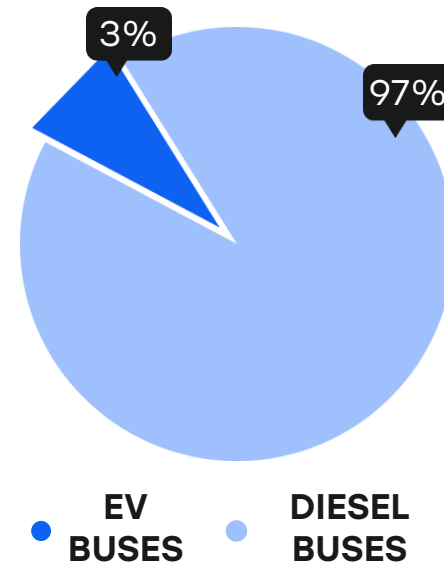


**28,000 LITRES DIESEL EACH**



**OVER 200M LITRES DIESEL PER YEAR**

## 10 Million Buses **Globally.**

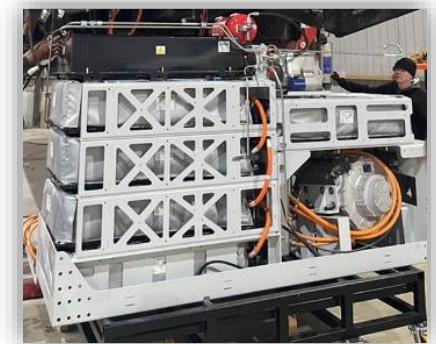


# What we do that's **Special**.



**KLEANDRIVE**  
TRANSFORMING TRANSPORT

- ✓ We design complete **Electric Powertrain** systems.
- ✓ Integrate **world leading** technology.
- ✓ Highly Scalable, Modular **“Drivetrain-in-a-box”** Solution.
- ✓ Our Software is the **Secret Sauce**.
- ✓ **Technology agnostic** – we evolve as the technology advances.



WHY NOW?

# Zero Emission Regulations.

Kleanbus' repower solution provides a cheaper and more sustainable alternative to purchasing a new electric fleet.



**£500k**

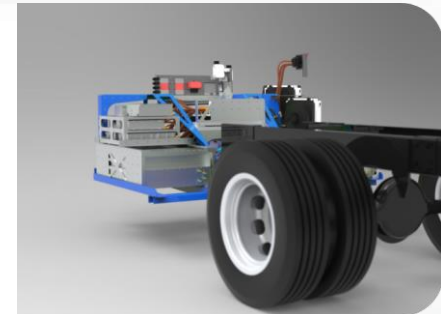
NEW ELECTRIC BUS



SAVING FLEETS UP TO

**70%**

KLEANDRIVE REPOWER



**1/3**

OPERATIONAL COST

# Key Advantages.

**Best in class technology**

Easily adopt new suppliers as we don't make components

**Scalable drivetrains**

Global suppliers, enabling fast growth and reliable scalability

**Drivetrain in a box solution**

Fleet engineers able to fit drivetrain, saving money and time

**Local government and community**

Upskilling local workforce to support new electric technologies



# Contact KleanDrive Today.



## We are on a **Mission.**

To accelerate the transition to zero emission vehicles for the health of our planet and all its inhabitants.

### GET IN TOUCH

WEBSITE: [KLEANDRIVE.EARTH](https://www.kleandrive.com)

EMAIL: [J.TIGHE@KLEANDRIVE.EARTH](mailto:J.TIGHE@KLEANDRIVE.EARTH)

PHONE: 07554889818



## Accelerate To **Zero.**

# ZEEBus

Ralph Hosier



# Questions



**Thank you!**

**Find out more about the scheme here:**

[Zero Emission Vehicle Repower Accreditation Scheme \(ZEVTRAS\) – Energy Saving Trust](#)

[zevras@est.org.uk](mailto:zevras@est.org.uk)