



A pioneer in AI-enabled, zero-emission, hydrogen fuel cell commercial vehicles

## AI CLIMATE TECHNOLOGY DECARBONISING THE ROAD FREIGHT SECTOR

DOCUMENT: AW V3.7\_24/12/2024  
PRE-NDA

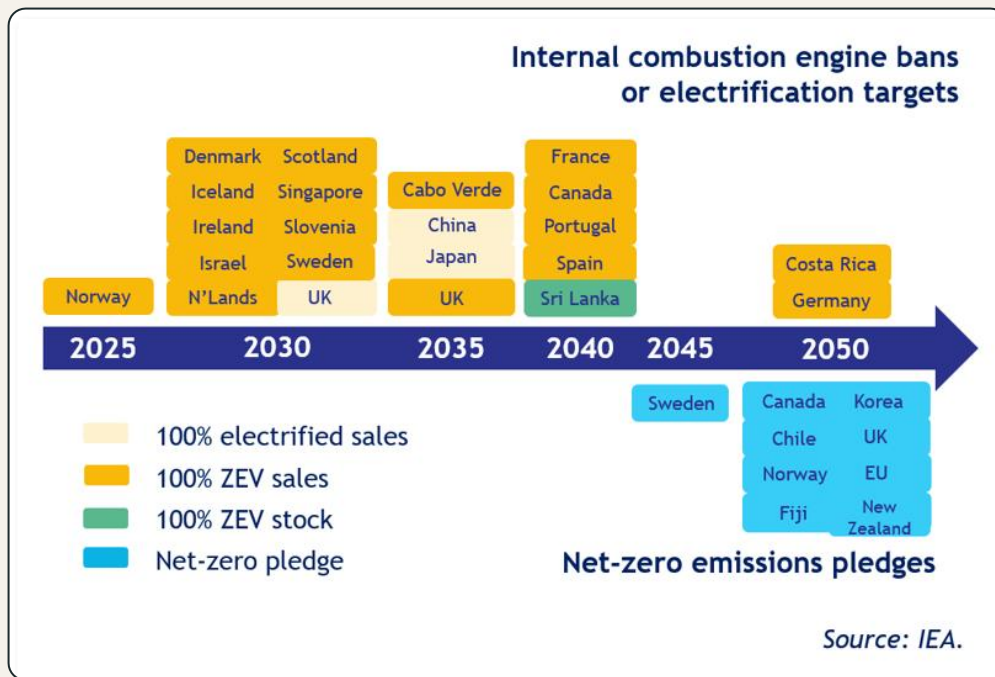
UNLESS OTHERWISE SPECIFIED - Commercially sensitive information Distribution not allowed without prior written consent by Hydrogen Vehicle Systems LTD ("HVS")  
2024 Hydrogen Vehicle Systems Ltd | Park View House | 96 Caledonia St | Glasgow | G5 0XG | United Kingdom | e: info@hvs.co.uk | +44 (0)141 418 5490 | hvs.co.uk



[www.hvs.co.uk](http://www.hvs.co.uk)



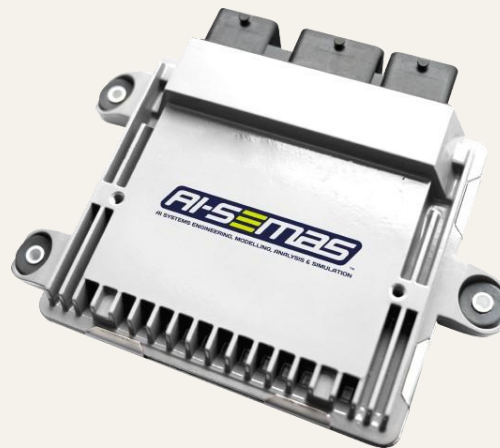
# TWENTY NATIONS ARE BANNING DIESEL TRUCKS DUE TO CLIMATE LEGISLATION



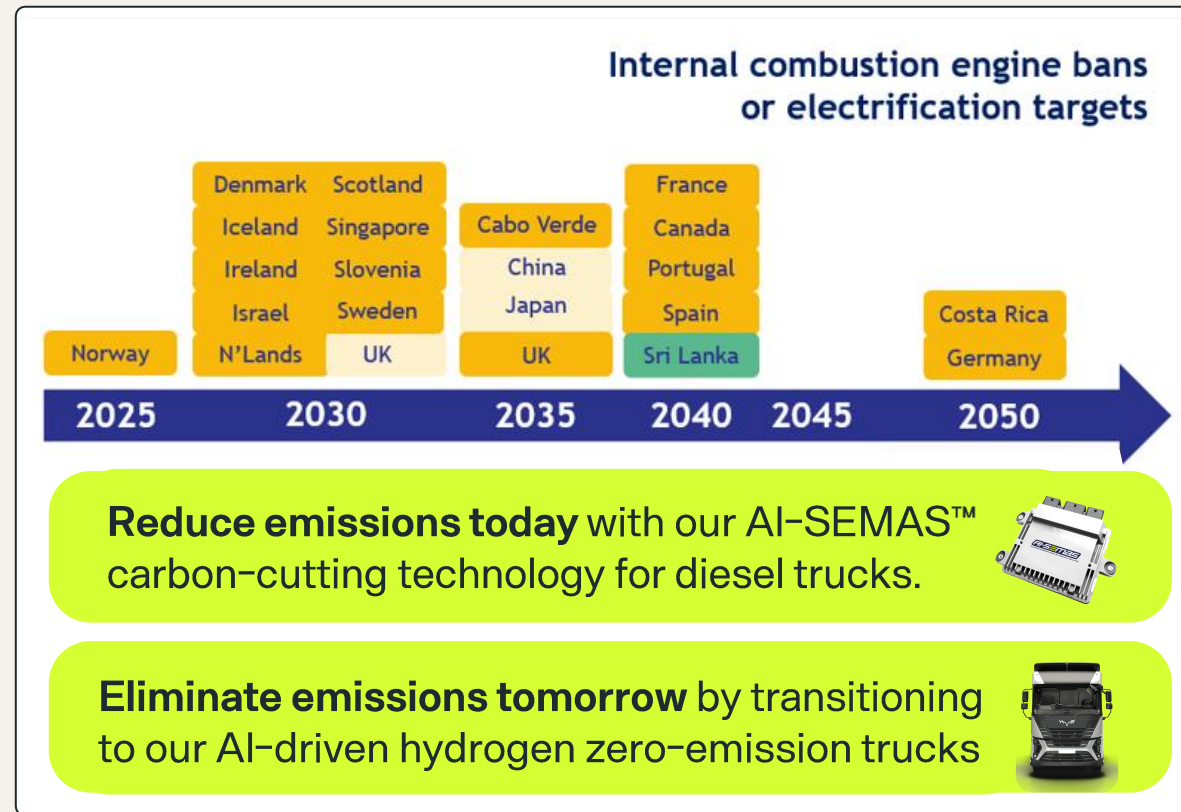


# WE BUILD ZERO-EMISSION TRUCKS AND CARBON-REDUCING TECHNOLOGY

ZERO-EMISSION HYDROGEN FUEL CELL POWER



# TIMED TO PERFECTION





# INTRODUCTION TO HVS: YOUTUBE VIDEO



ZERO-EMISSION HYDROGEN FUEL CELL POWER



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The SEMAS trademark is registered in the UK, EU and Australia, and pending in Turkey China, Canada, India, the Republic of Korea, and the US.



## Welcome to Hydrogen Vehicle Systems, where visionary technology fuels tomorrow's transport

Over two decades ago, my clean-tech journey began with Project Eureka, extracting hydrogen through magnetic water splitting. Today, that vision has evolved into HVS—a UK-based AI-Climate Tech company at the forefront of trucking decarbonisation.

We develop: **AI-Driven Hydrogen Zero Emission Trucks** and **AI-SEMAS™ Emission Reduction Technology**, enhancing diesel, battery, and hydrogen trucks to: **Perform Better. Drive Cleaner. Decarbonise Faster.** Our solutions deliver measurable results: **Up to 14% savings on hydrogen, 10% on battery, and 5% on diesel.**

**Our mission is to optimise diesel trucks for cleaner performance today while accelerating the transition to hydrogen trucks tomorrow.**

Abdul Waheed  
HVS Founder and CEO



1999



2017



2018



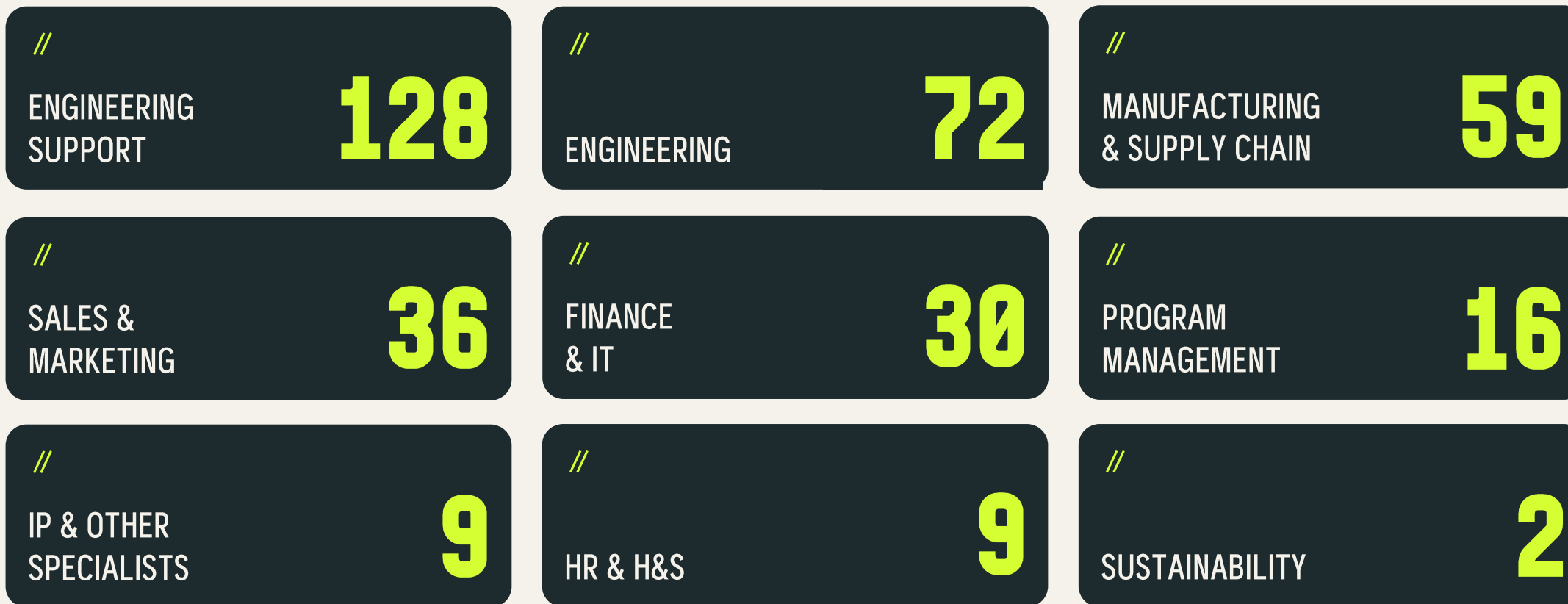
2019



2024



## 361 PEOPLE AS PART OF THE WIDER DELIVERY TEAM



World class team with deep industry knowledge with prior experience in:





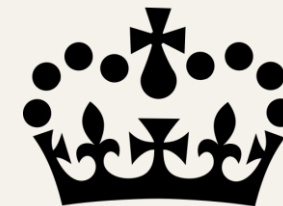
# INTRODUCING OUR INVESTORS



**£15M**



**£15M**



**GOV.UK**

**£30M**

ZERO-EMISSION HYDROGEN FUEL CELL POWER





# WE HAVE THE TRUCKS, FUELLING, AND CUSTOMERS



ZERO-EMISSION HYDROGEN FUEL CELL POWER



# WE'RE WINNING ALL THE TOP AWARDS. TECHNOLOGY. AUTOMOTIVE. CLIMATE.



ZERO-EMISSION HYDROGEN FUEL CELL POWER

Winner - Hydrogen Awards 2024 Automotive (Heavy trucks, buses and coaches); Winner - Hydrogen UK Awards 2024 Hydrogen For Transport Award; Winner - Engineering & Manufacturing Awards (EMA) 2024 Engineering Innovator 2024; Bronze Award - Net Zero Champion 2024; Winner - Hydrogen Awards 2023 Sector: Road Haulage; Winner - BQF Excellence in Environmental Sustainability 2023; Winner - Hydrogen For Life 2023; Winner - The Good Small Business Awards 2023 - Low Emissions Ambassador 2023; Finalist - The Good Small Business Awards 2023 - Good Small Business of the Year 2023; Winner - The Scottish Asian & Business Awards 2022 - Business Leader of the Year Award 2022; Winner - The Scottish SME Business Awards 2022 Tech Entrepreneur of the Year - Jawad Khurshheed; Winner - Business

UK Awards - Small Business Awards 2022 - Small Business Disruptor of the Year 2022; Winner - Business UK Awards - Small Business Awards 2022 - CEO / Director of the Year 2022; Winner - The Scottish SME Business Awards 2019 - Scottish Innovation of the Year 2019; Silver Award - Future Resource Green Apple Award 2019 For Environmental Best Practice Sustainability; Bronze Winner - International Green Apple Awards 2018 For Environmental Best Practice Transport & Automotive; Commended - Green Fleet Awards 2018 Industry Innovation Award 2018; Finalist - The Future Resource Green Apple Awards 2018 Sustainability Champion Award 2018; Sustainability Awards - Business Awards - Transport; SBL.



# MASTERS OF GRANT FUNDING

FUEL CELLS

## HVS Wins UK Grant to Develop Zero - Emissions Hydrogen Fuel Cell Powered Ambulance

By Fuel Cells Works  
October 20, 2021 at 12:14 PM EDT

**£1M**  
[Read Article](#)

Business Markets Sustainability Legal Breakingviews Technology More

## Supermarket Asda, startup HVS receive UK hydrogen self-driving lorry grant

By Nick Carey  
February 1, 2023 12:43 AM GMT - Updated 2 years ago

**£7M**  
[Read Article](#)

Home News Sport Weather iPlayer Sounds

## Glasgow firm awarded £30m to develop clean hydrogen HGV

© 2 December 2022

HVS designs and develops hydrogen-electric vehicles

**£15M**  
[Read Article](#)





# NOW IT'S THE €1.8 TRILLION GREEN FUND

**€1 TRILLION: EUROPEAN GREEN DEAL INVESTMENT PLAN (EGDIP)**

**€724 BILLION: RECOVERY AND RESILIENCE FACILITY (RRF)**

**€100 BILLION: JUST TRANSITION MECHANISM (JTM)**

European climate funds deployed in 2024:  
€226M for Daimler's hydrogen trucks, €1.5B for EU hydrogen R&D, and €6.9B for hydrogen sector aid.



# EUROPE TO QATAR

**€1 TRILLION: EUROPEAN GREEN DEAL INVESTMENT PLAN (EGDIP)**  
**€724 BILLION: RECOVERY AND RESILIENCE FACILITY (RRF)**  
**€100 BILLION: JUST TRANSITION MECHANISM (JTM)**

**£1B UK-Qatar Climate  
Tech Investment Fund**

**€10B EUROPEAN  
INNOVATION COUNCIL FUND**

**€30M PER PROJECT: NEW  
STRATEGIC TECHNOLOGIES  
FOR EUROPE STEP SCALE-UP**



وزارة التجارة والصناعة  
Ministry of Commerce and Industry  
دولة قطر - State of Qatar



وزارة المواصلات  
Ministry of Transport  
دولة قطر - State of Qatar



وزارة الخارجية  
Ministry of Foreign Affairs  
دولة قطر - State of Qatar



جهاز قطر للإستثمار  
QATAR INVESTMENT AUTHORITY

**excelledia**



# €30M EIC SCALE-UP FUND ELIGIBLE

✓ AI TECHNOLOGY ✓ DIGITAL ✓ DEEP TECH ✓ SCALABLE

✓ ADVANCED CONNECTIVITY ✓ AUTONOMOUS SYSTEMS

✓ HYDROGEN ✓ CARBON-REDUCTION ✓ NET-ZERO CLEAN TECHNOLOGY

“We are confident that AI-SEMAS™ Emission Reduction Technology aligns exceptionally well with the objectives and priorities of the EIC STEP Scale-Up programme. *Visiativ.com 12/12/24*”

ZERO-EMISSION HYDROGEN FUEL CELL POWER



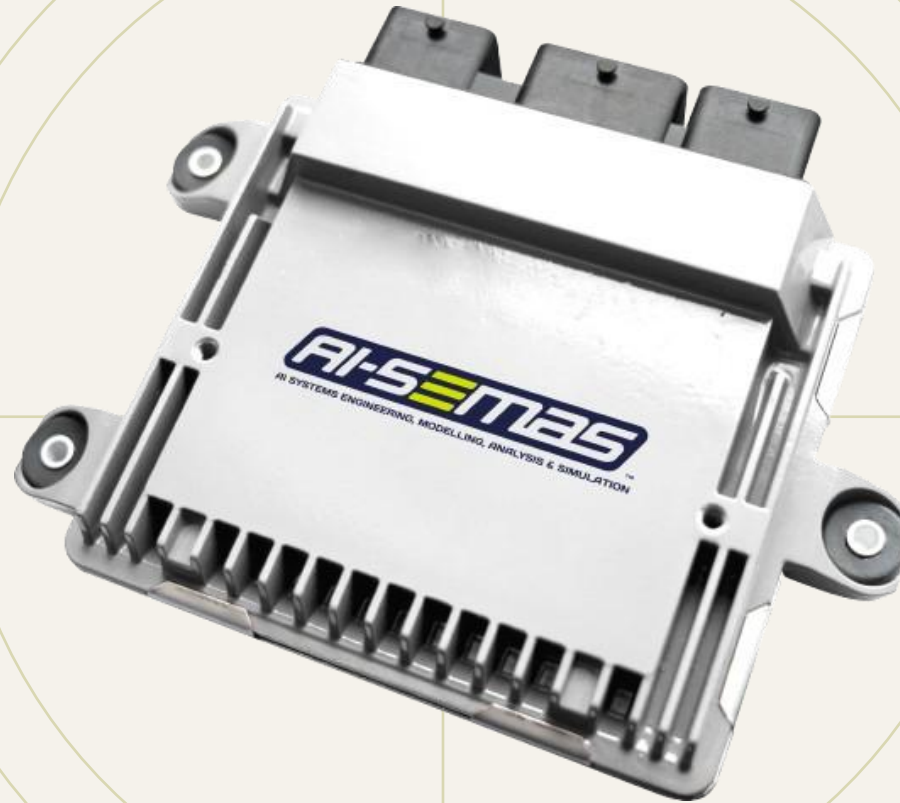
# PRODUCT 1

# CARBON REDUCING

# TECHNOLOGY



## HVS AI-SEMAS: THE FUTURE OF AI VEHICLE ENERGY MANAGEMENT



**SAVES UP TO:  
5% DIESEL  
10% BATTERY  
14% HYDROGEN**

5.25% average savings weighted average result based on fleet composition and excess fuel use: **Best (20 drivers):** 0% extra fuel used; **Good (25 drivers):** 3% extra fuel used; **Fair (30 drivers):** 5% extra fuel used; **Poor (20 drivers):** 10% extra fuel used; **Worst (5 drivers):** 20% extra fuel used.

FOOTNOTES

20% savings stem from driver performance differences (best driver v. worst driver), while 5% and 9% savings come from multi-energy-source powertrains. Battery Truck: Batteries & Regen Braking; Hydrogen Truck: Fuel Cell, Batteries & Regen Braking.





## \*PER-TRUCK DIESEL SAVINGS OVER 75,000 MILES

**3P PER MILE: £2,500 ANNUALLY**

**5 TONNES OF CO2 ANNUALLY**

**28KG OF NOx ANNUALLY**



## **CAN BE RETRO-FITTED TO EXISTING DIESEL TRUCKS**

"UK: 515,000 trucks; Europe: 6M+ trucks." source [GOV.UK](https://www.gov.uk)



\* Assumptions – A truck achieving 10 mpg and covering 75,000 miles (120,000 km) annually consumes 33,898 liters of diesel per year. With a 5.25% fuel savings, this reduces diesel consumption by 1,780 liters annually, saving £2,349 at a diesel price of £1.32 per liter, equivalent to 3.13 pence per mile. In terms of emissions, with diesel producing 2.51 kg CO<sub>2</sub>e per liter, this reduction equates to a decrease of 4.47 tonnes of CO<sub>2</sub> per year.

\* Estimated figures based on AI-SEMAS modelling and partial road testing – full system road testing and validation stage now being undertaken. On average, AI-SEMAS™ achieves a 5.25% saving across 100 diesel truck drivers. NOx savings can vary significantly depending on the fleet, particularly whether the vehicles are Euro 5 or Euro 6 diesel models with functional filters and catalytic systems.



## MEET THE AI-SEMAS™ TEAM AND INVENTORS



**CSO DR. TELFORD**



HVS Internal

 <b>Dr. David Telford</b> BSc PhD CEng Chartered Energy Engineer Fellow Institute of Energy, HVS Chief Scientific Officer and SEMAS Lead.	 <b>Dr. Charles Stone</b> PhD MBA, Head of IP and fuel cell technology, IP strategic lead for SEMAS. Ex Ballard VP of R&D. Holds 15 Fuel Cell Patents	 <b>Dr. Abdul Hye</b> BSc MSc PhD, Senior Propulsion Engineer at HVS. PhD in optimal energy management control systems for fuel cell vehicles	 <b>Malcolm Wallace</b> CEng MIET, Chief Engineer for EE Systems for HVS, 25 years experience in McLaren Cars on the F1, Lotus Engineering and Lotus Cars	 <b>Brian Cooper</b> MEng Mechanical and Manufacturing Engineering (Distinction), The Queen's University of Belfast - Chief Engineer Propulsion & Thermal	 <b>Abdul Waheed</b> HVS Founder, Chief Innovation Officer, and Business Development Officer, 25 Years in Tech Start-Up, AI Enthusiast
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External SEMAS Team

 <b>PNDC</b> Vehicle Control System & System Validation	 <b>MAGE</b> AI Enabled Hardware and Software		 <b>SCINTILLA</b> Intellectual Property		
 <b>Dr. Max Parker</b> EngD MEng MIET, Senior R&D Engineer who leads the Power Electronics, Machines & Drives (PEMD) innovation theme	 <b>Dan Cutting</b> Masters in Aero-Mechanical Engineering from University of Strathclyde. 6 years with Rolls Royce, Machines, Power Electronics and Drives	 <b>Matthew Love</b> BEng (Hons) MSc Control Systems Managing Director/Chief Engineer and SEMAS Design Authority ex Lockheed	 <b>Dr. Stephen Lochran</b> BSc PhD MSc Control Systems Head of Software Engineering, vehicle mounted sensors and real-time embedded signal processing	 <b>Susan Oliver</b> Director of IP Strategy at Scintilla, ex ARM, sits on HVS IP Committee, NED at UK IP Federation, World IP Strategist for 2017	 <b>Peter McBride</b> Founder & Director at Scintilla, electronics and software fields including microelectronics, photonics, communications technology



**HEAD OF IP DR. STONE**

### DR. TELFORD: NUCLEAR PHYSICIST

### DR. STONE: HYDROGEN FUEL CELL EXPERT

### SUZANNE: ARM HEAD OF PATENT INFRINGEMENT

ZERO-EMISSION HYDROGEN FUEL CELL POWER



**SEMAS™ VEMOS**  
Virtual-Vehicle Energy-  
Management Optimisation Suite

**SEMAS™ CUMULUS**  
AI Enabled Total Vehicle &  
Fleet Operational  
Database

**SEMAS™ AIPD**  
AI Predictive Drive

**PLAY  
VIDEO**

ZERO-EMISSION HYDROGEN FUEL CELL POWER

MULTI-PATENT-PROTECTED

**OPTIMUM PERFORMANCE | MAXIMUM FUEL EFFICIENCY | PREDICTABLE & ACCURATE RANGE | EXTENDED LIFE & DURABILITY**








# INTELLECTUAL PROPERTY: AI-SEMAS™

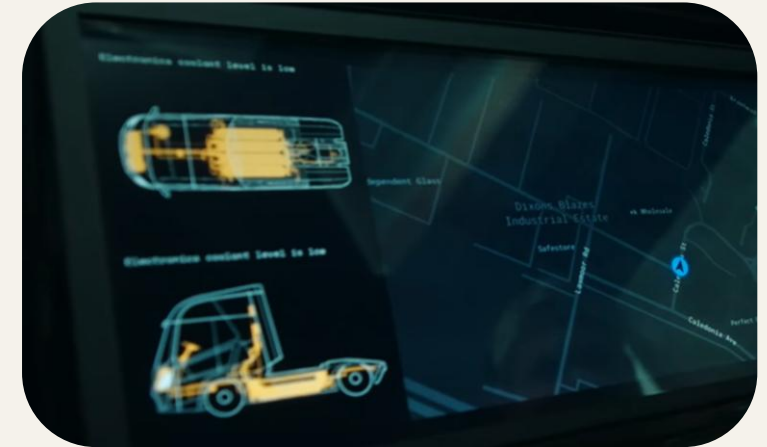


AI- Enabled SEMAS provides a system-level solution to onboard vehicle operations and fleet management



## BLOCK OVERVIEW

SEMAS®	Value proposition
 SEMAS™ VEMOS	<ul style="list-style-type: none"> <li>Virtual-Vehicle Energy- Management Optimisation Suite</li> <li>Total Vehicle Energy Management System</li> <li>Continuous Cyclic Optimisation</li> <li>Control Algorithm Library</li> <li>High-Fidelity Modelling Suite</li> </ul>
 SEMAS™ AIPD	<ul style="list-style-type: none"> <li>Always-On' AI Predictive Drive Controller</li> <li>Continuous Logistics Improvement Updates Data Logger, Telematics &amp; Sensors</li> <li>Connectivity module to AI-SEMAS iCloud</li> </ul>
 Telematics & sensors	<ul style="list-style-type: none"> <li>Data logger for individual vehicles</li> <li>Vehicle systems interrogation for maintenance and performance</li> </ul>
 SEMAS™ CUMULUS	<ul style="list-style-type: none"> <li>AI-Enabled Total Vehicle &amp; Fleet Operational Database,</li> <li>Predictive Maintenance,</li> <li>Algorithm Improvement</li> </ul>
 SEMAS™ DATASET	<ul style="list-style-type: none"> <li>Analysis &amp; Fleet Management</li> <li>Data mining &amp; AI enhancements</li> <li>Range Optimization &amp; Accuracy; Drive-Assist Functionality; Predictive &amp; Preventative Maintenance; Fleet Manager Interface;</li> <li>(Lowest Cost Logistics (per kg/per km)</li> <li>Regulatory Compliance</li> <li>Security &amp; Tracking</li> <li>Warranty validation</li> </ul>



- 5** UK Patents [granted]
- 5** UK Patents [pending]
- 8** International Patent Applications (PCT)
- 52** UK & International PCT patents [In progress future fillings]
- 30** Areas of Innovation
- 26** Trade Secrets & Know How
- 7** Registered Vehicle Designs
- 7** Other Prior Registered Designs



Trademark Registered: UK, Australia, EU, Turkey & US









Trademark Registered: UK, Australia, China, EU and US

ZERO-EMISSION HYDROGEN FUEL CELL POWER



# AI-SEMAS™: FROM DEVELOPMENT TO SALES TIMELINE



	YEAR 1	YEAR 2	YEAR 3	YEAR 4
<b>AI-SEMAS HARDWARE UNIT FOR DIESEL TRUCKS</b>  	 Testing & Development: Leading Global OEM	Sales 8,000,000 Truck Market	Sales 8,000,000 Truck Market	Sales 8,000,000 Truck Market
	 Testing & Development: HVS	Safety Regulation Testing HVS	Road Safety Certification: HVS	Sales 7,000,000 EU Truck Market
<b>AI-SEMAS AS A SOFTWARE FOR BATTERY AND HYDROGEN TRUCKS</b>  	 Testing & Development: HVS	Testing & Development: HVS	Road Safety Certification: HVS	Sales: HVS OWN VEHICLE 7,000,000 EU Truck Market
	 Outreach to Volvo, Mercedes, Renault etc.	Testing & Development: Volvo, Mercedes, Renault etc	Road Safety Certification : Volvo, Mercedes, Renault etc	Sales: Volvo, Mercedes, Renault etc 7,000,000 EU Truck Market

5.25% average savings weighted average result based on fleet composition and excess fuel use: **Best (20 drivers):** 0% extra fuel used; **Good (25 drivers):** 3% extra fuel used; **Fair (30 drivers):** 5% extra fuel used; **Poor (20 drivers):** 10% extra fuel used; **Worst (5 drivers):** 20% extra fuel used.

FOOTNOTES

HVS has partnered with [Evage](#), a company in India with 70 years of family automotive expertise. Their motors are integral to HVS' E-axle supplier, Meritor. More significantly, Evage has strong ties to a global-leading truck manufacturer (details available under NDA), which can fast-track AI-SEMAS technical development, implementation, and safety testing within a targeted six-month timeframe. Additionally, India's minimal road safety regulations for trucks allow immediate sales opportunities. This is further bolstered by a direct connection to the Chairman of the Board of India's Trucking Association, representing members who collectively operate 8 million trucks—unlocking a substantial market potential.



# PRODUCT 2

# ZERO-EMISSION

# TRUCKS

# HVS HYDROGEN-ELECTRIC TRUCK



// Watch videos showcasing the development stages of our truck.  
// Scan the QR Code to watch on YouTube, Or click the link below:  
[youtube.com/@HVSTrucks](https://youtube.com/@HVSTrucks)



**TRANSFORMING  
THE TRUCKING  
INDUSTRY**



**DRIVE CLEANER,  
PERFORM BETTER  
AND DECARBONISE  
FASTER**







# WATER-EMITTING TRUCK: A REVOLUTION IN TRUCK DESIGN

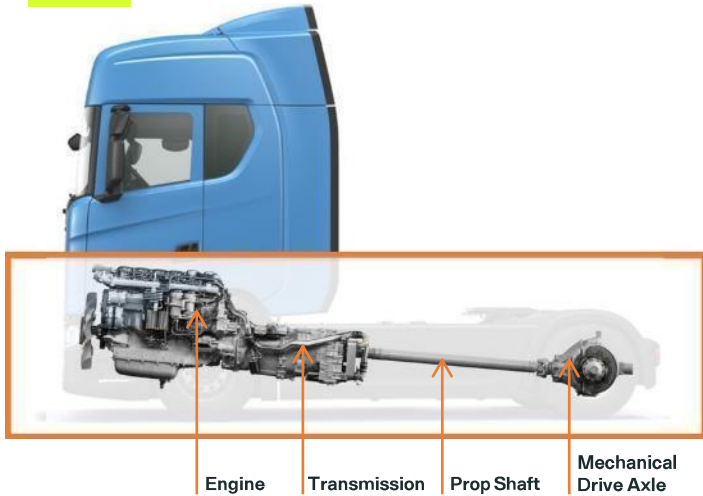


Purpose-built design and chassis that optimises operational efficiency, a competitive advantage to retrofitted trucks

Unlike other hydrogen powertrain designs using an ICE vehicle chassis, HVS has designed its chassis from the ground-up. This optimises cutting-edge hydrogen powertrain technology to provide maximum operational efficiency, safety and driver comfort for HGV fleets striving to meet their net zero goals.

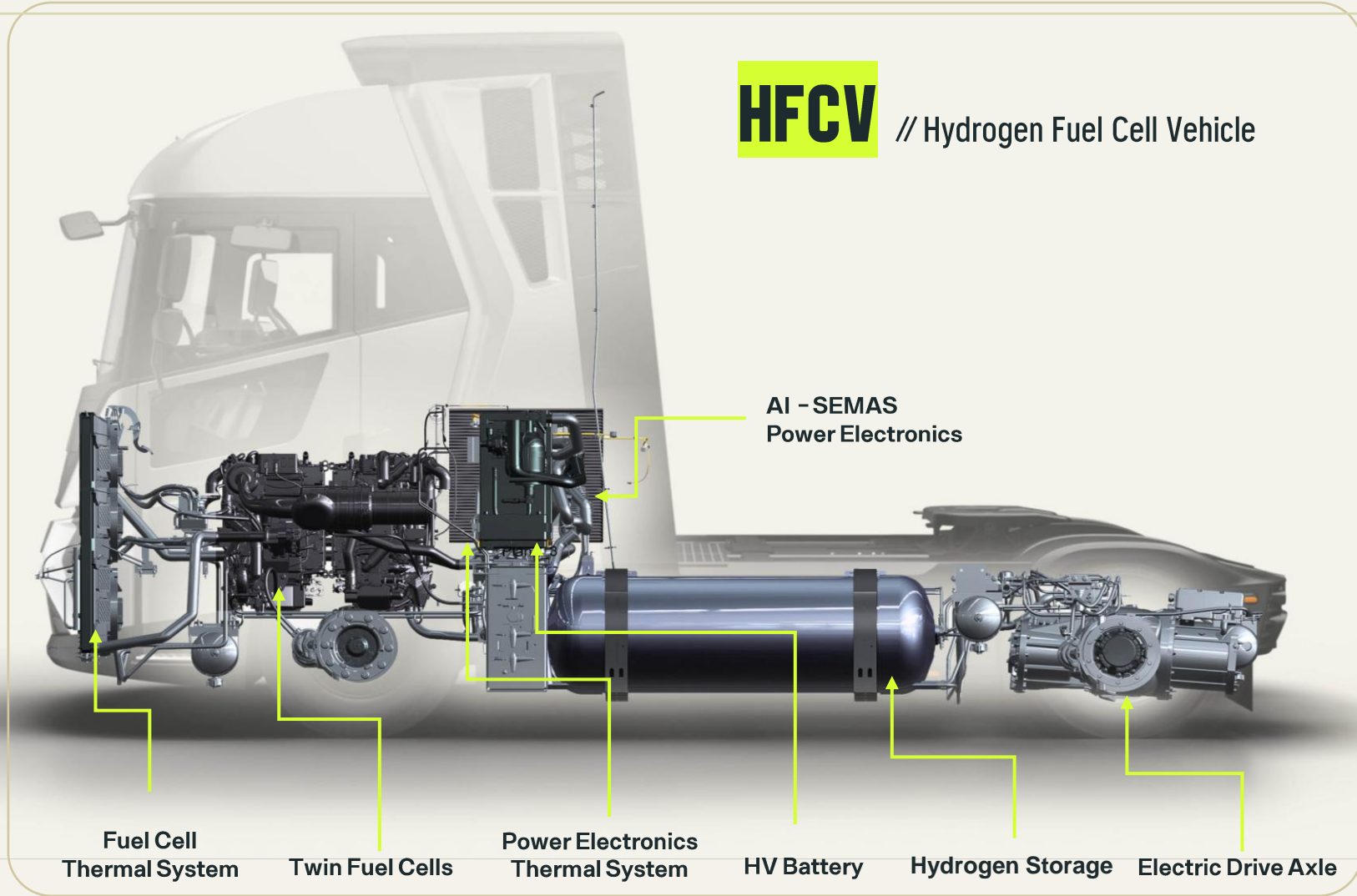
**ICE**

// Internal Combustion Engine Diesel Powertrain



**HFCV**

// Hydrogen Fuel Cell Vehicle



# VEHICLE SPECIFICATIONS



WIDE ERGONOMIC ENTRANCES



BESPOKE DISPLAY FOR MAXIMISED FOCUS & PRODUCTIVITY



INCREASED GLAZING AREA & VISION



ENHANCED AERODYNAMIC PROFILED CAB, ENHANCING EFFICIENCY & RANGE

EXCITING NEW HGV DESIGN BENCHMARK, INCREASING VEHICLE APPEAL & ADDRESSING DRIVER RETENTION

MAXIMUM HYDROGEN STORAGE, SAFELY LOCATED, CENTRALLY WITHIN THE WHEELBASE

Vehicle Category  
**N3 Europe**

Powertrain Type  
**HFCV**

GCW (Gross Combined Weight)  
**up to 42 tonnes** (Tractor+Trailer+Payload)

Fuel  
**Gaseous Hydrogen**

Refuelling Time  
**10- 15 minutes**

Axle Configuration  
**4x2**

CO2 Emissions  
**0g/km**

GVW (Gross Vehicle Weight)  
**19 tonnes** (Laden Tractor only)

Hydrogen Compression  
**up to 700bar**

Road Speed  
**up to 95km/h**

Range: **600km**  
*Dependent on driving style, payload & terrain conditions*



# 6 REASONS WHY HYDROGEN TRUCKS OUTPERFORM BATTERY TRUCKS



## HEAVY PAYLOADS ✓

Hydrogen propulsion is able to pull heavy duty without the payload deficit of a heavy BEV (battery truck)



## LONG RANGE ✓

Operators can stay on the road for 600km\* before needing to refill the Hydrogen tanks



## ALL-WEATHER MOBILITY ✓

HFCEV maintain range & performance in cold operating conditions (unlike battery trucks)



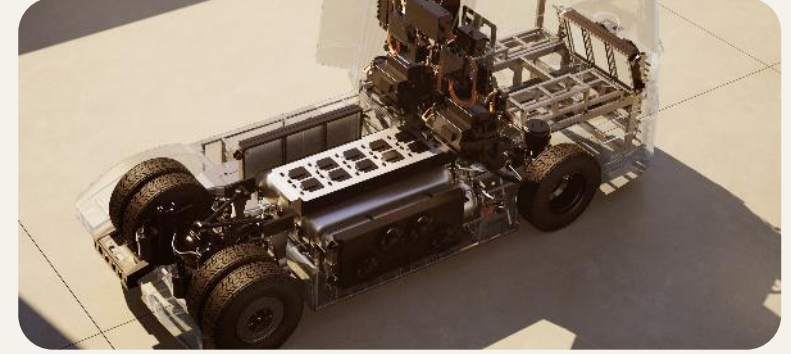
## FUELLING STATION NETWORK ✓

Leveraging existing stations for hydrogen supply and installing back-to-base hydrogen stations at depots..



## QUICKER RE-FUELLING ✓

Hydrogen tank refilling takes only 10-15 mins, a fraction of BEV'S charging time



## POWERING TAIL LIFTS ✓

Capability to supply high on-board power demand for tail lifts, refrigerant trailers and specialist trailers



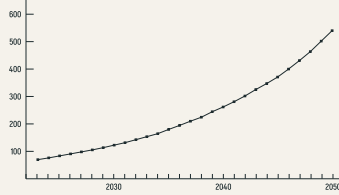
# THE MARKET OPPORTUNITY



Compelling underlying trends with a sizable serviceable addressable market supported by strong regulatory tailwind

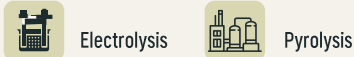
## MARKET OPPORTUNITY

Hydrogen is a **£80+bn** global market, expected to grow **7+%** per year and reach **£500+bn** by 2050

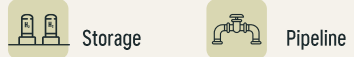


## THE HYDROGEN MARKET

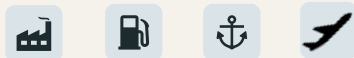
### Hydrogen Production



### Hydrogen Storage & Distribution



### Site Infrastructure



### Industry application

Energy application

Material application



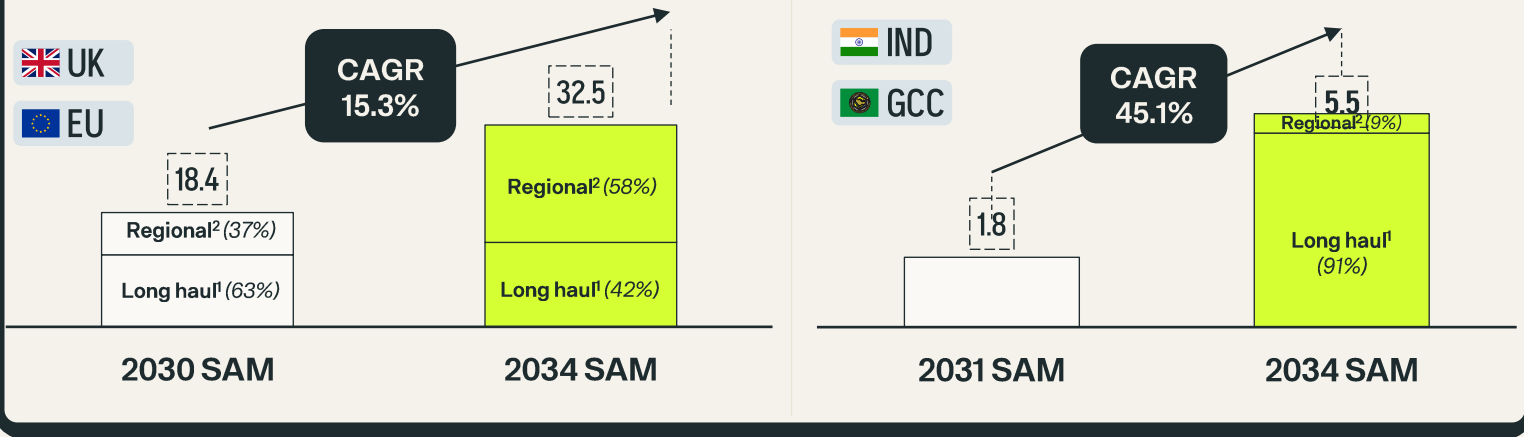
### Logistics & mobility

Road & special vehicles



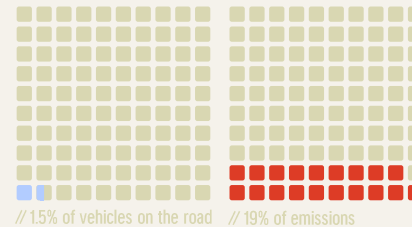
## SERVICEABLE ADDRESSABLE MARKET

**£38bn** of serviceable addressable market annually by 2034 in key strategic markets<sup>1</sup>



## ENVIRONMENTAL IMPACT OF DIESEL HGVS

Heavy goods vehicles represent **1.5%** of the transportation sector, but contribute **19%** of the CO<sub>2</sub> emissions



By 2040, all HGVs must be **zero-emission**; however currently, **96%** run on diesel. Decarbonisation of HGVs is not occurring fast enough.

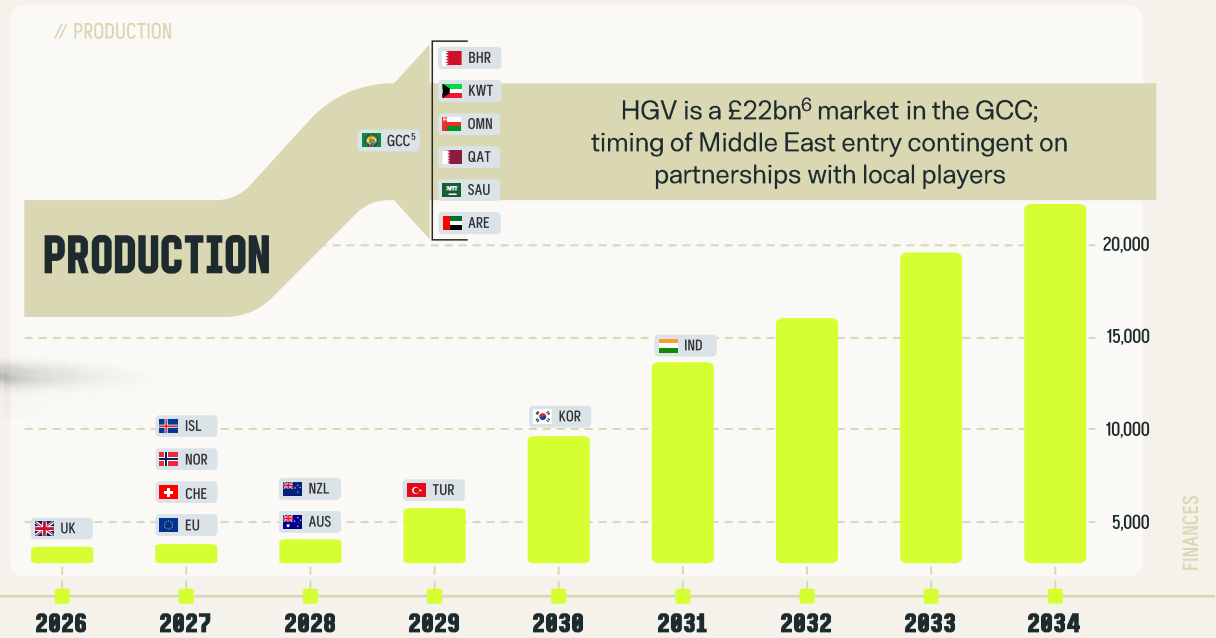
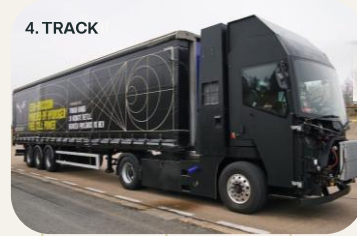
**96%**

ZERO-EMISSION HYDROGEN FUEL CELL POWER

<sup>1</sup>. XcApricum CVDD market sizing – Key strategic markets include UK, EU, India and GCC

# PROTOTYPE TO PRODUCTION

**SO FAR, WE'VE BUILT 4 STUNNING PROTOTYPES, TESTED FROM DESIGN TO DYNO, AND TOWING ON TRACK. NEXT STEP: PRODUCTION.**



ZERO-EMISSION HYDROGEN FUEL CELL POWER

FINANCES

FINANCES



VISIT OUR WEBSITE [HVS.CO.UK](https://hvs.co.uk)

DISCOVER MORE ON OUR SOCIAL

     YouTube 

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HAVE QUESTIONS? EMAIL US.  
[kerry.cosgrove@hvs.co.uk](mailto:kerry.cosgrove@hvs.co.uk)

