ELECTRA™

ZERO EMISSION REFUELLING

THE OPPORTUNITY, THE MYTH AND THE REALITY

IN ASSOCIATION WITH

GROUP CESAR®

Centre Of Excellence & Service Aviation Refuellers

Richard Lewis Aviation Sector Director

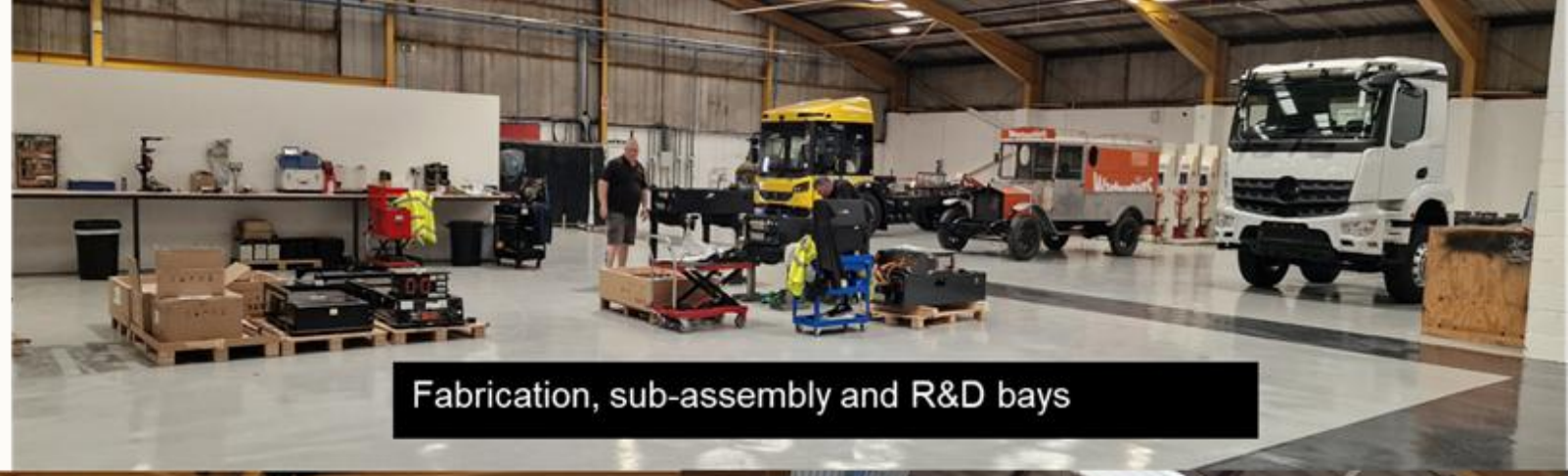
Ex Royal Navy Marine Engineer - Almost 20 years in the refueller industry

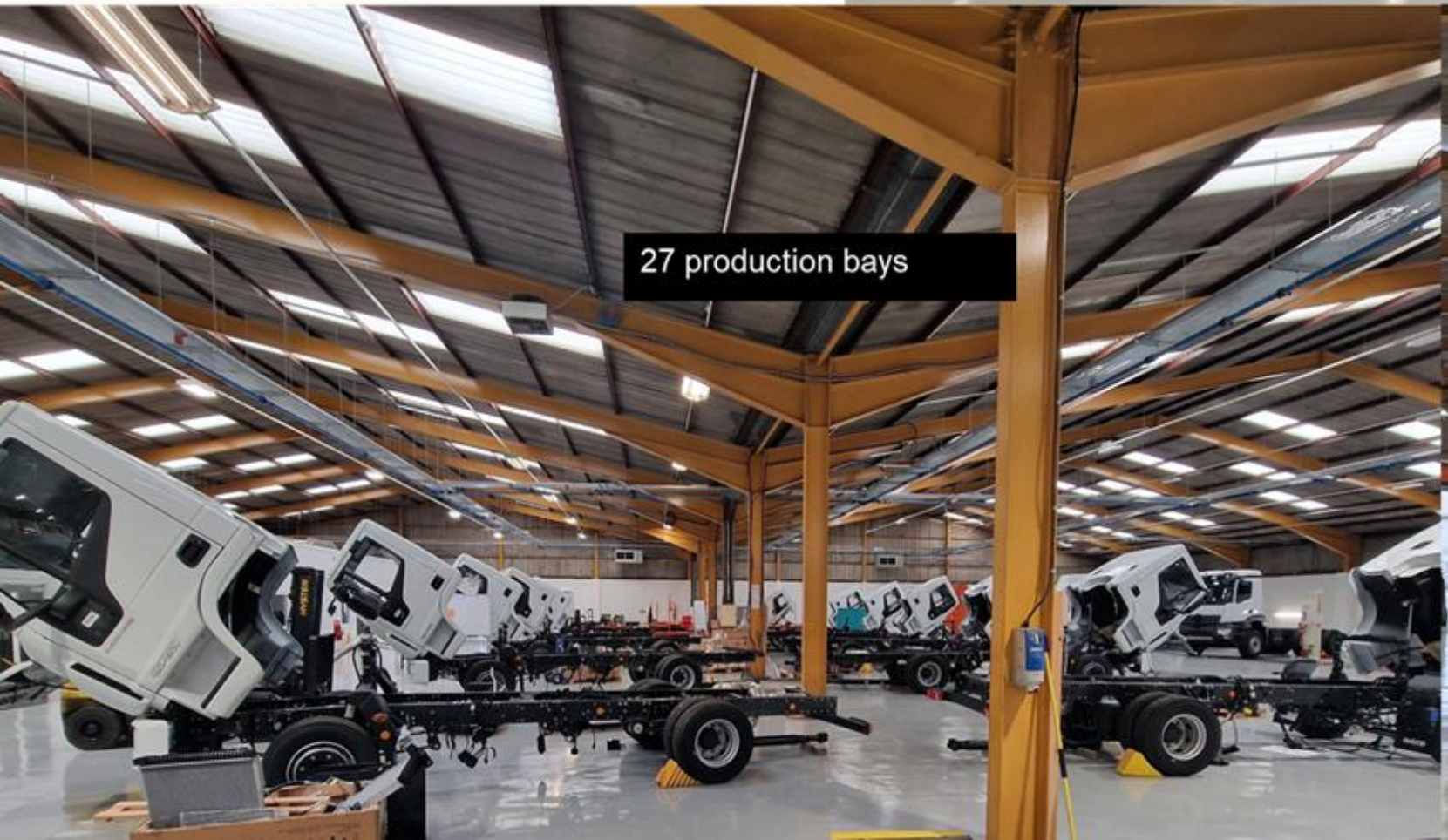
UK, France, USA - Joined Electra in September 2024

FULLY ELECTRIC AND HYDROGEN FUEL CELL VEHICLES BY ELECTRA

More medium - heavy duty trucks supplied into the UK than any other manufacturer

ELECTRA™


Fabrication, sub-assembly and R&D bays


27 production bays


Dedicated repair bays

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2017 Creation of Electra - Production of first Mercedes platform vehicle

1 of only 3 companies World-wide to be supplied Glider chassis by Daimler

Global warranty carried over from Daimler , IVECO, Isuzu

UK’s 1st hydrogen fuel cell vehicle in operation

Global oil company , global approval of chassis for airside refuelling

Building chassis for applications in the Nordics to the Middle East

Global distributor/partner network

Vehicles now in their 7th year of operation

Utilizing the safest LFP batteries available from the world largest manufacturer

They just work ! On and On

eStar

NRG RIVERSIDE Experts in Specialist Fleets

DTM Intelligent Tyre Solutions

GUEST Truck and Van

BALLARD™

enerlytic

PROTIUM

THE e-merge GROUP

Element-2

TyreWatch.com Intelligent Tyre Solutions

CODESMITH TECHNOLOGY

THE EARLY ADOPTER PHASE FOR AIRSIDE EV IS OVER – THIS IS NOW PROVEN

So much has happened in the last 2 years and the electric revolution is now well underway.

Electra have now built more electric chassis for airside refuelling vehicles than any other supplier

- There are x5 refueller builders at InterAirport building on Electra chassis -

Electra have now supplied or are building for customers in:

- Europe
- USA
- UAE
- Saudi Arabia
- North Africa
- Australia

TCO (Total Cost of Ownership) is proven - significant Gov. subsidies are available in some countries

- Really significant cost and operation savings are clearly demonstratable
- Huge Co2 emission savings are proven
- With upcoming 15 year batteries – you can potentially miss a buying cycle!

- **IN-ACTION IS A DECISION – there are no longer any excuses!**

Electra build electric chassis specifically for the application, safety, reliability and performance are paramount aircraft refuelling is a safety critical operation.

Electra are the only chassis manufacturer given BP Global approval for Airside refuelling, we have met and complied with BP exhaustive safety requirements.

We ensure that the refueller or dispenser body work in unison with chassis, unlike other electric chassis supplier *“one size does not fit all”* and we will not compromise - Major truck builders build standard trucks for highway applications

The refueller or dispenser must work in unison with the refuelling system and safety interlock systems.

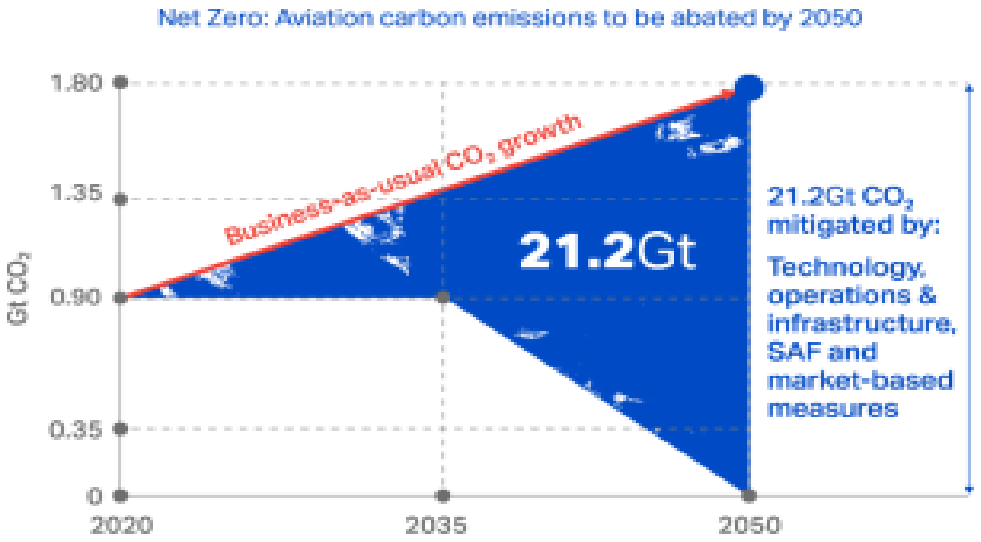
Safety – Reliability - Performance

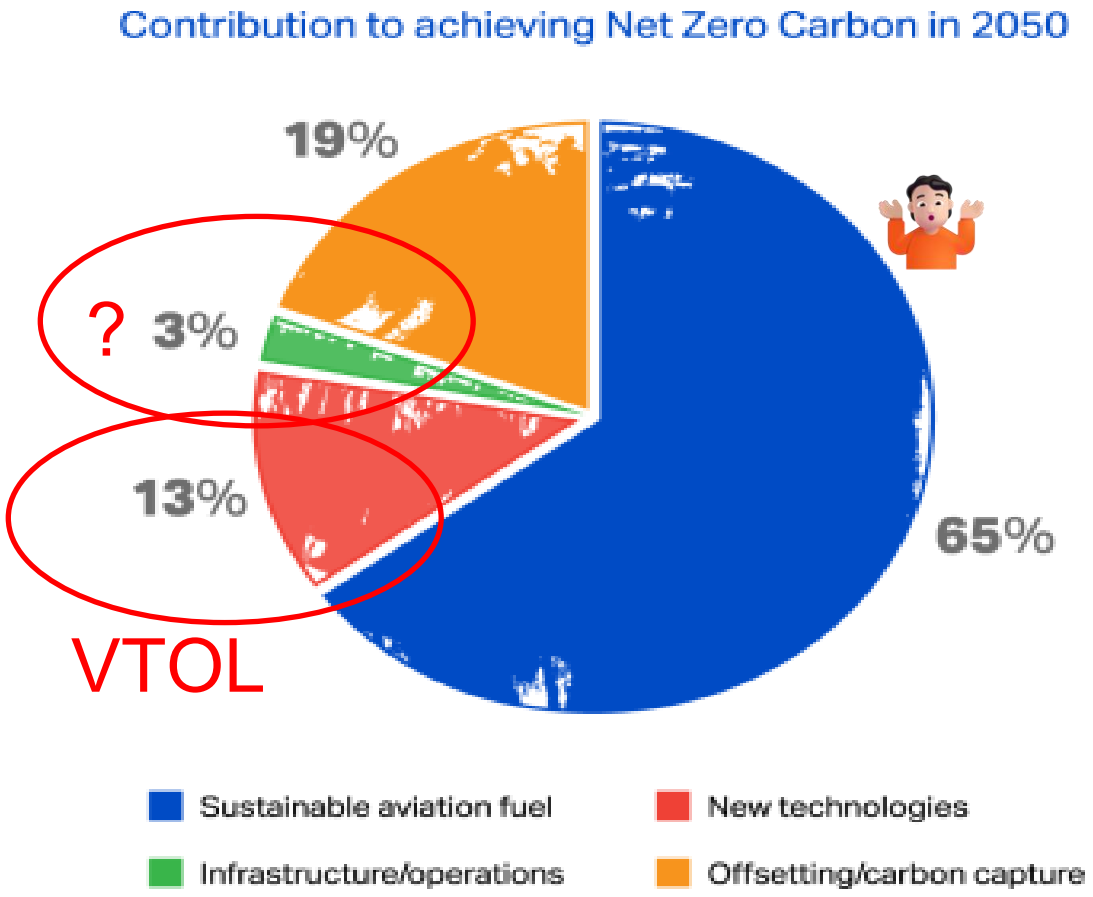
THE OPPORTUNITY

Net zero carbon 2050 resolution

Fact sheet

At the 77th IATA Annual General Meeting in Boston, USA, on 4 October 2021, a resolution was passed by IATA member airlines to reach net-zero carbon emissions from their operations by 2050. This pledge brings air transport in line with the temperature objectives of the Paris agreement.

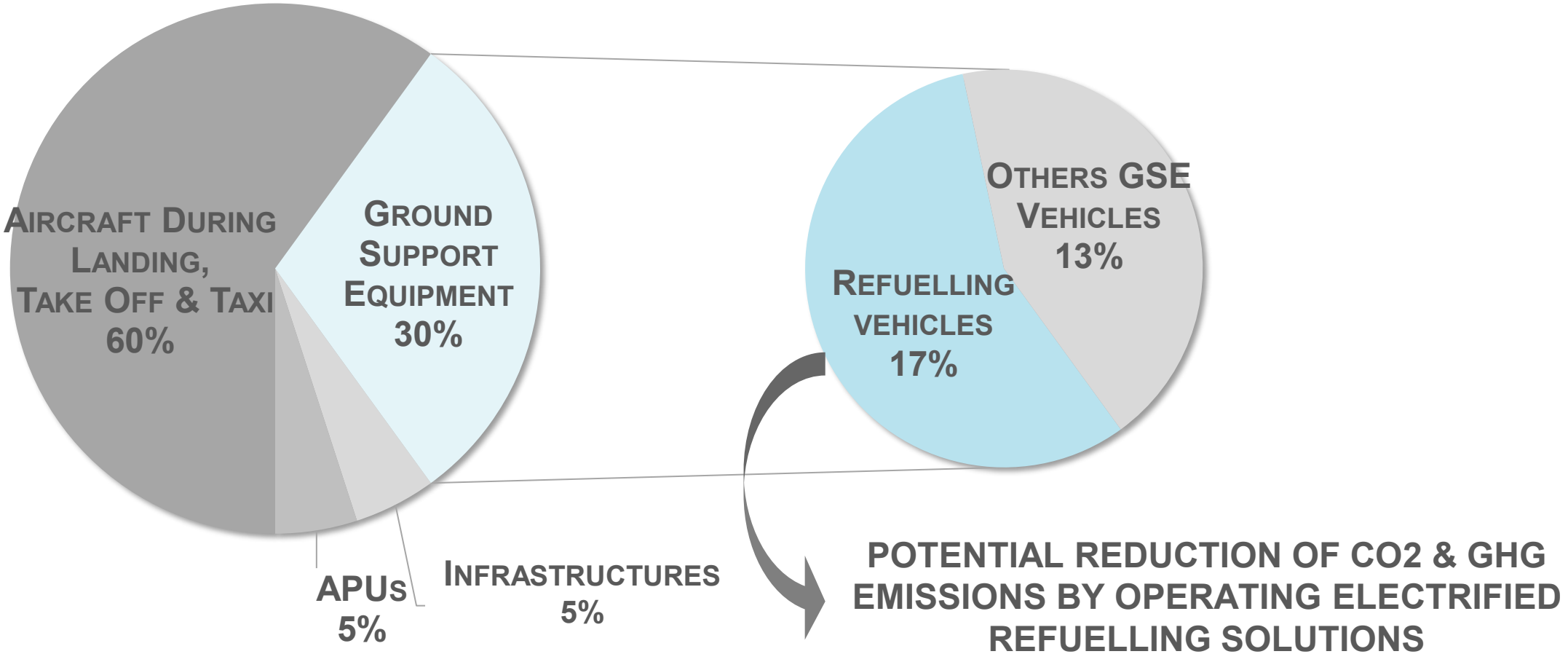




Source: IATA Net zero carbon 2050 resolution

BUT … WHAT CAN WE DO AT GROUND LEVEL? - *RIGHT NOW*

Source: Major European airport - emissions within the airport perimeter



REFUELLER MARKET SIZE

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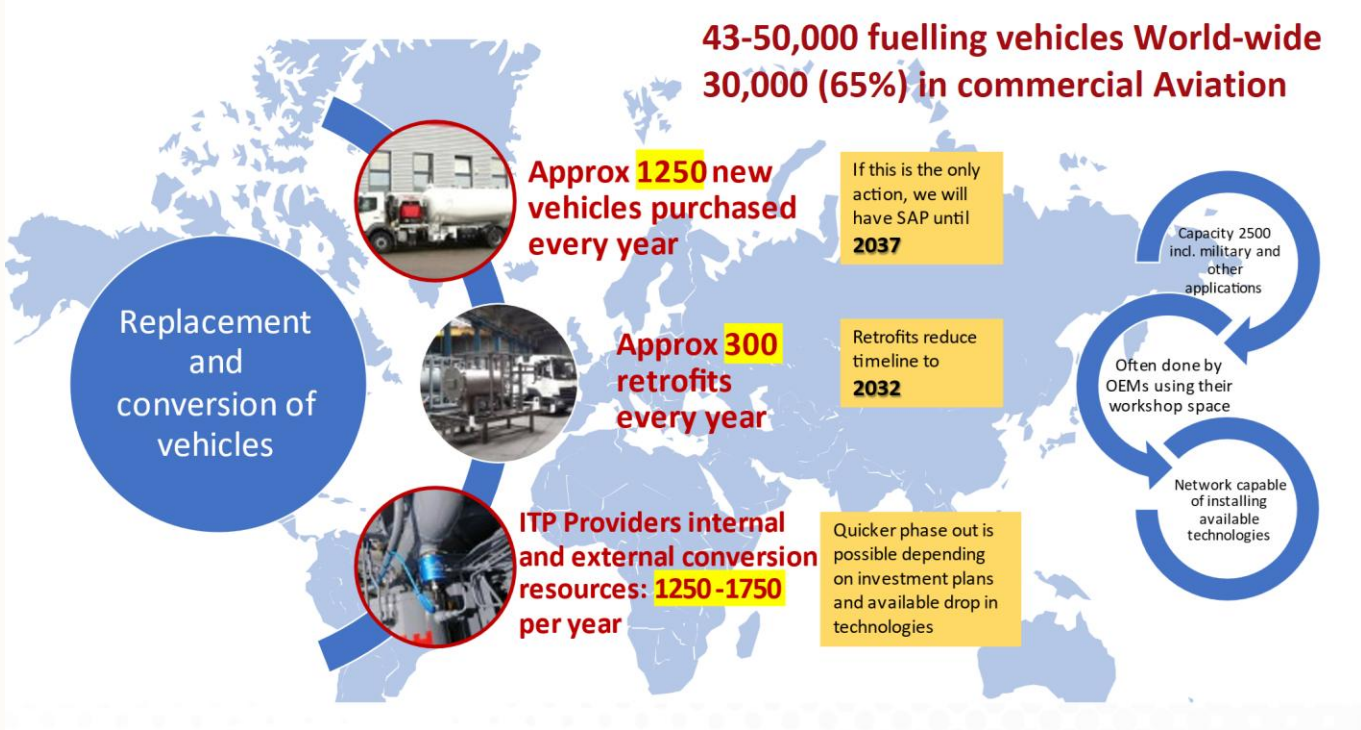
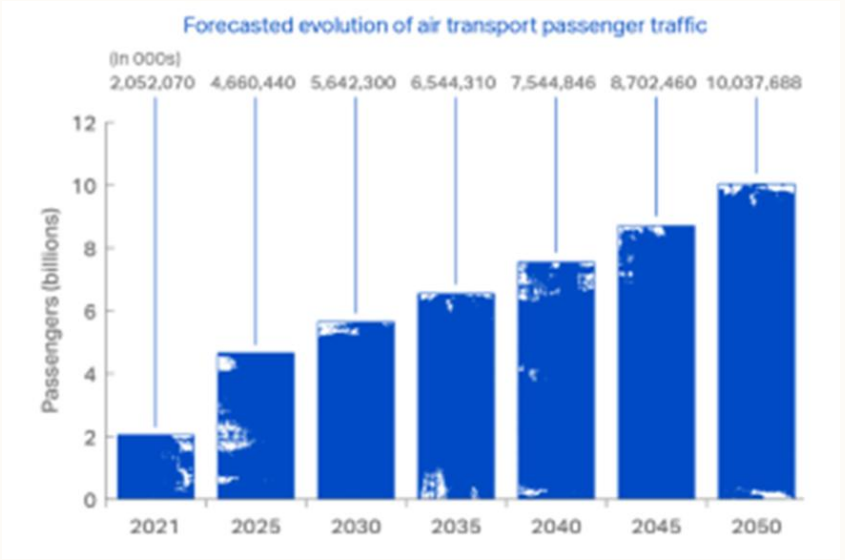
- Number of vehicles in operation is closely guarded by customers no reliable stats/reports are published - However, JIG has published the attached in 2019



XXXXXX Passenger + Freighter aircraft		
Region	**Start Fleet 2020**	**End Fleet 2042**
Africa	670	1,630
Asia-Pacific (excl. PRC)	3,960	9,920
Europe/CIS	6,010	9,910
Latin America	1,440	2,630
Middle East	1,280	3,120
North America	5,710	8,420
World	**19,070**	**35,630**



XXXXXX Predicts 186% growth in their aircraft fleet by 2040
Similar figures from other OEM's
IATA Predicts x1.62 PAX from 2025 - 2040

THERE ARE NO TECHNICAL BARRIERS

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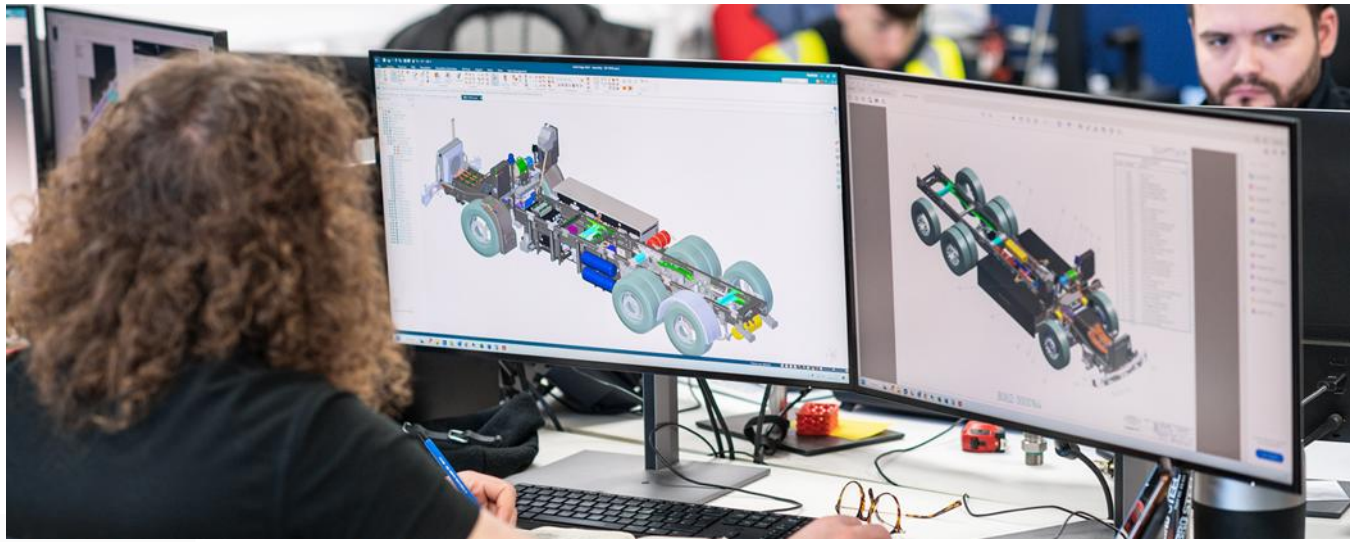
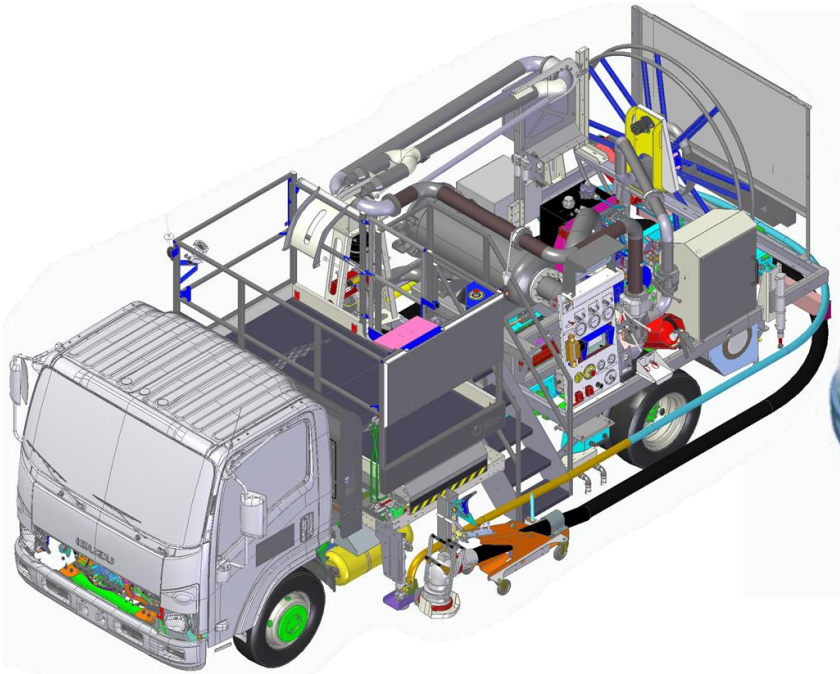
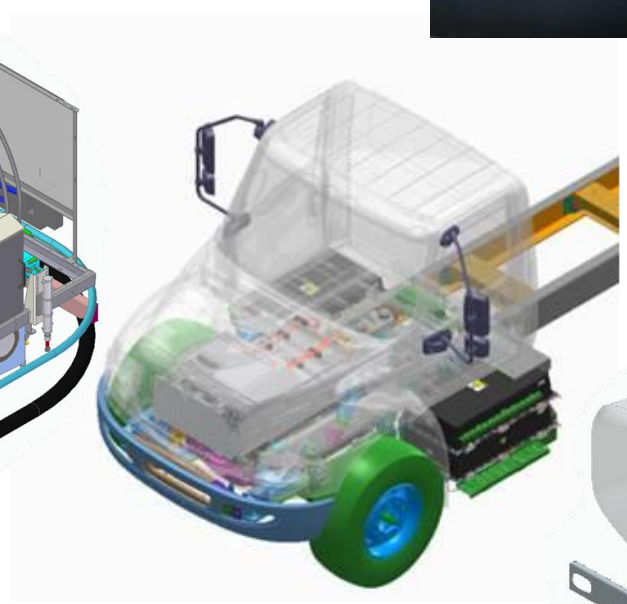
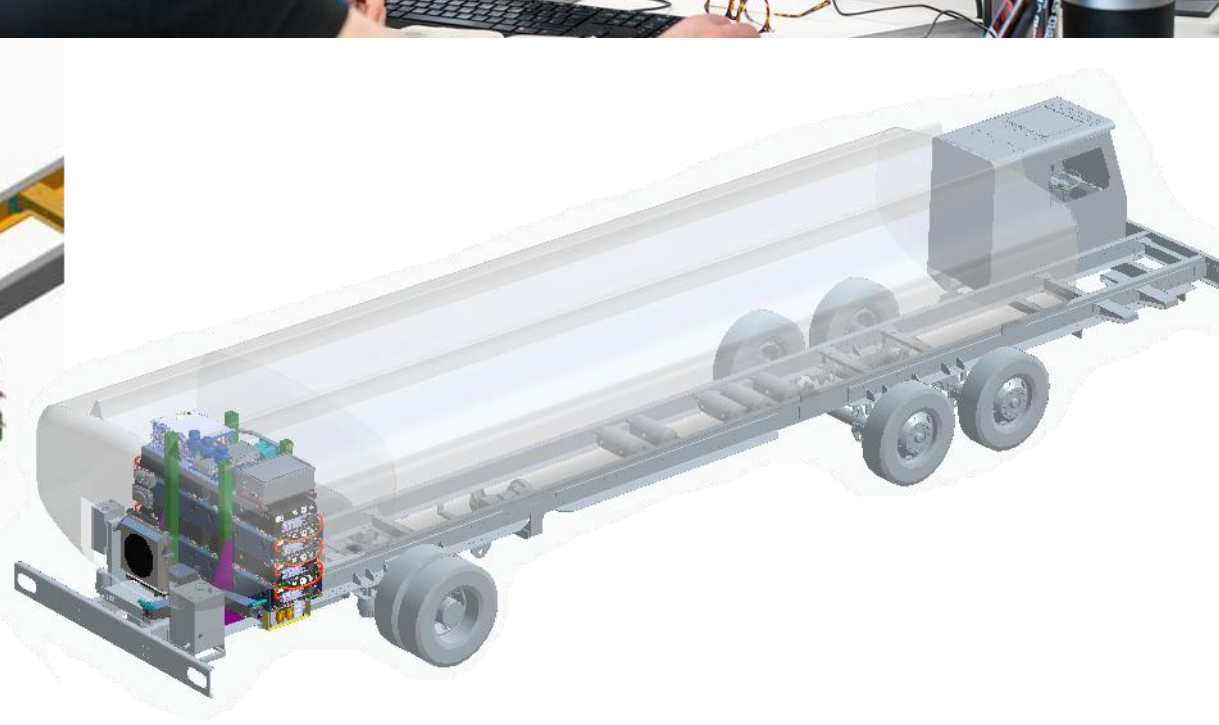
In-house:

- 3D CAD design team
- Software Engineers
- Electronic integration specialists
- Sub system manufacturing
- Reverse engineering of CANBus
- Global procurement
- After market support network and training

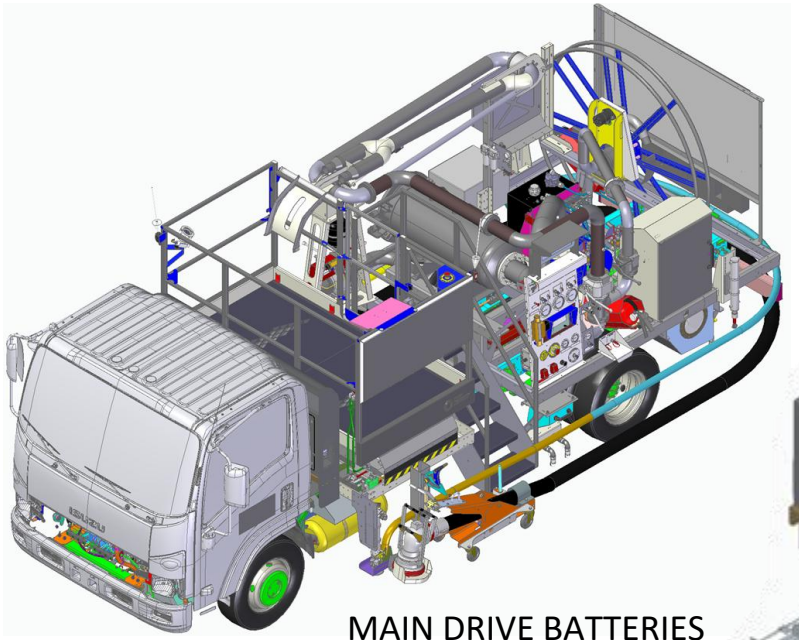


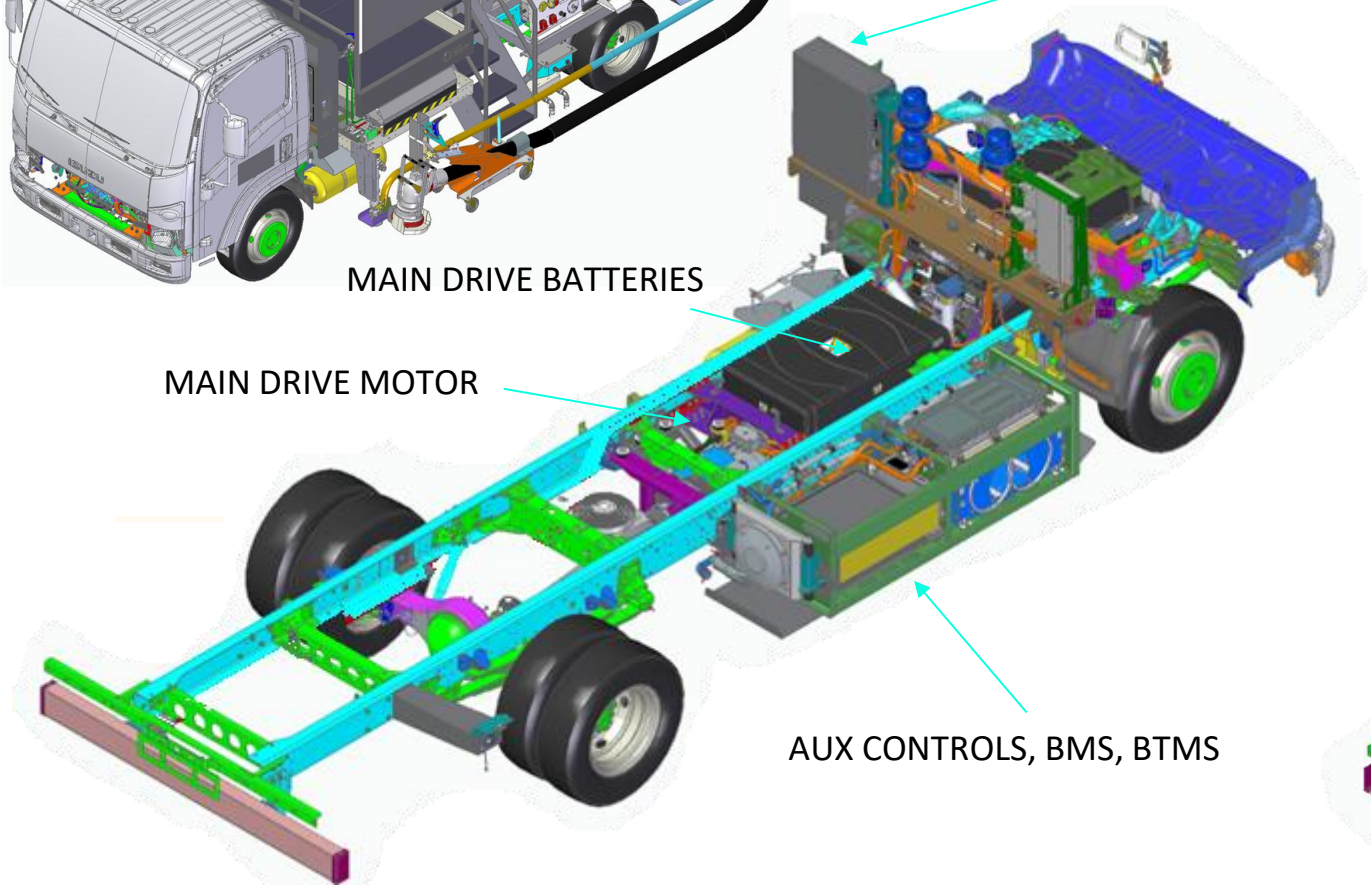


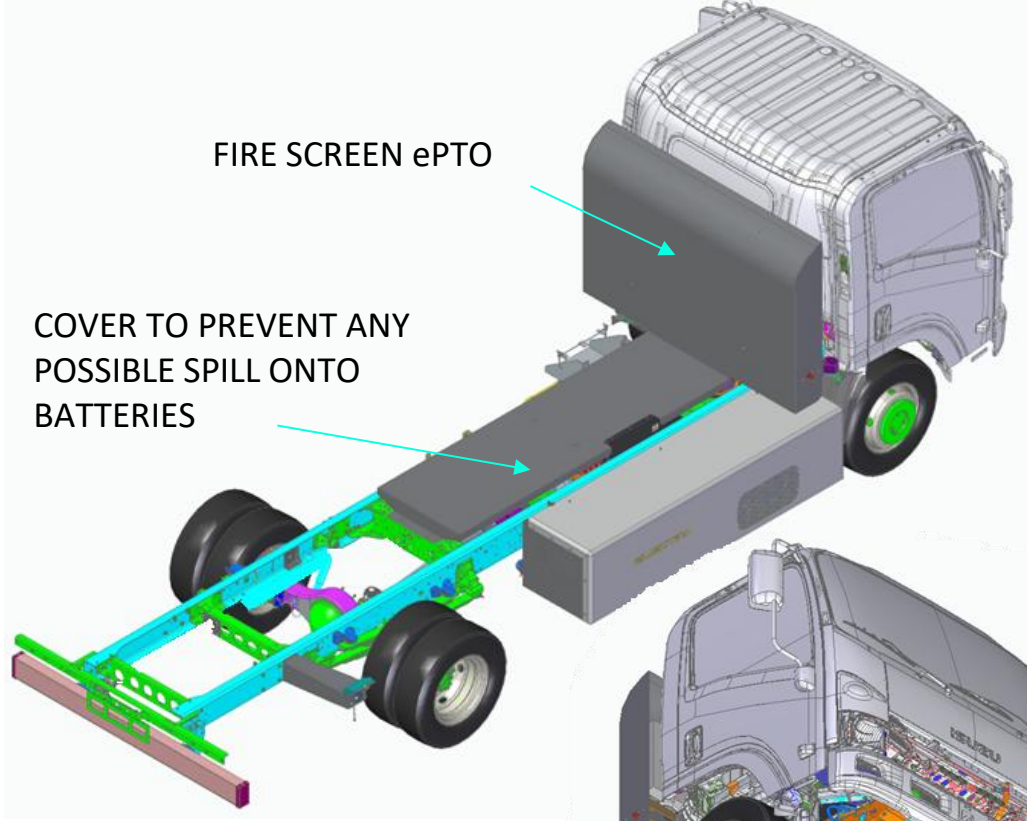


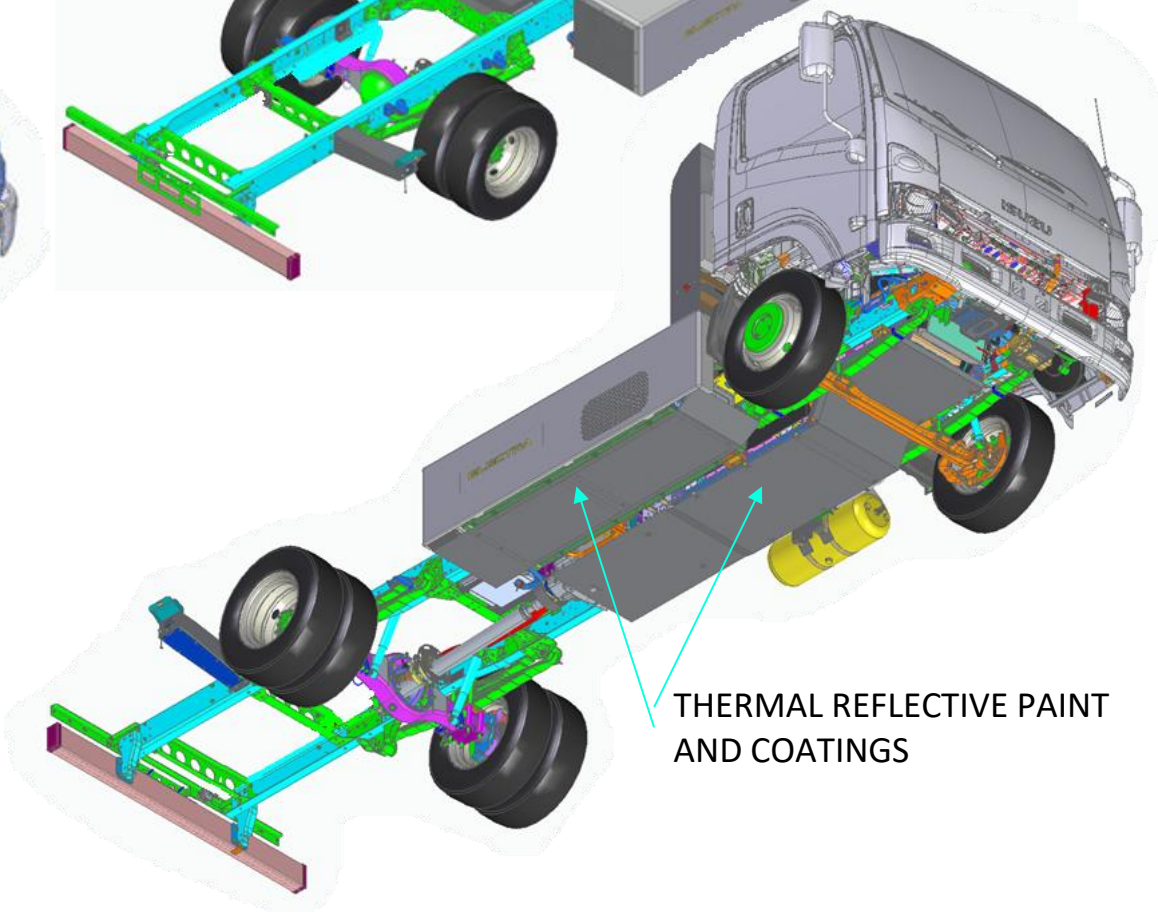


DISPENSER CHASSIS MAIN FEATURES









REFUELLER CHASSIS MAIN FEATURES

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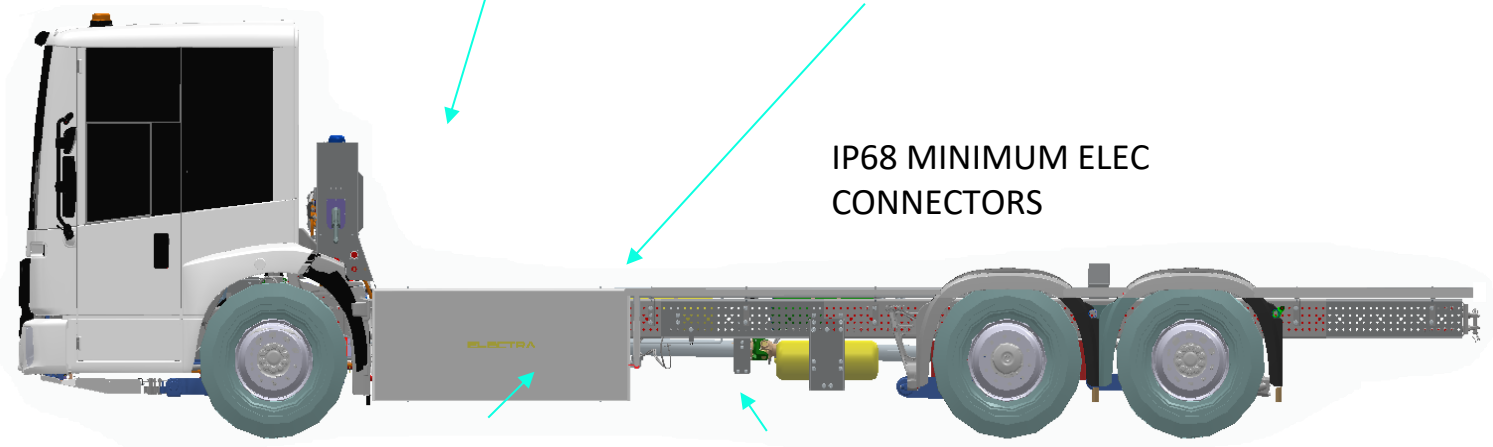
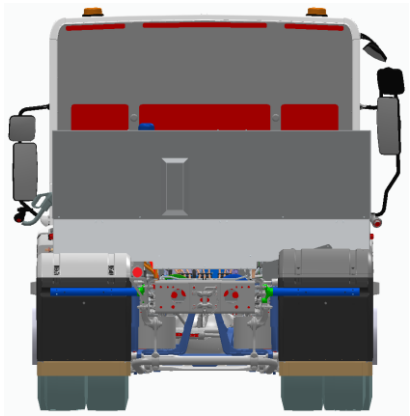
BRUSHLESS ePTO BEHIND FIRE SCREEN

SPLASH GUARD OVER MAIN ELECTRICAL ITEMS

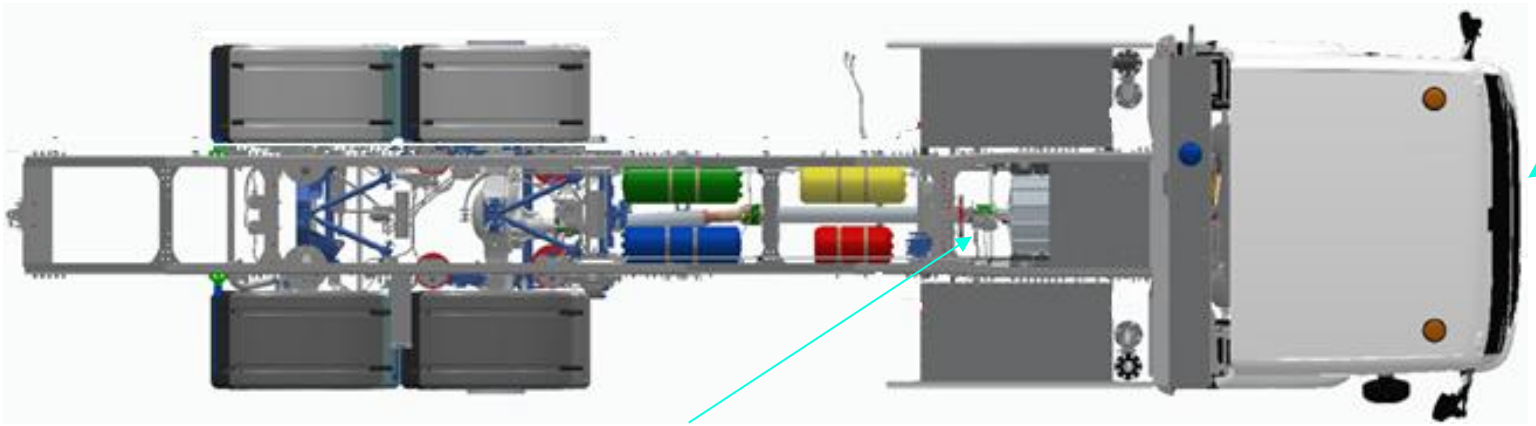


IP68 MINIMUM ELEC CONNECTORS



THERMAL REFLECTIVE PAINT AND COATINGS

THERMALLY MANAGED BATTERIES



FULL SYSTEM DIAGNOSTICS AND REAL TIME REPORTING WITH REAL TIME ALERTS

FULL TELEMETRY TO MONITOR BATTERY DUTY AND DRIVER PERFORMANCE

BRUSHLESS DRIVE MOTOR SYSTEM THERMALLY MANAGED – STATE OF ART BATTERY MANAGEMENT SYSTEM

RE-CHASSIS OF DISPENSERS – OR ANY OTHER GSE

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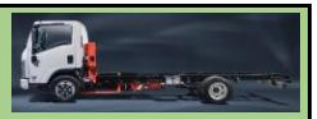
STAGE 1 Customer supply donor diesel dispenser

STAGE 2 AS remove from chassis & refurbish module

STAGE 3 Electra and AS exchange drawings

STAGE 3 Electra prepare and send electric chassis to AS



STAGE 4 Module is prepared and fitted to chassis

STAGE 5 Electra technicians attend AS for final set up and knowledge transfer

STAGE 6 Finished electric dispenser is handed over to customer and operational training is given

STAGE 7 AS provide local technical support and on-going maintenance (any particular spares/support from Electra)

PROJECT ONGOING → Technical exchange, validation → Drawings, work instructions, manuals produced → Full knowledge transfer → Full knowledge transfer

GROUP CESAR®

Centre Of Excellence & Service Aviation Refuellers

TELEMETRY FITTED FOR AIRSIDE REFUELLING

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- Battery range in an electric truck is affected by many of the same factors that affect fuel consumption in a diesel engine.
  Such as payload, type of operation, body type, area of operation (topography) & driving style

- A well-trained driver can consume around *20 percent less energy than a poorly trained driver.*

- The optimal driving technique is good anticipation with minimal braking and accelerating and importantly smooth and controlled cornering

- With an electric truck, smooth braking is important since *the energy is being recuperated and stored in the vehicle's battery,*
  which extends the range.

- The telemetry system allows precise recording of the vehicles routes and importantly the driving style, excessive acceleration, fierce braking and cornering too fast can be measured – the system can tell you which drivers are efficient and safe – *and most importantly which drivers required additional training or re-deployment.*

DIAGNOSTICS – PREDICTIVE MAINTENANCE - TESTING

- Our engineering and data teams continuously monitor all aspects of vehicle performance, including comprehensive tracking of battery metrics and full chassis diagnostics.
- Data at approximately 9.24 MB per minute (~9,240 documents per minute).
- This system allows us to easily identify errors or faults, quickly determine the root cause of any issues, and take prompt, effective action, with an alert system in place to notify us of any battery concerns (but we've not seen these)
- Predictive maintenance – the same system enables us to monitor in real time all aspects of the vehicle, if any component or signal deviates from our expectations then we can make remote checks and intervein to prevent failures before they even happen.
- Electra provide as standard a dedicated portal formatted in your corporate style to present performance and technical data, all the right info at your finger tips and in real-time
- You can present data back to your management/customers, to show fuel cost and emission savings, which drivers are best performing (or least)
- JiG 14 2027?

Maintenance costs are vastly reduced often in the region of 1/3- Why?

- Minimal moving parts
- Brushless motors
- Sealed for life components
- Optimised performance of all components, temperature regulated
- Dry system, no engine oil
- Braking is also via motor retardation and regen, 3-4 times the life for brake pads
- All systems are closely monitored, any off-spec conditions are seen before failures ever happen
- Annual maintenance is just x 2 easily accessible screw on filters

- 1.2% degradation observed over 1 year as calculated from **SoH** (the ratio of usable capacity to nominal capacity)
- **<u>8 Year battery warranty – soon to be increased to 15 years – that's the service life of a refueller or more !</u>**

Bulk storage and charging stations are available with various capacities

How does it work ?

- We will size a bulk storage and charging module based on the No. vehicles and duty that you're operating
- The system has full battery management systems and thermal controls
- The module is connected to a low power, easily available continuous power supply, 32amps 3 phase 400v
- The module can charge–out at up to 100kWh

Example - Using a 200kW bulk storage and charging module.
You have x4 hydrant dispensers each with 140kWH batteries
- using approx. 50kW of charge per vehicle per day:

1 Vehicle charging - At 100kWh charge rate:
Dispenser will top up 1 x 50kw in approx. 30 minutes

2 Vehicle charging - At 100kWh charge rate:
Dispensers will top up 2 x 50kw in approx. 1 hour

4 Vehicles charging - At 100kWh charge rate:
Dispensers will top up 4 x 50kw in approx. 2 hours

CHARGING TIMES TYPICAL - MUCH BETTER THAN YOU IMAGINE

*Dependent on ambient and other conditions

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Type	Capacity	Charger type	Charger Loc'	Supply required	Current	Charging time HRS 0-100%	Charging time HRS 1/3 top-up
20KL/Disp	140kWh	22kW	Onboard	3 Phase 415V	32A	6	2.0
20KL/Disp	140kWh	D/C fast	Onboard	3 Phase 415V	32A	0.8	0.3
20KL	210kWh	25kW	Onboard	3 Phase 415V	32A	8.4	2.8
20KL	210kWh	D/C Fast	Comb'	3 Phase 415V	DC Station	1.2	0.4
20/45KL	280kWh	25kW	Onboard	3 Phase 415V	32A	11	3.7
20/45KL	280kWh	D/C fast	Comb'	3 Phase 415V	DC Station	1.5	0.5
45KL	315kWh	25kW	Onboard	3 Phase 415V	32A	14	4.7
45KL	315kWh	D/C fast	Comb'	3 Phase 415V	DC Station	1.7	0.6
45+KL	350kWh	25kW	Onboard	3 Phase 415V	32A	14	4.7
45+KL	350kWh	D/C fast	Comb'	3 Phase 415V	DC Station	1.9	0.6
45+KL	420kWh	25kW	Onboard	3 Phase 415V	32A	16.8	5.6
45+KL	420kWh	D/C fast	Comb'	3 Phase 415V	DC Station	2.3	0.8

*Depenedant on ambient and other conditions

CHARGING INFRASTRUCTURE – THERE'S LOTS OF INOVATIVE SOLUTIONS AVAILABLE

KEY METRICS 20KL ELECTRIC REFUELLER - REAL DATA

140kWh battery (Our smallest battery)

(REAL Data collected 01 Jan 24- 31 Dec 24)

2024 YEAR ANALYSIS - KEY METRICS 20KL ELECTRIC REFUELLER

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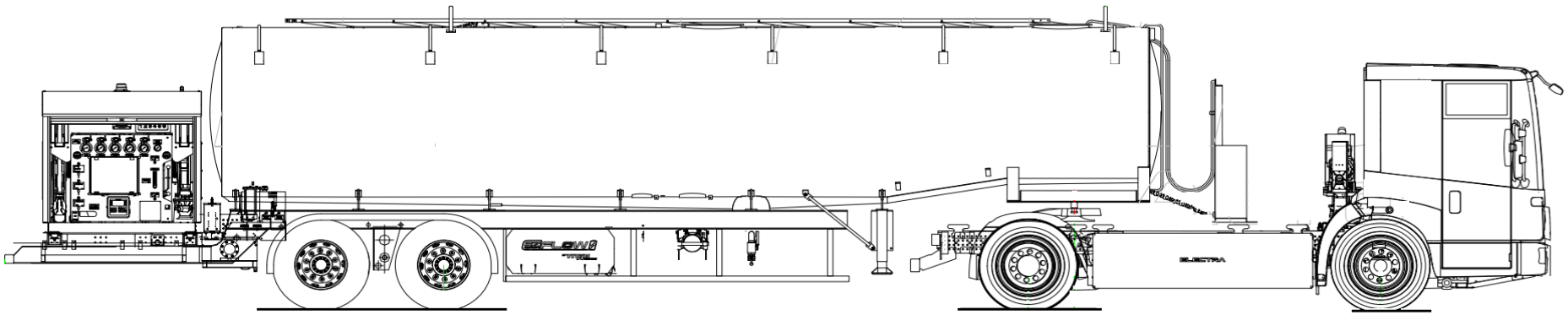
Distance Covered (km)	Energy Consumed (kWh)	Energy Recovered (kWh)
1504	4959	147

Diesel Fuel Cost (£)	Electrical Cost (£)	CO2e Savings (kg)
5728	1339	2,230

Exchange diesel chassis with Electra eStar 4x2 Tractor Unit with 210kWh battery pack



YEAR ANALYIS - Diesel vs. Electra – 45KL Refueller

ELECTRA™

Distance Covered (km)	Fuel Uplift (L)
2,336	16,425,000

Diesel Used (L)	Fuel Cost (£)	Adblue cost (£)	Emissions Co2 (kg)
10,220	12,366	300	25,477

Electric Used (kw)	Electric Cost (£)	Adblue cost (£)	Emissions (kg)
11,096	2,940	0	0

Diesel £/L £1.21 Electric cost £/kWh £0.265

10 YEAR ANALYIS – Service Costs - 45KL Refueller

DIESEL £12,000 - Indication from Customer

ELEC £5,000 - Expectation from Electra based on customer operator experience

10 Year Analysis Total Savings

Savings Diesel vs.Elec (£)

94,260

Savings Adblue (£)

3,000

Savings Emissions Co2 (kg)

254,770

Savings Service Costs (£)

70,000

Total anticipated cost savings 10 years = £167,261

Total anticipated emission savings 10 years = 254,770 kg = 561,767 lbs

END

*OTHER EV MANUFACTURERS ARE AVAILABLE,

but they can’t do what Electra can do 😉 *