



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

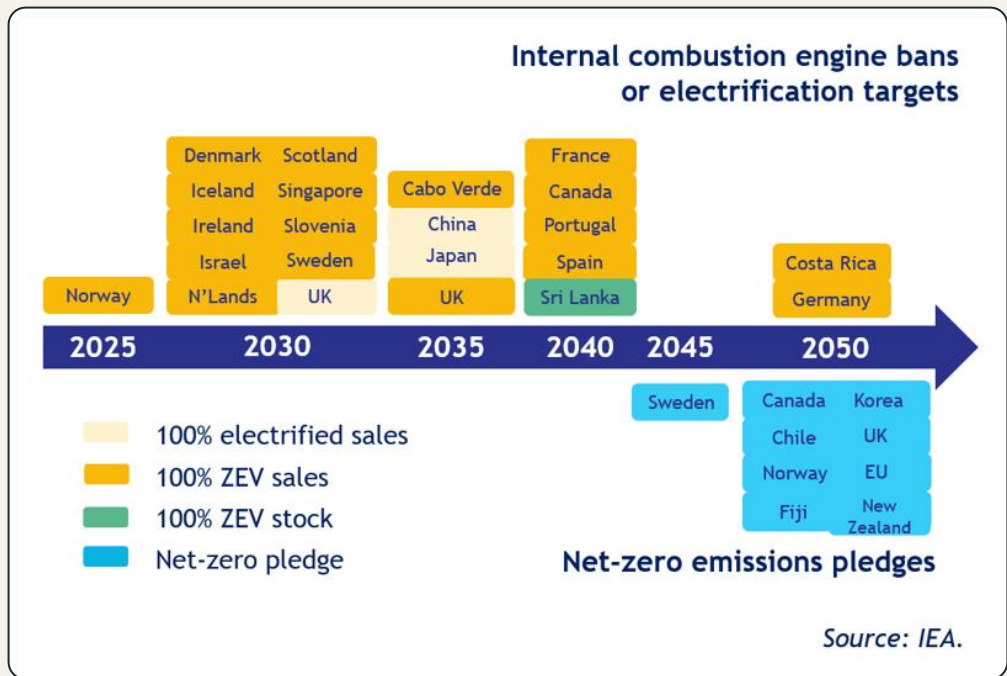
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2024 Hydrogen Vehicle Systems Ltd | Park View House | 96 Caledonia St | Glasgow | G5 0XG | United Kingdom | e: info@hvs.co.uk | +44 (0)141 418 5490 | hvs.co.uk



www.hvs.co.uk



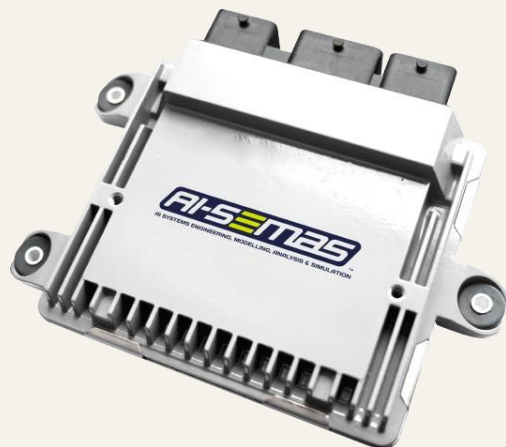
TWENTY NATIONS ARE BANNING DIESEL TRUCKS DUE TO CLIMATE LEGISLATION





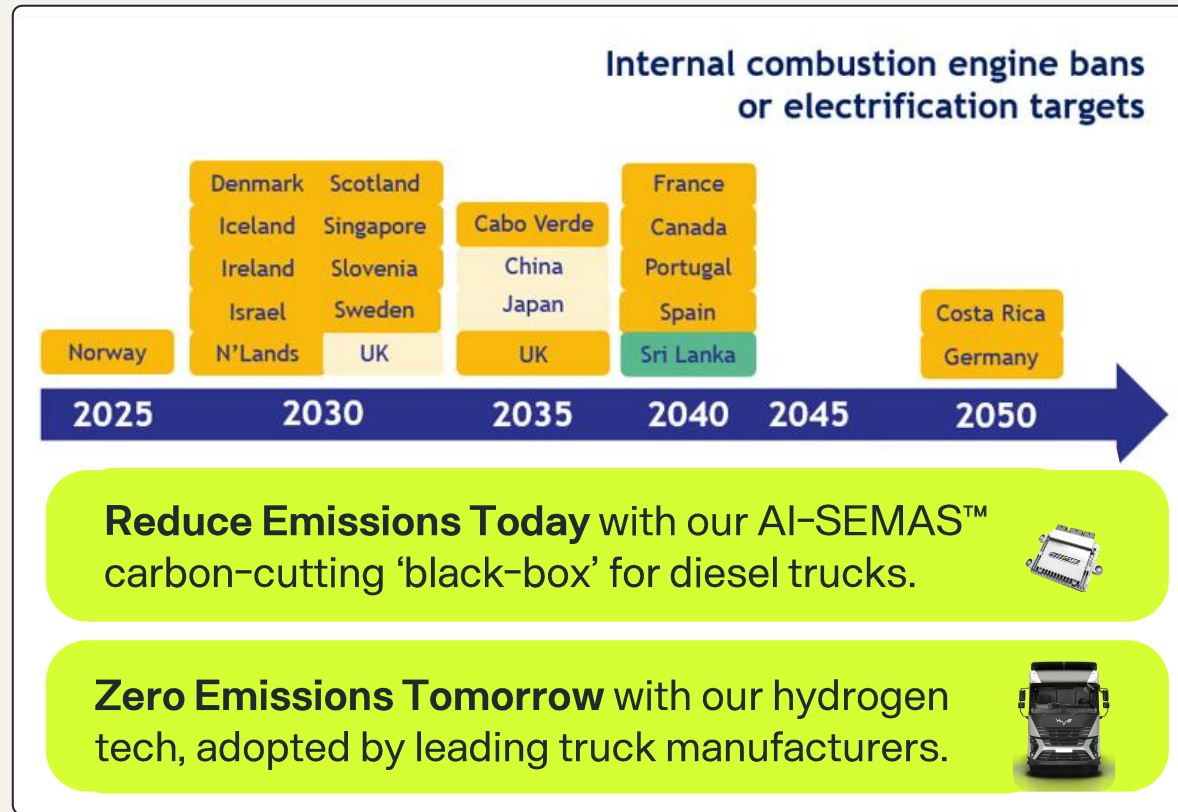
CARBON REDUCTION TECHNOLOGY AND HYDROGEN PROPULSION TECHNOLOGY

ZERO-EMISSION HYDROGEN FUEL CELL POWER



TIMED TO PERFECTION

ZERO-EMISSION HYDROGEN FUEL CELL POWER





PRESS PLAY



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

Perform Better. Drive Cleaner. Decarbonise Faster.

Two decades ago, my clean-tech journey began with exploring hydrogen technologies. Today, that vision drives HVS, a UK AI-Climate Tech leader in trucking decarbonisation.

We are a technology licensing company, providing hydrogen propulsion system designs to existing truck manufacturers and AI-SEMAS™ carbon reduction technology to existing diesel truck owners.

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

WE LICENCE OUR TECHNOLOGY AND DESIGNS TO:

TRUCK OWNERS

- 1. RETROFIT AI-SEMAS TO YOUR DIESEL FLEET**
- 2. SAVE £2,500 PER TRUCK PER YEAR**
- 3. REDUCE 5 TONNES OF CO2 PER TRUCK PER YEAR**

TRUCK MAKERS

- 1. USE OUR HYDROGEN TRUCK DESIGNS**
- 2. TAP INTO CLIMATE FUNDING TO DE-RISK**
- 3. BUILD ZERO-EMISSION FUEL CELL TRUCKS**



PORT OF GOTHENBURG: 35 TRUCKS DAILY



HYUNDAI HYDROGEN



DAIMLER HYDROGEN

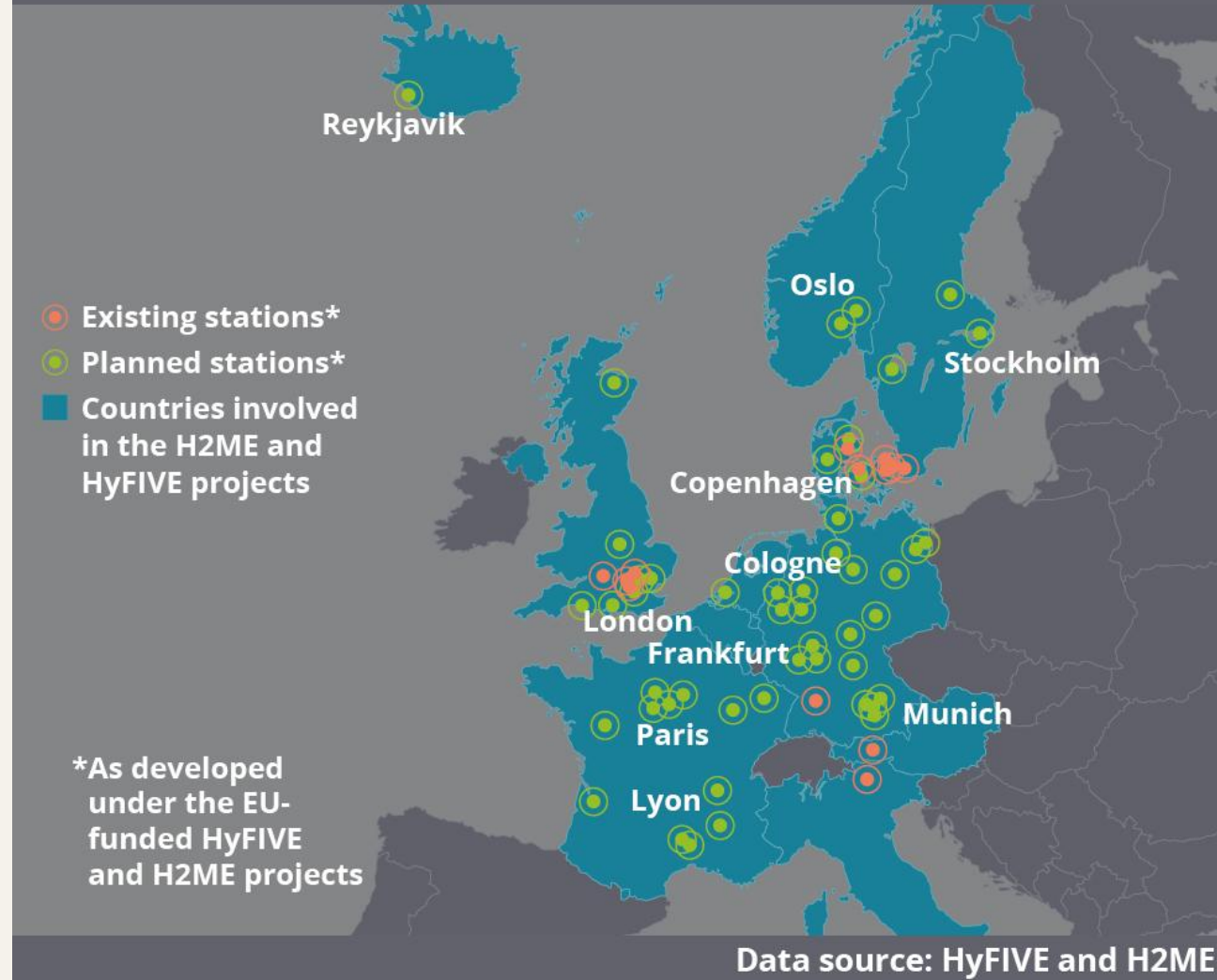


MAN HYDROGEN

EUROPE IS BUILDING A HYDROGEN HIGHWAY FOR HEAVY MOBILITY

- Total & Air Liquide: 100+ hydrogen stations for HGVs in 5 EU countries
- Italy funds 36 hydrogen stations with €100m for heavy vehicles.
- Ovako and Volvo partner for Sweden's hydrogen initiative

EUROPE'S HYDROGEN NETWORK





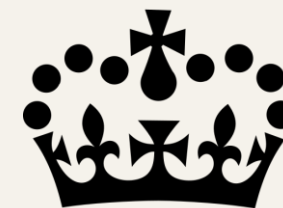
INTRODUCING OUR INVESTORS



£15M



£15M



GOV.UK

£30M



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.



PwC HAVE RECOGNISED US AS “ONES TO WATCH” UNDER THEIR FUTURE50

ZERO-EMISSION HYDROGEN FUEL CELL POWER

Re: PwC Net Zero Future50 Update



UK Net Zero Future50 MBX <uk_net_zero_future50@pwc.com>

To ✓ Abdul Waheed

Reply
 Reply All
 Forward

Fri 24/01/2025 15:22

You forwarded this message on 26/01/2025 13:15.

Dear Abdul,

We are delighted to inform you that HVS has been selected for inclusion in the “PwC Net Zero Future50 report” as one of 50 exciting businesses developing innovative solutions to support the drive to Net Zero.

We would like to thank you for your ongoing engagement and the time you’ve dedicated to this process. It has been a pleasure to get to know you and learn more about your company.

We have incorporated your suggestions into your company profile to the best of our ability, given word limit and the need to remain factual. Our marketing team are currently working on the report design and, once complete, we’ll share your profile page with you for final review.

Kind regards,

PwC Net Zero Future50 Team



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](#)

REUTERS

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](#)

BBC

Glasgow firm awarded £30m to develop clean hydrogen HGV

© 2 December 2022

£15M
[Read Article](#)

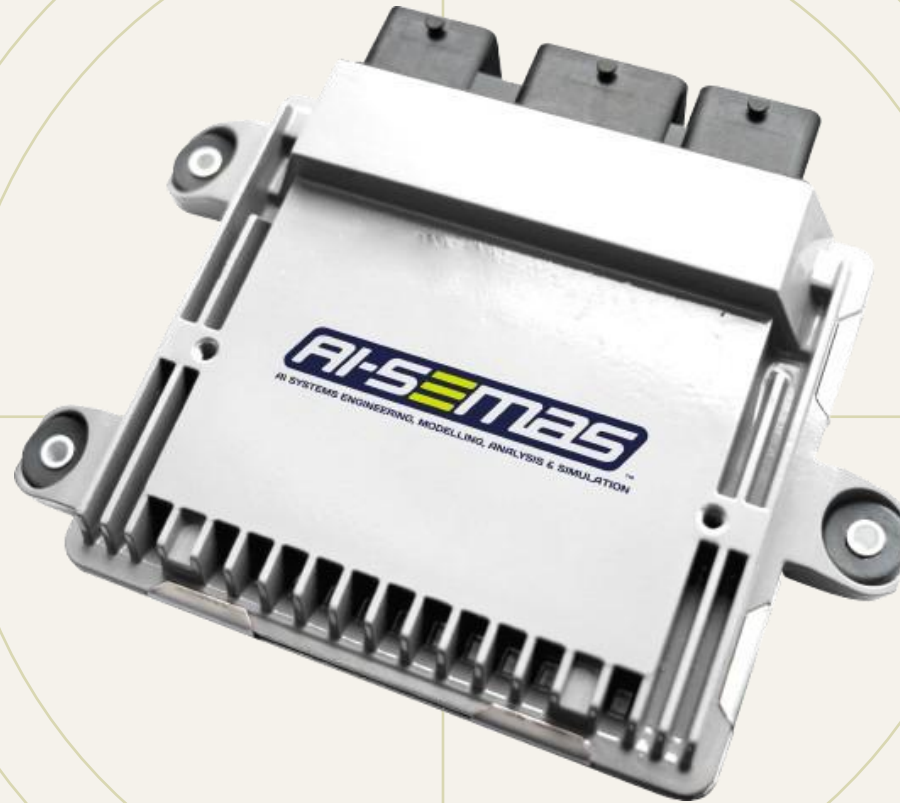


PRODUCT 1

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_{2e} per liter, this reduction equates to a decrease of 4.47 tonnes of CO₂ 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

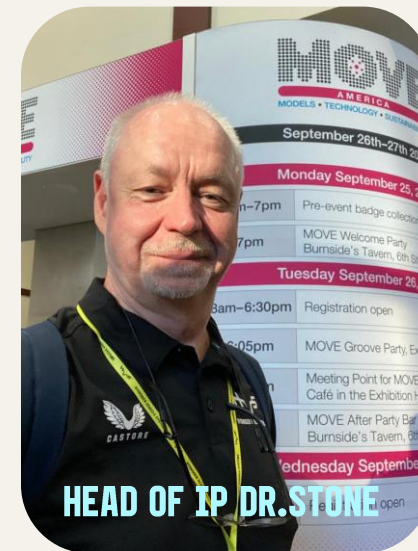


HVS Internal

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

 PNDC Vehicle Control System & System Validation		 MAGE AI Enabled Hardware and Software		 SCINTILLA Intellectual Property	
 Dr. Max Parker EngD MEng MIET, Senior R&D Engineer who leads the Power Electronics, Machines & Drives (PEMD) innovation theme	 Dan Cutting Masters in Aero-Mechanical Engineering from University of Strathclyde. 8 years with Rolls Royce, Machines, Power Electronics and Drives	 Matthew Love BEng (Hons) MSc Control Systems Managing Director/Chief Engineer and SEMAS Design Authority ex Lockheed	 Dr. Stephen Lochran BSc PhD MSc Control Systems Head of Software Engineering, vehicle mounted sensors and real-time embedded signal processing	 Susan Oliver Director of IP Strategy at Scintilla, ex ARM, sits on HVS IP Committee, NED at UK IP Federation, World IP Strategist for 2017	 Peter McBride 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



AI SYSTEMS ENGINEERING, MODELLING, ANALYSIS & SIMULATION

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



- 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
AI-SEMAS HARDWARE UNIT FOR DIESEL TRUCKS 	 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
AI-SEMAS AS A SOFTWARE FOR BATTERY AND HYDROGEN TRUCKS 	 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

TRUCK DESIGN



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



**TRANSFORMING
THE TRUCKING
INDUSTRY**



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





WATER-EMITTING TRUCK: A REVOLUTION IN TRUCK DESIGN

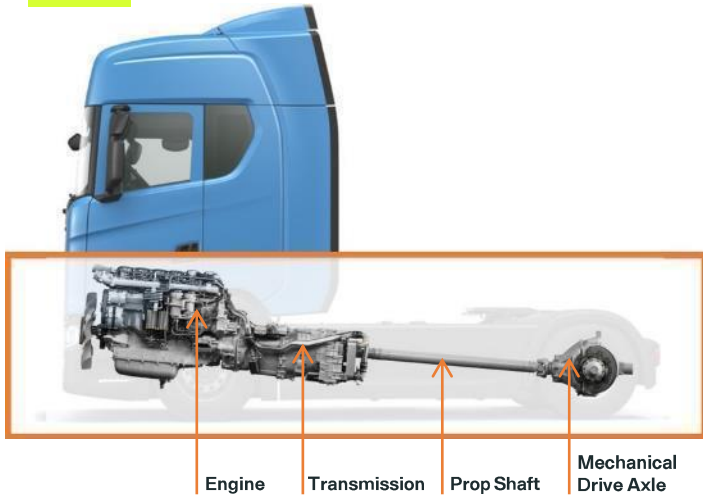


Purpose-built design and chassis that optimises operational efficiency, a competitive advantage to retrofitted trucks

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.

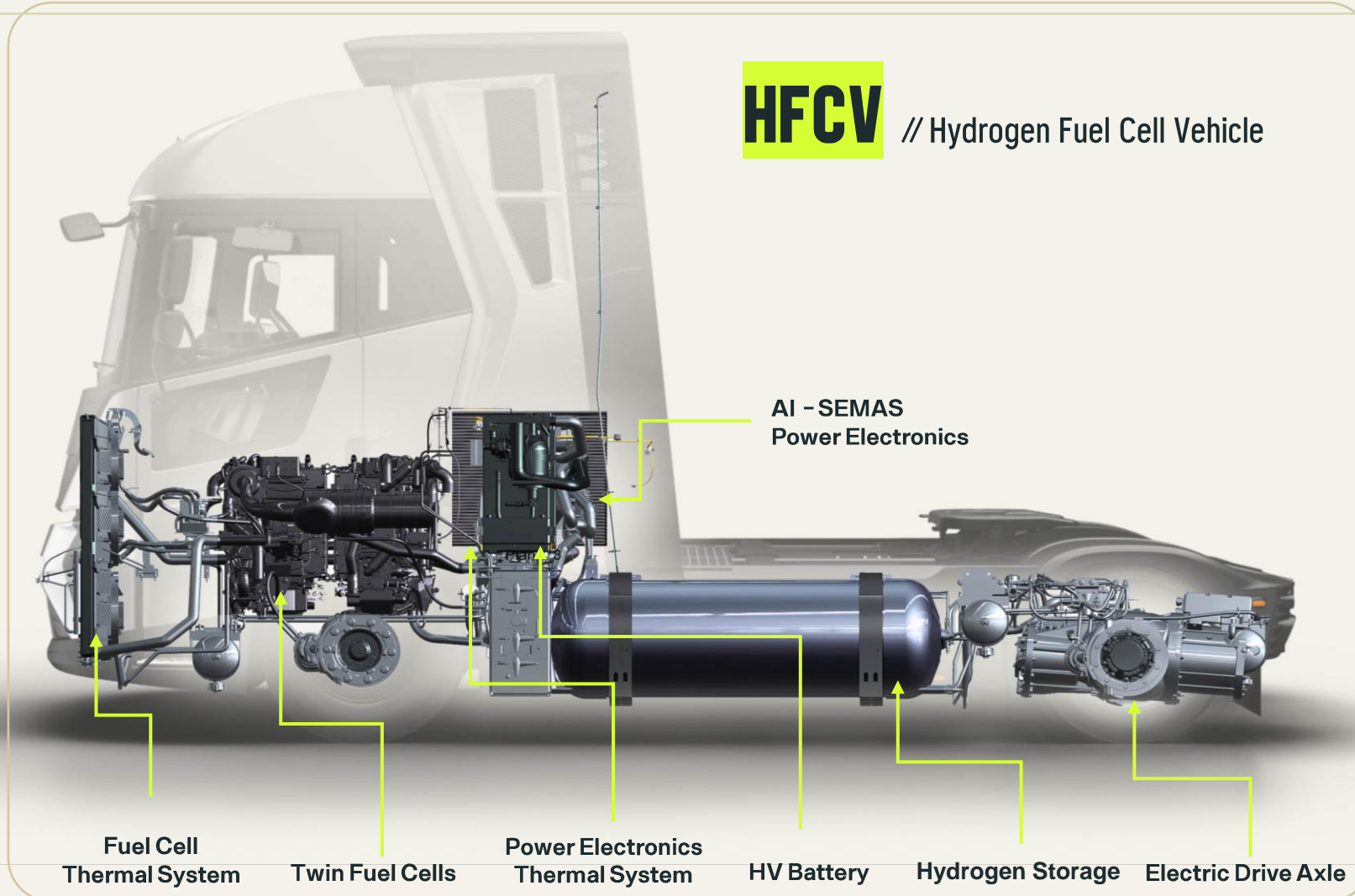
ICE

// Internal Combustion Engine Diesel Powertrain



HFCV

// Hydrogen Fuel Cell Vehicle





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

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

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



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)



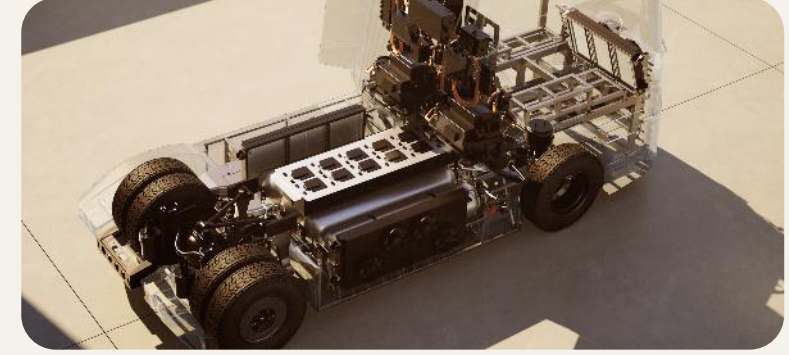
FUELLING STATION NETWORK ✓

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



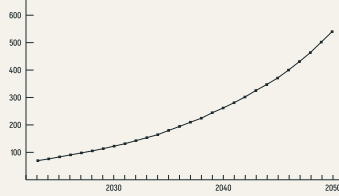
THE MARKET OPPORTUNITY



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

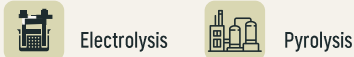
MARKET OPPORTUNITY

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

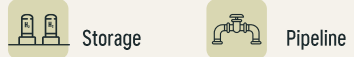


THE HYDROGEN MARKET

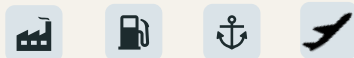
Hydrogen Production



Hydrogen Storage & Distribution



Site Infrastructure



Industry application

Energy application

Material application



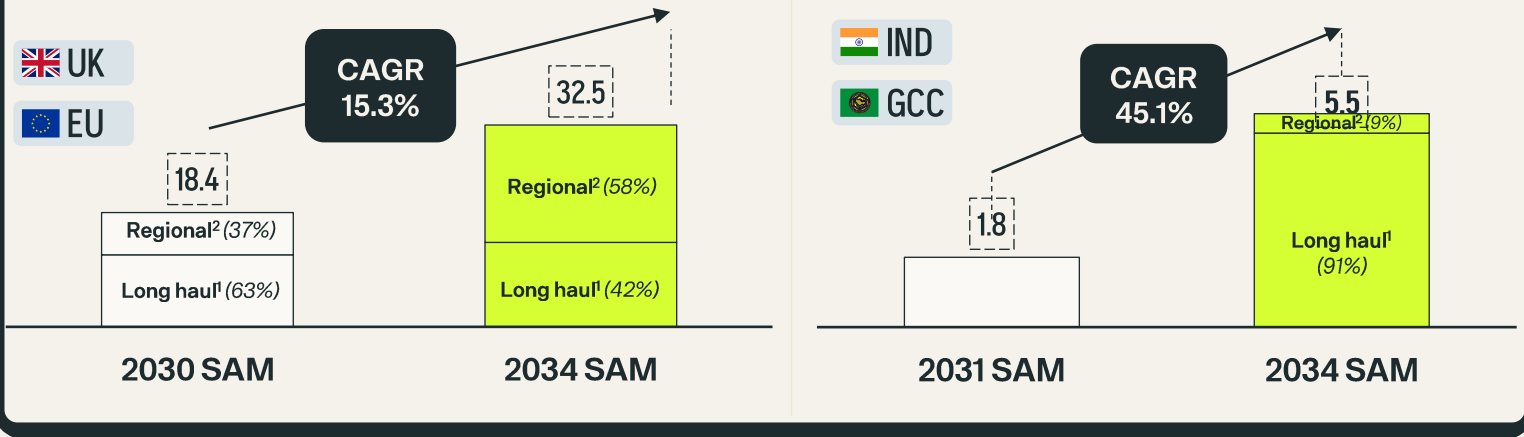
Logistics & mobility

Road & special vehicles



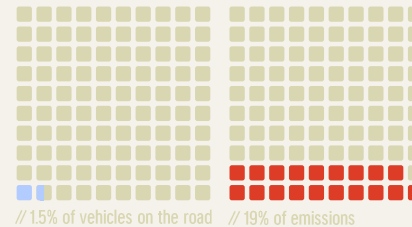
SERVICEABLE ADDRESSABLE MARKET

£38bn of serviceable addressable market annually by 2034 in key strategic markets¹



ENVIRONMENTAL IMPACT OF DIESEL HGVS

Heavy goods vehicles represent **1.5%** of the transportation sector, but contribute **19%** of the CO2 emissions



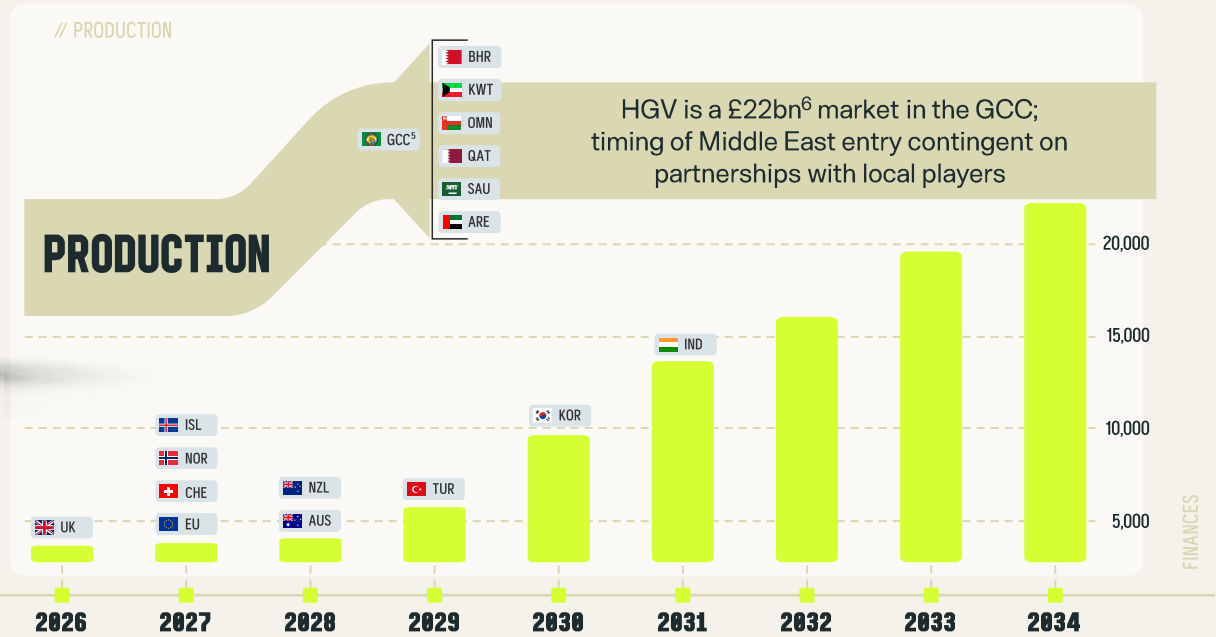
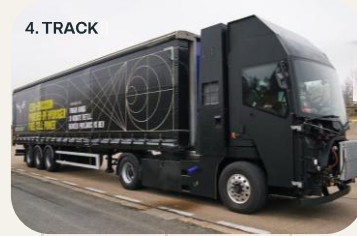
By 2040, all HGVs must be **zero-emission**; however currently, **96%** run on diesel. Decarbonisation of HGVs is not occurring fast enough.

96%

ZERO-EMISSION HYDROGEN FUEL CELL POWER

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

WE'VE BUILT FOUR CUTTING-EDGE PROTOTYPES, TESTED FROM DESIGN TO DYNO, TO TRACK TOWING. NEXT STEP: LICENCING TO TRUCK MANUFACTURERS.



ZERO-EMISSION HYDROGEN FUEL CELL POWER

FINANCES

FINANCES



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

DISCOVER MORE ON OUR SOCIAL

     YouTube 

@HVSTrucks
#HVS #HVSTrucks #HydrogenGoodsVehicles #HydrogenVehicles

HAVE QUESTIONS? EMAIL US.

kerry.cosgrove@hvs.co.uk

