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Alternative Fuels for Freight and Logistics

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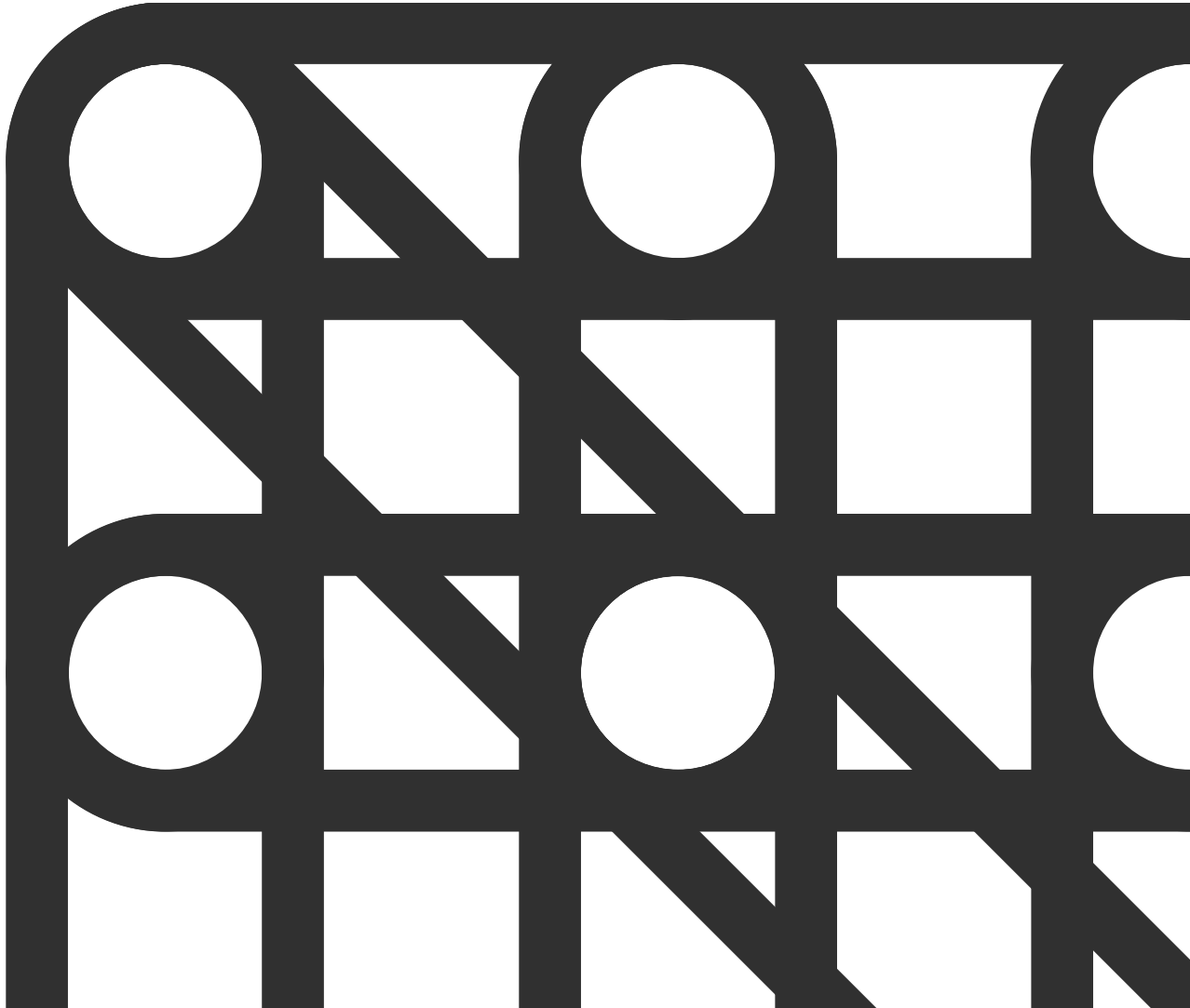
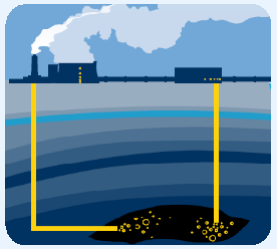
Katheryn Gregory

Making opportunities visible, accessible and winnable!



EAST RIDING OF YORKSHIRE COUNCIL







TSCN

Alternative Fuels For Freight and Logistics

2022

Element Energy Ltd

William.darby@element-energy.co.uk

Element Energy, a consultancy focussed on the low carbon energy sector

- Element Energy is a **specialist energy consultancy**, with an excellent reputation for rigorous and insightful analysis in the area of low carbon energy
- We consult on both **technical and strategic issues** – our technical and engineering understanding of the real-world challenges support our strategic work and vice versa
- Element Energy covers all major low carbon energy sectors:

Energy Networks

Smart Energy Systems

CCUS and Industrial Decarbonisation

Hydrogen and Fuel Cells

Low Carbon Transport

Built Environment

- We also coordinate many low carbon energy projects through our **Project Management** team.

Element Energy has an unrivalled knowledge of and links with the hydrogen industry

- We are involved in much of the strategic planning around hydrogen mobility roll-out. This includes running **H_2Mobility initiatives (planning and delivering national hydrogen transport roll-out) in Ireland, the UK and France.**
- We are currently working for a number of corporate clients developing feasibility studies and business models for first commercial renewable hydrogen deployment projects. Example clients include **Shell, Hyundai, Toyota, Iveco, Orsted, Vattenfall, ITM Power, Inovyn and Ryse Hydrogen.**
- We have developed **end to end renewable-hydrogen-mobility business models**, for clients including the Hype taxis in Paris, Green Tomato taxis in London, Toyota (UK and Ireland), Ryse/Wrigtbus, INOVYN, Motor Oil (Hellas) and Aberdeen (buses), and a range of European truck players.
- **We have excellent knowledge and contacts covering all hydrogen technologies,** having initiated and then collaborated in numerous public and private hydrogen projects over the past 20 years, we have an extensive network in the hydrogen sector.

Agenda

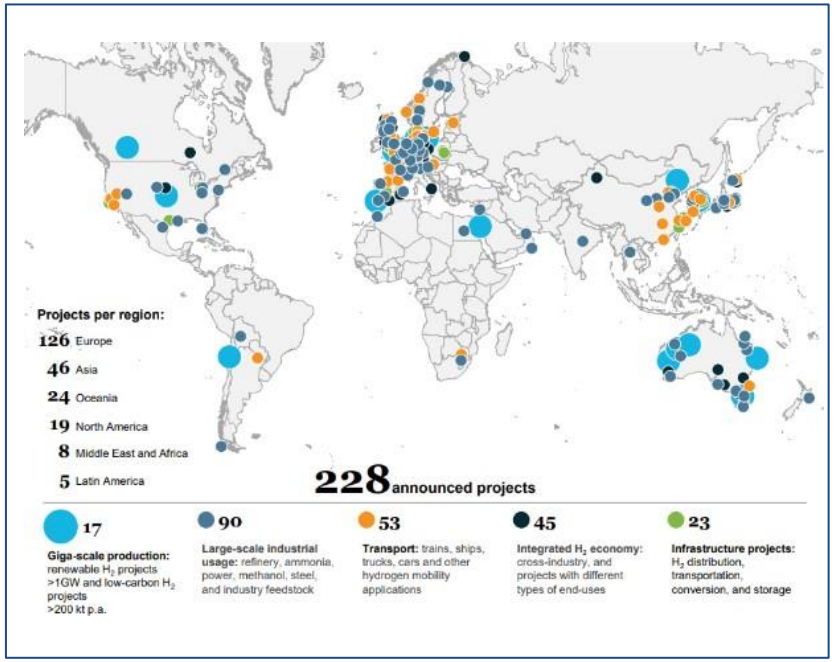
Introduction to hydrogen, fuel cells and the wider context

A strategy for deployment of hydrogen mobility technology

Conclusions on a UK Hydrogen for freight strategy

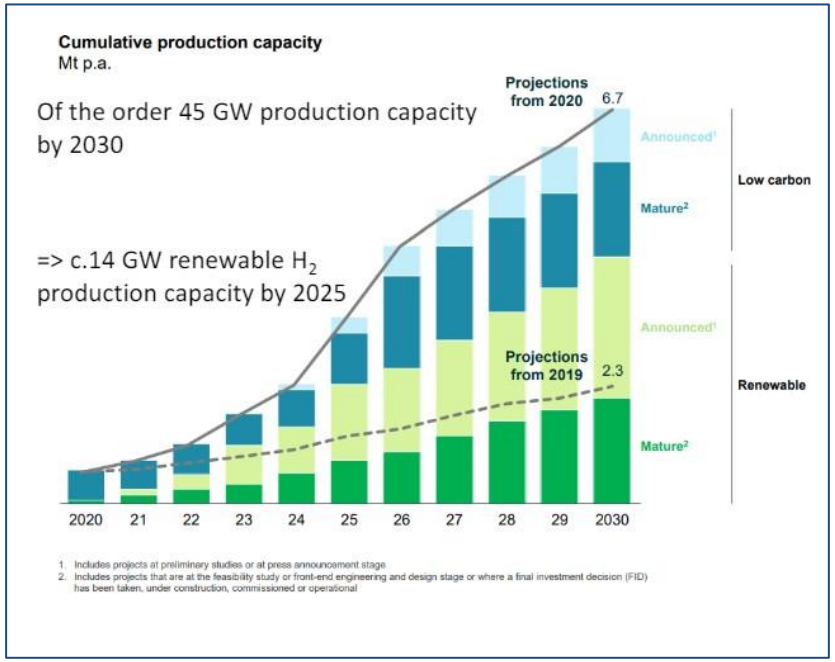
Interest in hydrogen production projects has gown rapidly in recent years and is expected to reach ~7 million tonnes per year by 2030

Total hydrogen projects announced globally



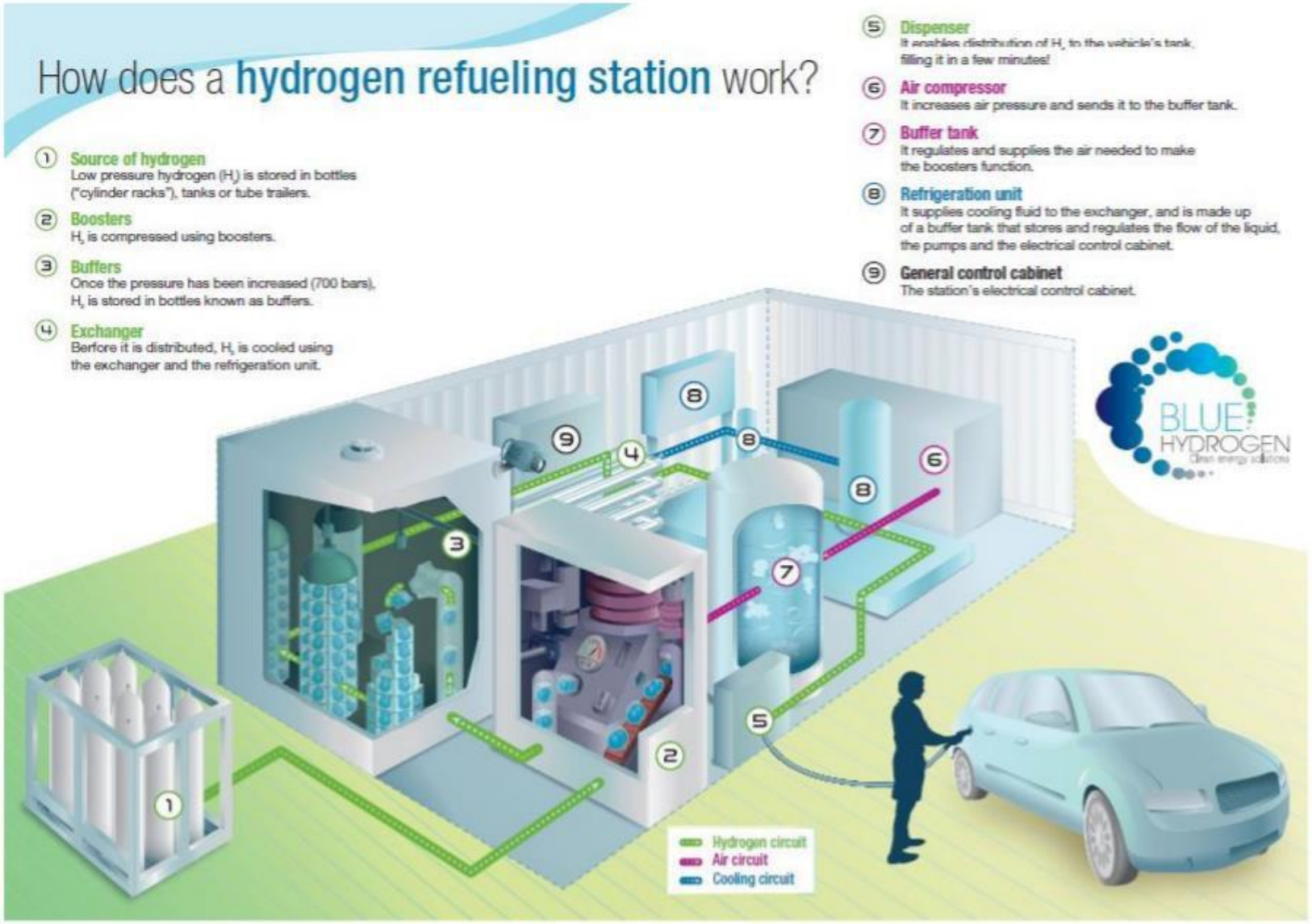
- The Hydrogen Insights Report (2021) identified 228 hydrogen project around the world 17 of which are “giga-scale” i.e. >1GW of renewable capacity and >200ktH2/yr
- The transport sector is a potentially large, high-value market for hydrogen

Planned hydrogen production capacity scale



- Massive growth in hydrogen production capacity is expected out to 2030 – over 45 GW.
- Note the largest electrolyser currently used is 10MW at a Shell refinery.

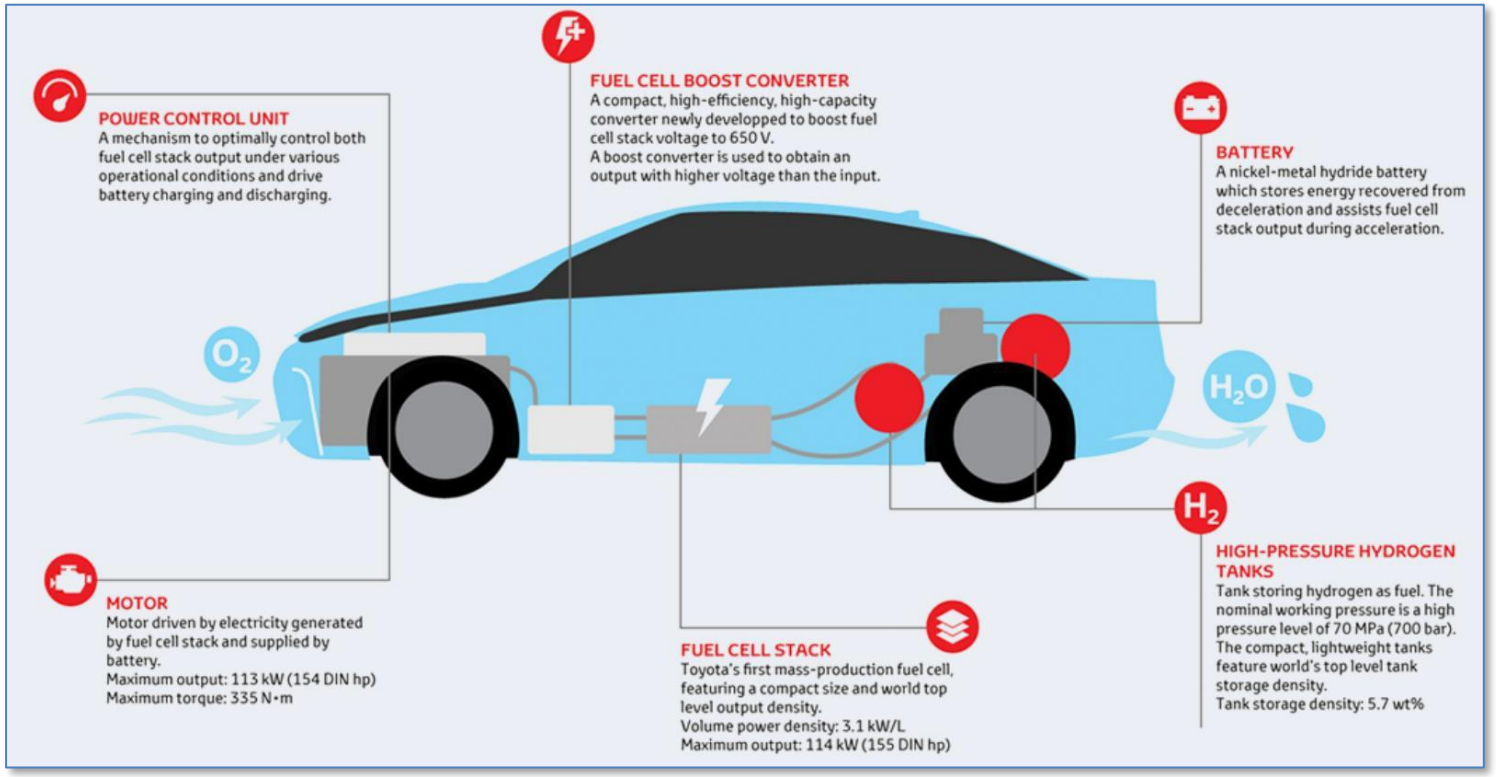
Current hydrogen stations compress gaseous hydrogen to be dispensed into vehicles



https://www.airliquide.com/sites/airliquide.com/files/2019/01/28/medium-to-long-term-development-of-hydrogen-mobility-in-the-uae.pdf

Hydrogen can be used in fuel cell, electric vehicle applications or in traditional combustion engine vehicle types

Schematic representation of a fuel cell vehicle



- Hydrogen fuel cell vehicles are a type of electric vehicle but instead of a battery, a fuel cell vehicle contains a tank which can be filled with hydrogen gas.
- The hydrogen gas is drawn from the tank and enters the fuel cell where it combines with oxygen in the air to create an electric current which drives the vehicle. The only by product is water vapour

https://www.toyota.co.uk/world-of-toyota/environment/fuel-cell-vehicle

Hydrogen fuel cell technology has a high potential to decarbonise mobility

Hydrogen mobility's value proposition

1 Matches the duty cycles of fossil equivalents

*Hydrogen vehicles have the **same range as fossil equivalents** and can refuel in ~3-15 minutes*

2 Is an ultra low carbon technology

Hydrogen produced from renewable electrolysis or CCS has almost zero carbon footprint

3 Improves the local air quality

FCEVs emit only water vapour and have an air filter which reduces particulate pollution

4 Reduces fuel dependence and creates economic growth

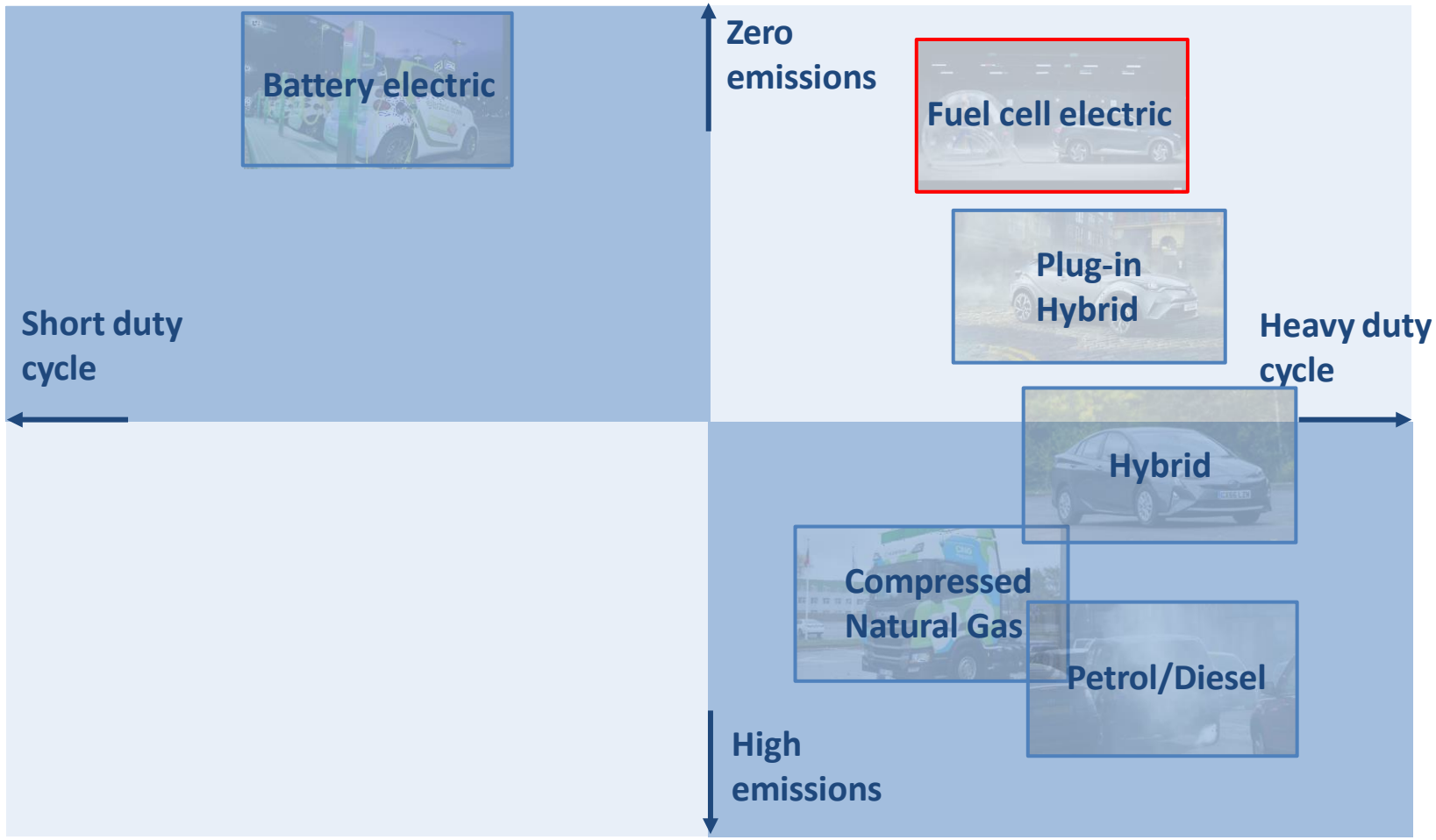
Hydrogen can be produced locally so reduces reliance on oil exporting nations and fuel cell vehicle manufacturing can preserve high end European engineering jobs

5 Can achieve parity with diesel in the future

Provided policy measures are introduced to meet decarbonisation goals and hydrogen costs come down with scale, we can expect hydrogen to achieve cost parity with diesel over the next ~10 years

Fuel cell electric vehicles offer the same low emissions as battery electric while matching the duty cycles possible from conventional drivetrains

Graphic of emissions vs duty cycle for different powertrain types

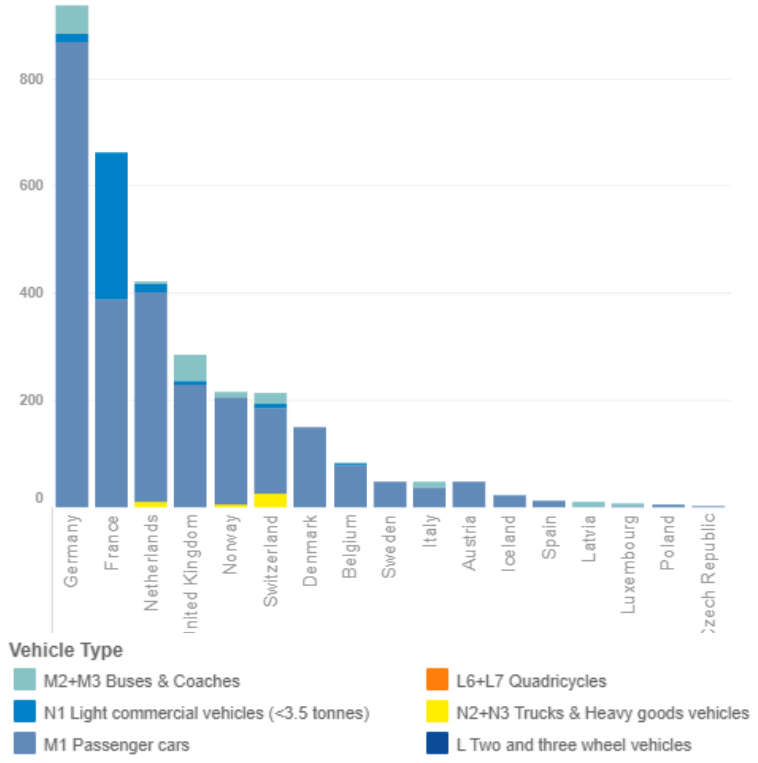


Agenda

- Introduction to hydrogen, fuel cells and the wider context
- **A strategy for deployment of hydrogen mobility technology**
  - **Progress and lessons**
  - Strategic motorways and heavy freight
  - Cities and lighter freight
- Conclusions on a UK Hydrogen for freight strategy

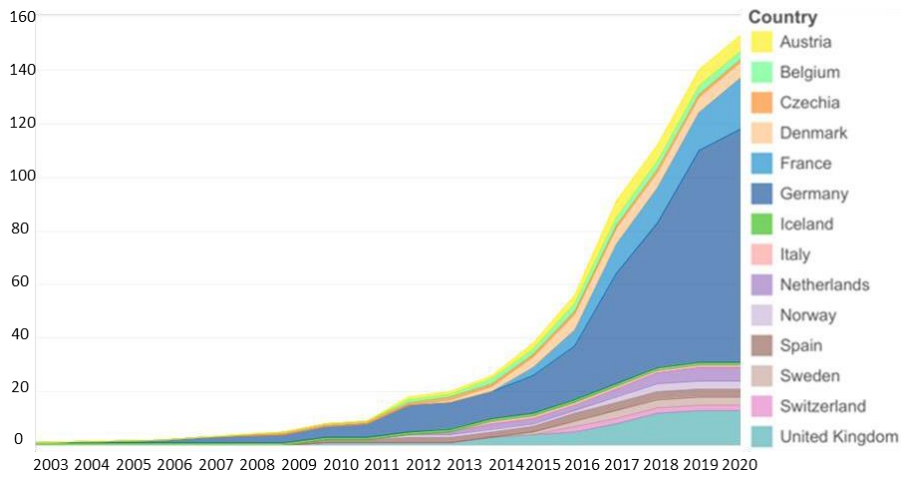
Hydrogen vehicle deployments are well underway across Europe with over 3000 vehicles and 160 stations currently in operation

Vehicles by country and type



- The FCH JU estimates that were are ~3000 hydrogen vehicles operating in Europe in August 2021.

H2 Stations by country by year



- These vehicles are being refuelled at ~160 fuel cell stations across Europe. Germany leads in terms of stations and vehicles deployed.
- The average loading of these stations is still low (~18 vehicles/station) and is expected to rise significantly.

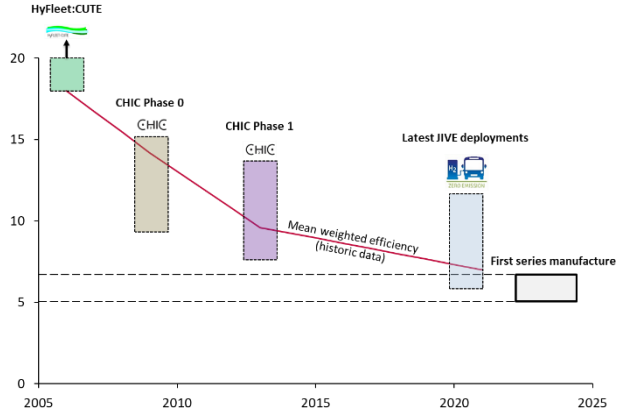
https://www.fchobservatory.eu/observatory/technology-and-market/hydrogen-refueling-stations/cumulative-data

Conclusions: early projects have laid the foundations for vehicle deployments to accelerate, but there is mor done for FCEVs to fulfil their potential

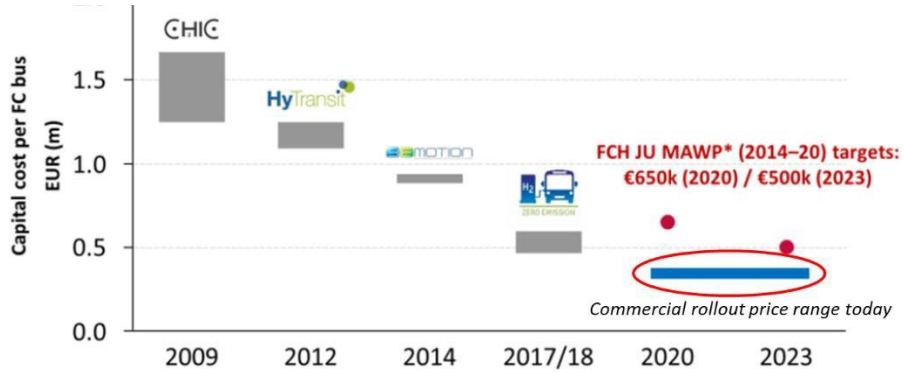
High level conclusions from the role out

- Technical performance of hydrogen transport solutions has been proven and efficiency continues to improve
- Significant momentum around hydrogen is building across Europe and beyond
- Vehicle costs have come down and scale up in vehicle manufacturing is needed to meet targets and for cost competitive manufacture (particularly for trucks)
- Policy support is still needed to incentivise deployment during this scale up period
- Ingredients for success:
  - Reliable technologies (vehicles & infrastructure)
  - Scale of demand
  - Low cost (renewable) energy for hydrogen supplies

Fuel cell bus efficiency improvements



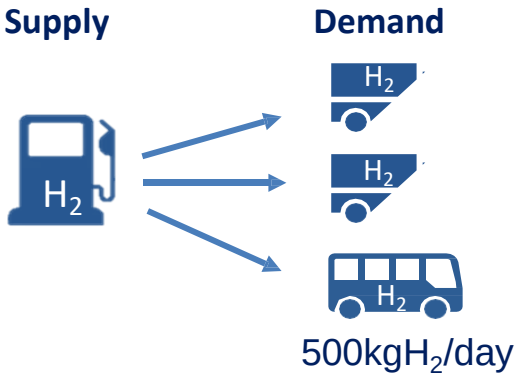
Fuel cell bus capital costs reductions



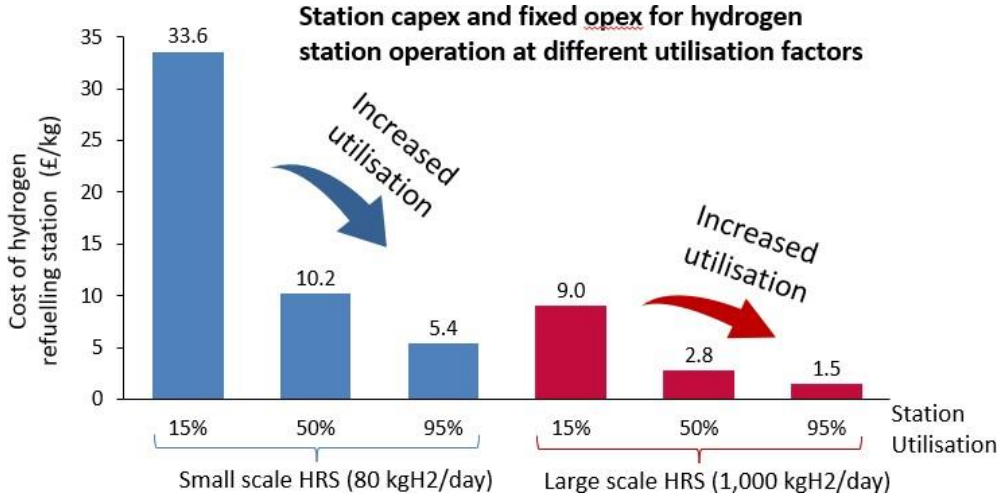
A key lesson is that jumping to scale in the hydrogen ecosystem is a rapid way to reduce vehicle ownership costs and improve performance

Rationale for aggregating demand

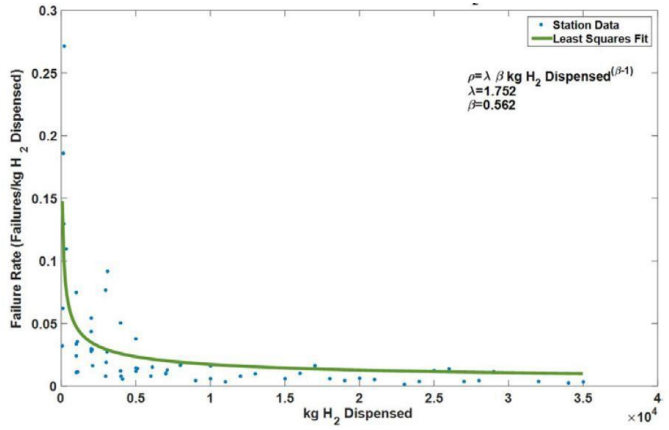
- **Scale reduces hydrogen fuel and vehicle costs**
  - Purchasing vehicles in larger quantities brings down capital costs.
  - The dispensed price of hydrogen drops rapidly with scale e.g. 1 HGV refuel per day would cost $15/kg and 20 HGVs per day is >$7/kg
- **Scale enables reliability**
  - It is possible to deploy ultra-reliable stations at scale due to the inbuilt redundancy of multiple dispenser units.
  - This is achieved by closely coupling station deployment with large vehicle demand.



HRS size and utilization with cost



Station failure rate with H2 dispensed



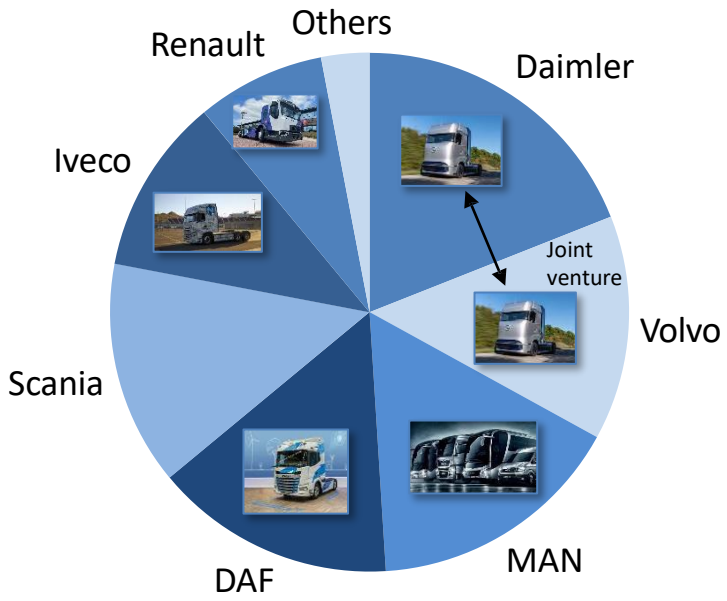
Agenda

Global OEMs and new market entrants see hydrogen as a promising technology and are investing heavily into it

Plans for hydrogen vehicle deployments

- 6 of the 7 dominant European truck manufacturers have announced programs to develop fuel cell vehicles. Daimler and Volvo have announced a €1.2 billion joint product development program for fuel cell trucks.
- These 6 companies have plans for vehicles to enter series production between 2024-2028.
- This behaviour is being driven largely through EU CO2 emission standards for heavy-duty vehicles for reducing emissions from new trucks for 2025 (15%) and 2030 (30%). The 2030 target will require new non-fossil technologies[iii].
- New market entrants are moving faster, Hyundai are the EU market leaders with 50 hydrogen trucks operating in Switzerland with plans for 1600 by 2025. Hydrogen truck specialists Nikola and Hyzon also have 100s of trucks operating globally.

2020 EU truck market share & FC trucks



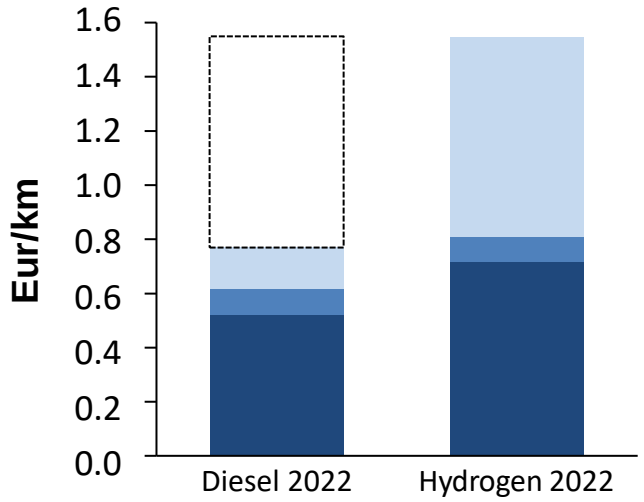
Hyundai trucks in Switzerland

A Hyzon truck in the Netherlands

https://ec.europa.eu/clima/eu-action/transport-emissions/road-transport-reducing-co2-emissions-vehicles/reducing-co2-emissions-heavy-duty-vehicles_en

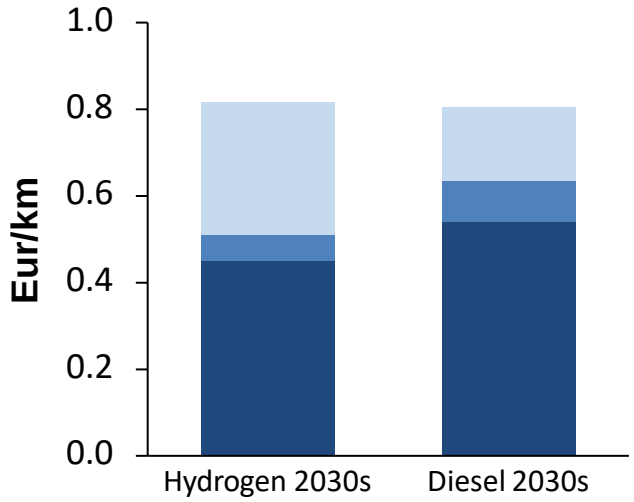
The major barrier to hydrogen vehicle deployment is the ownership cost

Hydrogen vs Diesel trucks presently



- At present, hydrogen fuel cell trucks are a nascent industry and a hydrogen truck is expected to cost around twice as much as diesel to own and operate.

Hydrogen vs Diesel trucks in future



- It is expected that diesel truck ownership costs will increase over the coming decade as fuel prices increase and emissions standards for new trucks drive up capital costs.

How do we overcome the ownership cost gap to get to the point of diesel price parity?

Fuel Cost | Maintenance Cost | Capital Cost | Ownership cost gap

The Swiss 1600 trucks project has pioneered the concept of aggregated demand for hydrogen freight

Swiss 1600 truck overview organogram

Truck supplier

HYUNDAI

Fuel suppliers

H2energy

Linde

ALPIQ

Truck operators

fenaco

coop

MIGROS

Galliker Logistics

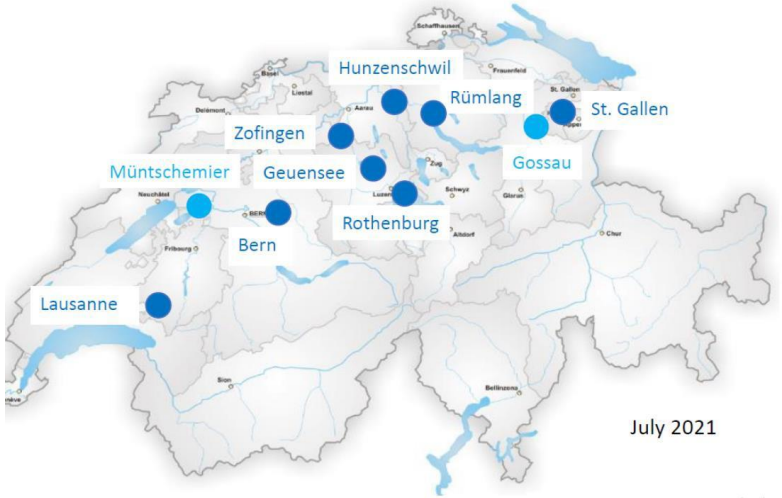
F.MURPF AG TRANSPORTE UND LOGISTIK

CAMION TRANSPORT

G.Leclerc Transport AG

- The project now has 46 trucks in operation across 9 stations and aims for 1600 trucks by 2025.
- The combination of aggregated demand and generous road tax exemptions for zero emission vehicles (~€50,000/year) allowed the project to pioneer.

Swiss Truck Refuelling Stations



First trucks operated by the 7 original operators

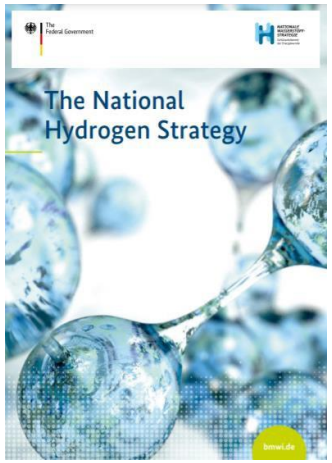
Government support schemes for zero emission trucks are being announced across Europe

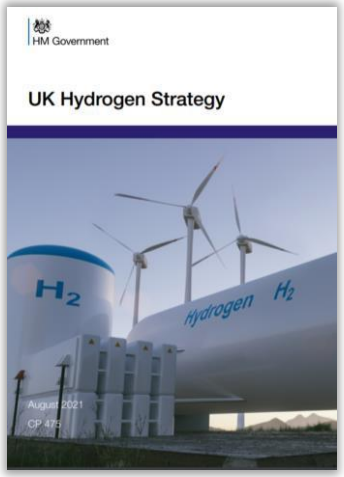
Government support schemes are being announced in Europe and Globally

- Germany has already announced a scheme to subsidise 80% of vehicle and infrastructure delta costs to diesel vehicles with any company able to claim up to €15 million per year. States surrounding Germany are expected to announce similar schemes.

- The UK is expected imminently to announce a c.£100 million fund called the Zero Emission Road Freight Trail.

- France has introduced tax break laws which allow a 40% over depreciation of low carbon trucks.





Numerous projects are looking to copy this approach across Europe and even round the world

H2Accelerate

- H2Accelerate is a collaboration with the aim to accelerate the use of hydrogen as a fuel for heavy duty road transport in Europe.
- The group targets 60,000 trucks and 400 stations in operation across Europe by 2030.

AHFC Aggregated Hydrogen Freight Consortium

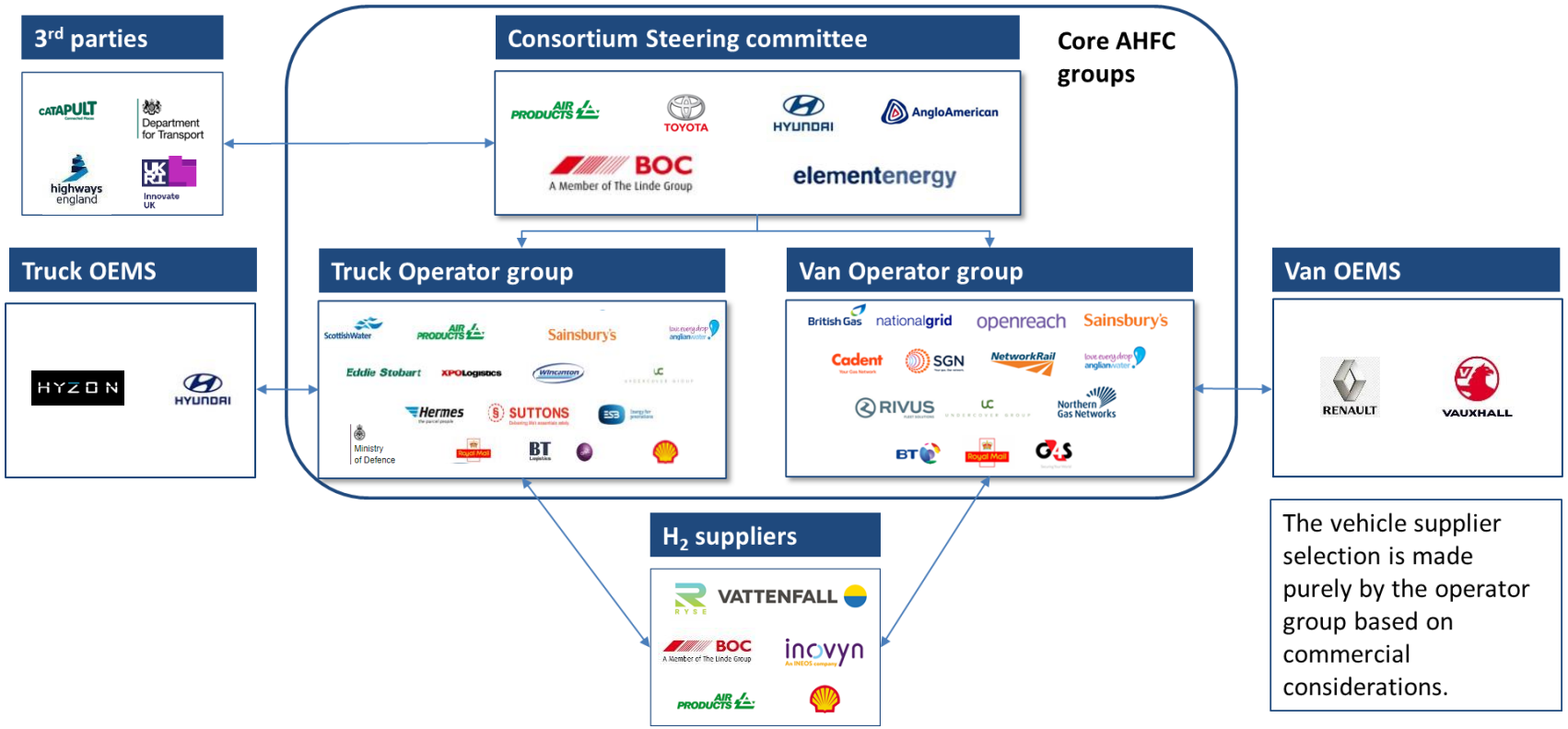
- The UK Aggregated Hydrogen Freight Consortium aims to accelerate the deployment of fuel cell vehicles for freight applications
- The group expects to deploy 100 fuel cell trucks in the UK by 2025 and 1000s by 2030.

HyTrucks

- HyTrucks one of Europe's largest initiatives aiming to deploy zero-emission heavy vehicle fleets in the region aims to have 1000 hydrogen-powered trucks in Belgium, The Netherlands and West Germany by 2025

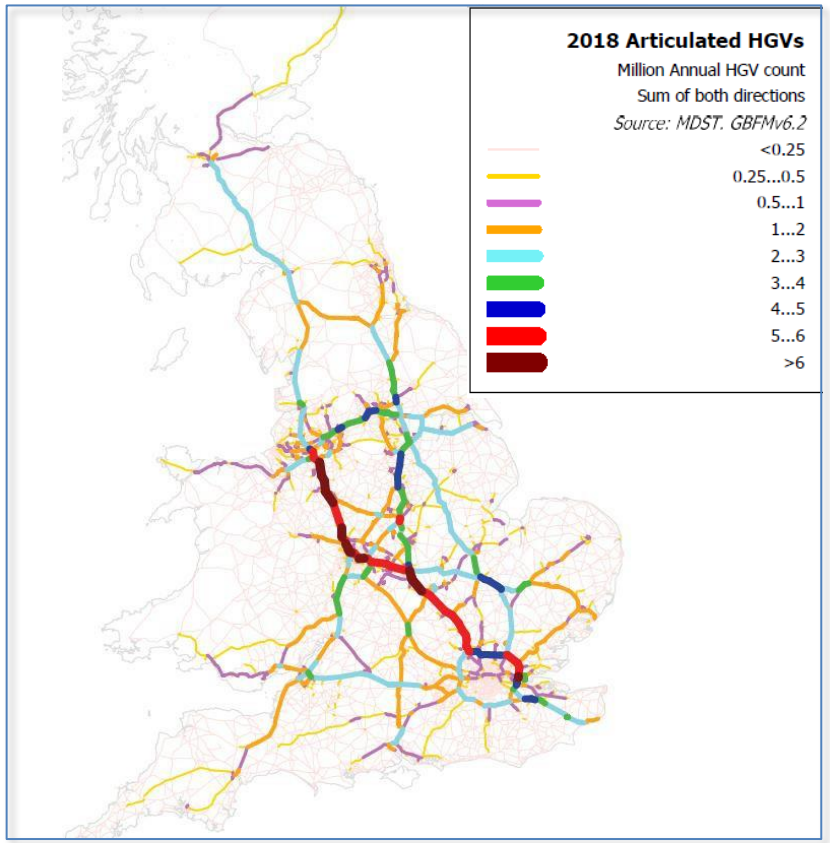
The Aggregated Hydrogen Freight Consortium is a demand led project to accelerate the deployment of fuel cell trucks and vans in the UK

Overview of the AHFC members

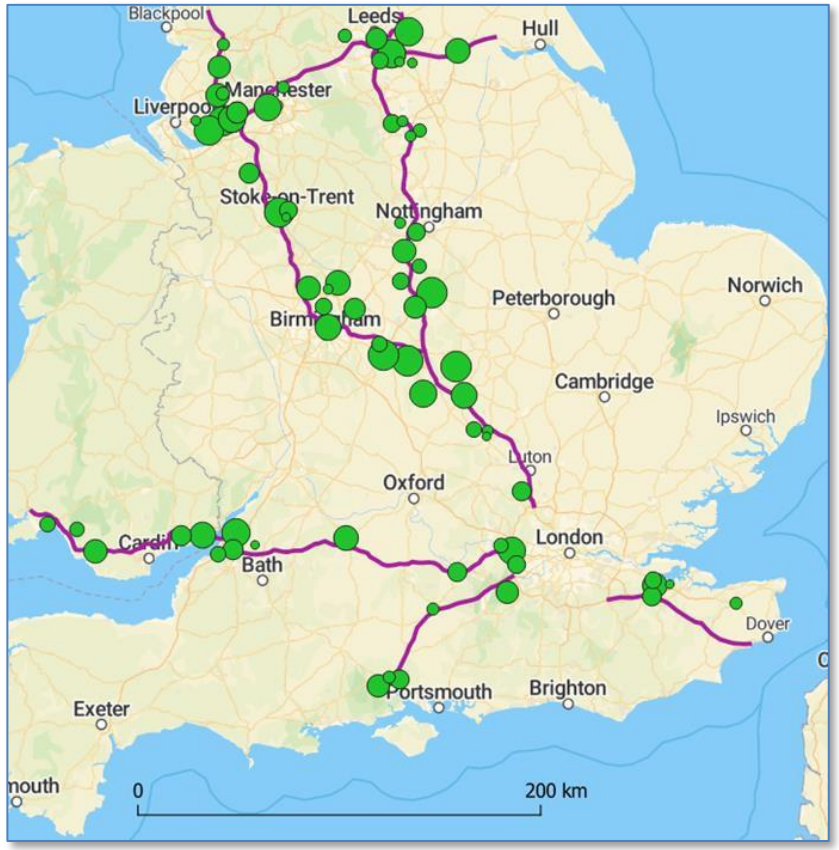


The group is also looking to develop intercity hydrogen hubs on major truck routes in the UK

Major routes which artic trucks operate on



AHFC depots near major motorways



- Truck route data and depot locations point strongly to refuelling stations being deployed close to clusters of truck depots along the London, Liverpool and Leeds “Y-shape” trunk routes.

Agenda

Introduction to hydrogen, fuel cells and the wider context

A strategy for deployment of hydrogen mobility technology

- Progress and lessons
- Strategic motorways and heavy freight
- **Cities and lighter freight**

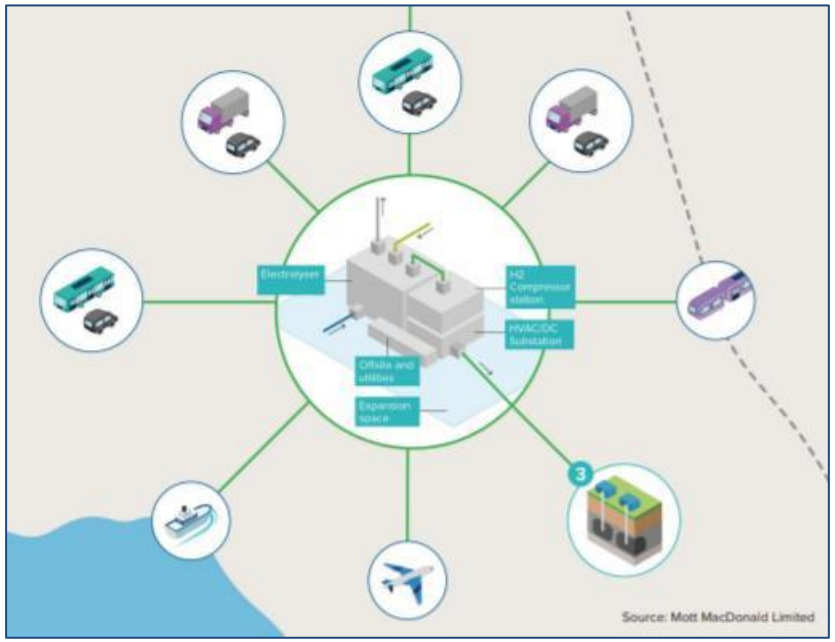
Conclusions on a UK Hydrogen for freight strategy

The multimodal hydrogen vehicle valley/hub concept looks to achieve scale around transport hubs

Multimodal hydrogen hub concept

- The second deployment strategy which is being pioneered successfully is the city based hydrogen transport hub concept.
- This aims to achieve scale of refuelling system by coordinating a large number of multimodal hydrogen vehicle operators to purchase vehicles synchronously and collaboratively.
- The process of starting finds a transport hub e.g. city, airport, port etc. and seeks to build a minimum of two/three large, public hydrogen stations which have anchor tenants

Hub visualisation



The range of hydrogen vehicles available to cities has expanded rapidly over the past 2-3 years

Hydrogen vehicle classes

Light weight municipal / Private hire vehicles

H2 demand: 2kg/day

- Fully developed market and available to order in the 100s in the UK

Vans

H2 demand: 2kg/day

- Renault/ Vauxhall vans will be available from 2022/2024.

Refuse collection vehicles

H2 demand: 20kg/day

- Only diesel combustion engine retrofits are currently available. Fuel cell models are expected in ~2024

Buses

H2 demand: 15kg/day

- 20 buses in operation. Two UK based OEMs building production lines capable of meeting orders for 100s of FC buses

Forklifts

H2 demand: 1kg/day

- Toyota will be demonstrating the first UK FC forklift at the Teesside International airport from January 2022

Delivery Trucks

H2 demand: 15kg/day

- Hyundai lead with UK start-up Electra doing first demonstration trials in 2021, large OEM models expected in ~2023

Trains

H2 demand: 300kg/day

- Alstom are in negotiations with parties to deploy the first H2 trains in the UK in 2023

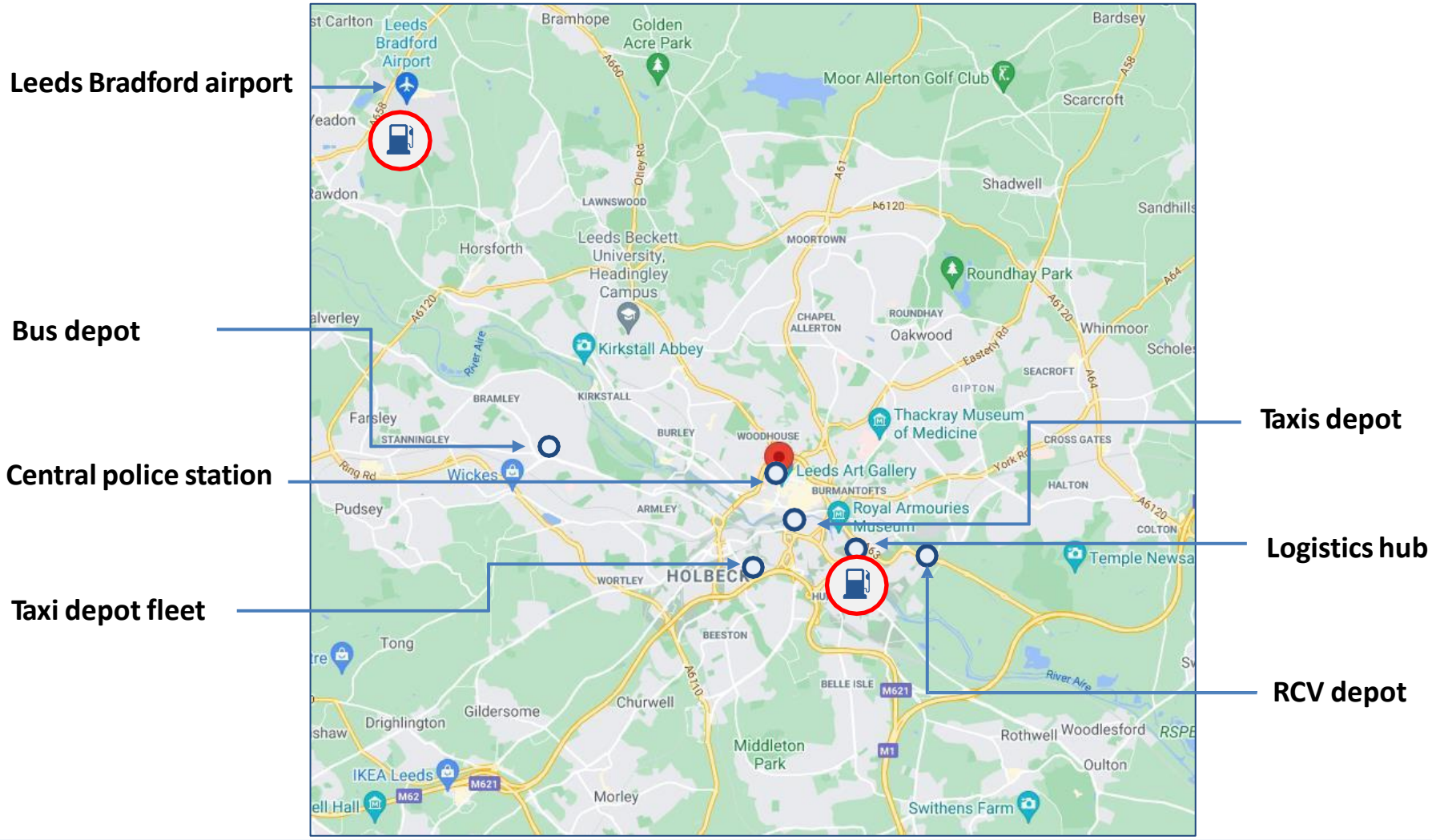
Ships

H2 demand: 500kg/day

- Government's clean maritime competition will open in the spring of 2022.

The hub concept can be applied to any city with sufficiently large transport demand

Indicative overview map of a Transport Hub Concept in Leeds UK



Hydrogen valley and transport hub concepts are being delivered across Europe and in the UK

Example projects

The French "Zero Emission Valley" obtains a European financial support

La Région Auvergne-Rhône-Alpes

UK invests £3 million in Tees Valley hydrogen transport hub

By Dominic Ellis

March 17, 2021 • 3 mins

Jan 26, 2021 - 09:48 pm

HysetCo moves to run 600 hydrogen cabs in Paris

AIR LIQUIDE | FCEV | FRANCE | HYPE | HYSETCO | PARIS | SLOTA | STEP | TOYOTA

TEES VALLEY COMBINED AUTHORITY

Agenda

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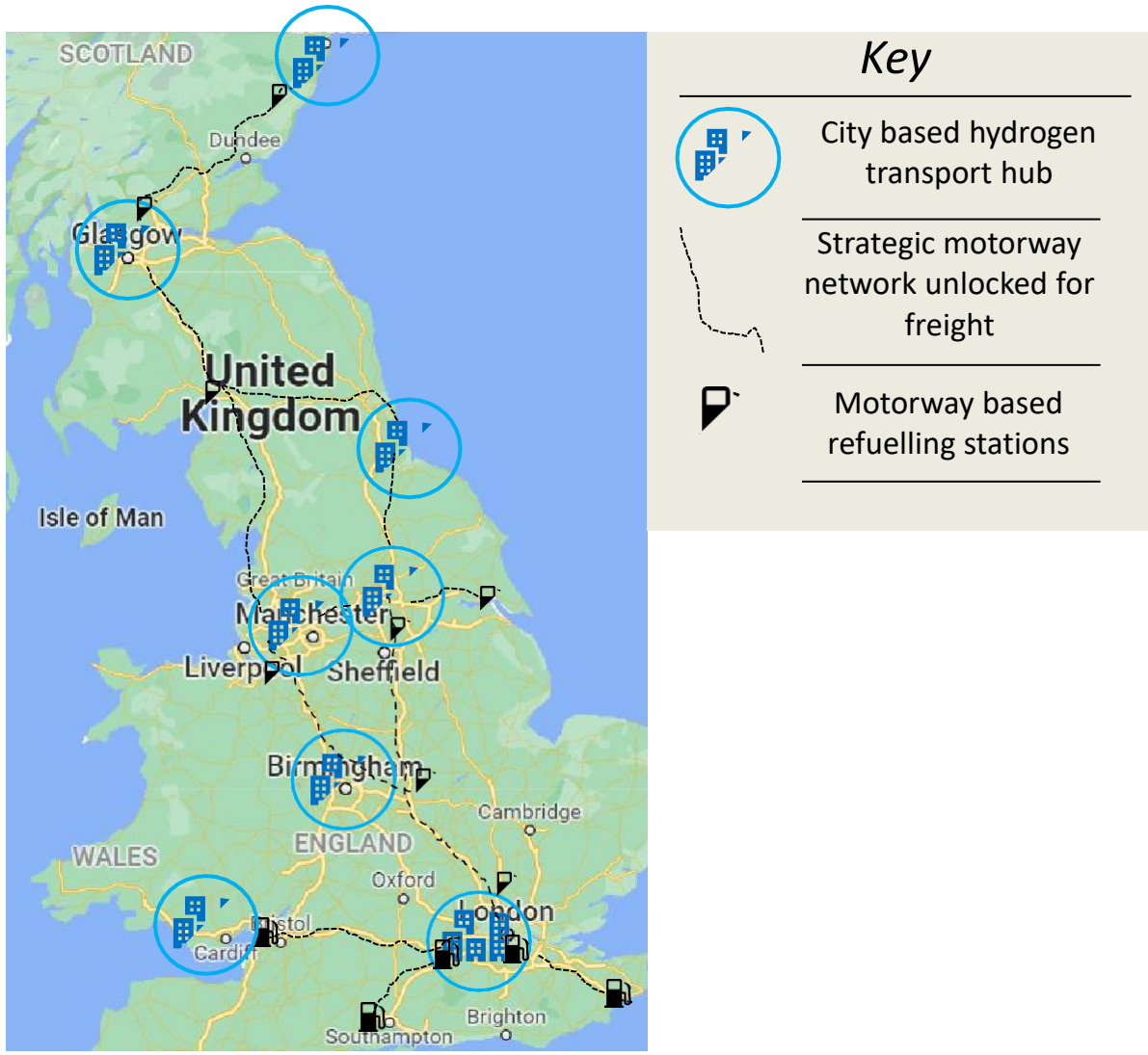
By joining the trunk route strategy with a city scale hub strategy, a nation can create a cost effective, nationwide refuelling network

Description of approach

- Marry the hydrogen hub concept with the truck trunk route strategy in a hub and spoke model and create a network of large, well loaded public stations that allow any vehicle to travel relatively freely across large distances.
- This will need centrally coordinated and efficiently spent public funds of the total magnitude of ~£200-300M and could be achieved by any country.
- This represents a relatively low cost way to begin decarbonising the hard to treat transport sectors

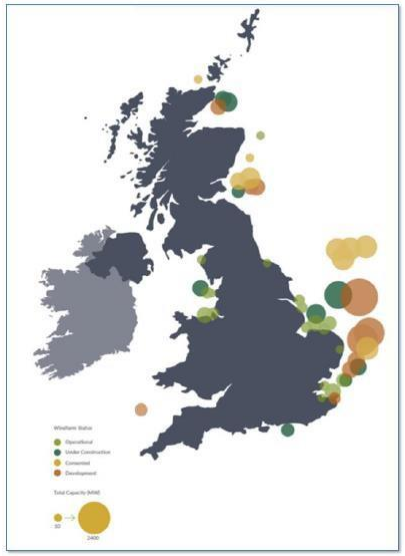
Indicative strategy for how the UK might create an H2 strategy



The transport deployment strategy needs to align closely with existing and planned hydrogen production and delivery infrastructure

Likely hydrogen production plant sites

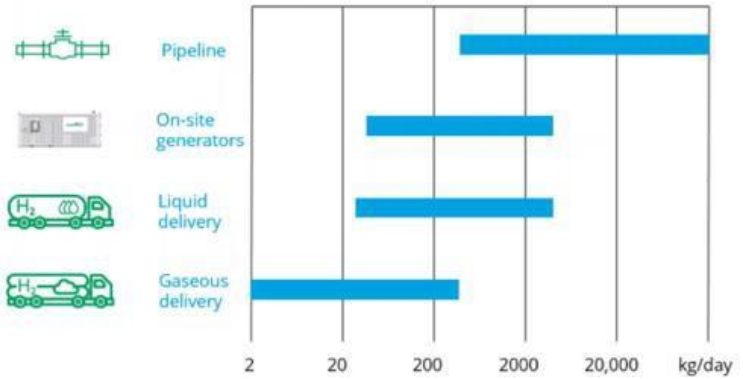
Green hydrogen hubs



Blue hydrogen hubs

- First mover hydrogen sites that require delivered hydrogen should aim to be near large planned or existing hydrogen production hubs.
- Large-scale blue H2 hubs are long term ~10 year infrastructure projects and are known.
- Large-scale green H2 hubs will likely be located near to large, low cost renewable energy sites

Types of hydrogen delivery



- There are 4 types of hydrogen delivery commonly employed today which are listed above.
- Each is suited to different demand volumes and different site constraints.
- The further hydrogen is transported the higher the added cost of delivery.
- Note that projects are underway to transport hydrogen through the national gas grid, so stations seeking to futureproof may want to locate near to gas grid points.

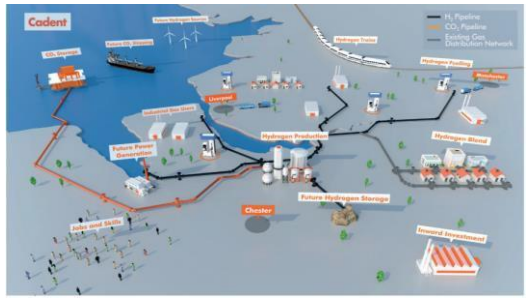
An integrated national strategy for hydrogen would link large production sources to large freight stations via dedicated pipelines

- Hydrogen for freight is a rapidly developing technology which is growing in maturity.
  - Numerous OEMs are developing vehicles
  - Vehicles costs are decreasing and efficiency and reliability is improving.

- Hydrogen as a transport fuel will become widely available at low costs over the coming decade.
  - Dozens of large scale blue and green projects announced in the UK
  - Hydrogen transport costs will drop rapidly at scale – pipeline delivery will become commonplace
  - Next generation refuelling stations are cutting costs and increasing availability

Large scale hydrogen production

Large scale hydrogen transport networks



Networks of large hydrogen stations

Thank you for your attention

VOLVO

Volvo Trucks Alternative Fuels and Electrification

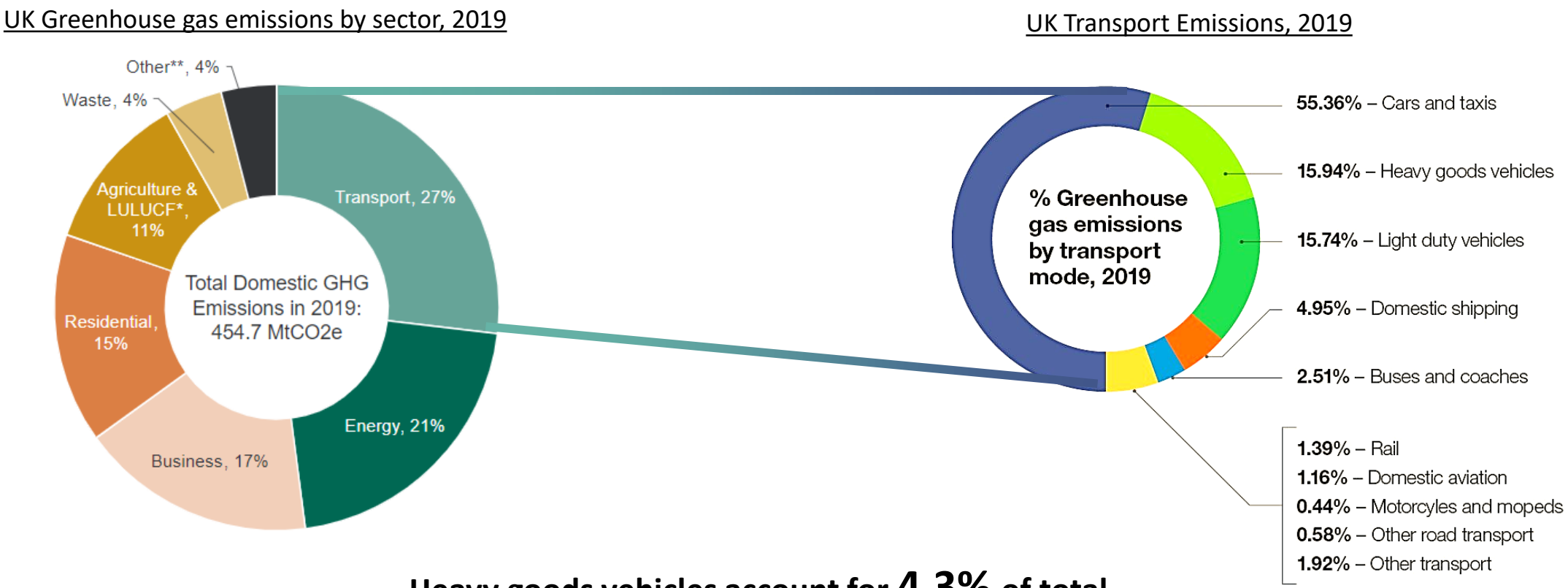
Mark Collins
Sales Engineer

Volvo Trucks

2022-03-11

Road Transport Contribution to CO_2

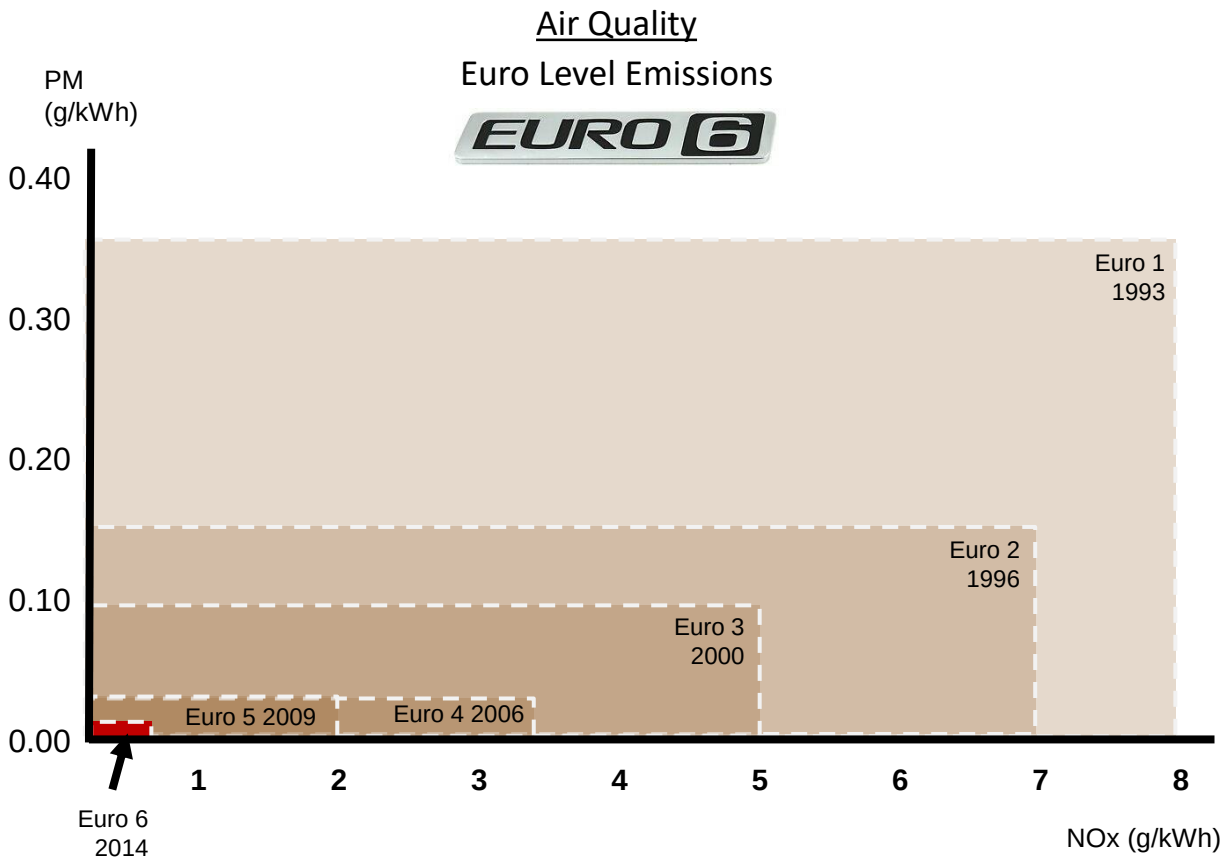
2019 levels

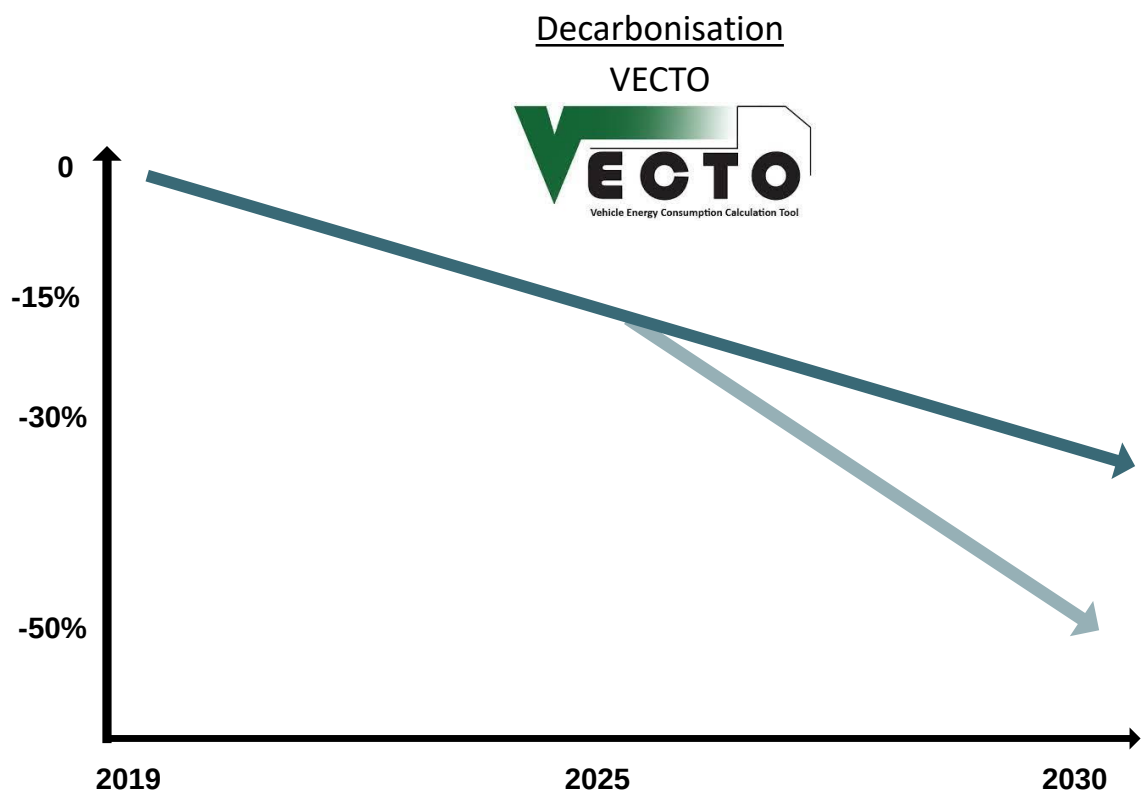


Heavy goods vehicles account for 4.3% of total greenhouse gas emissions in the U.K.

Sources: gov.uk and DfT

Emission Standards and Frameworks





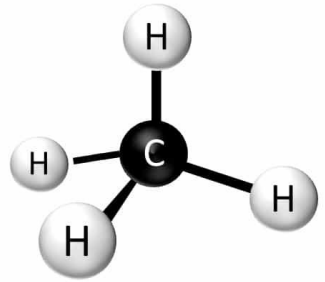
Well-to-wheel decarbonisation

What are our options?

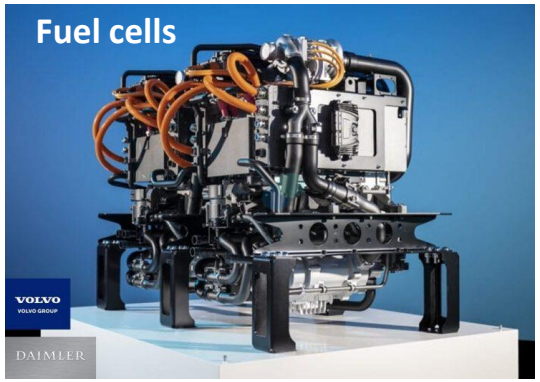
Improving current diesel technology

Renewable ‘drop-in’ fuels

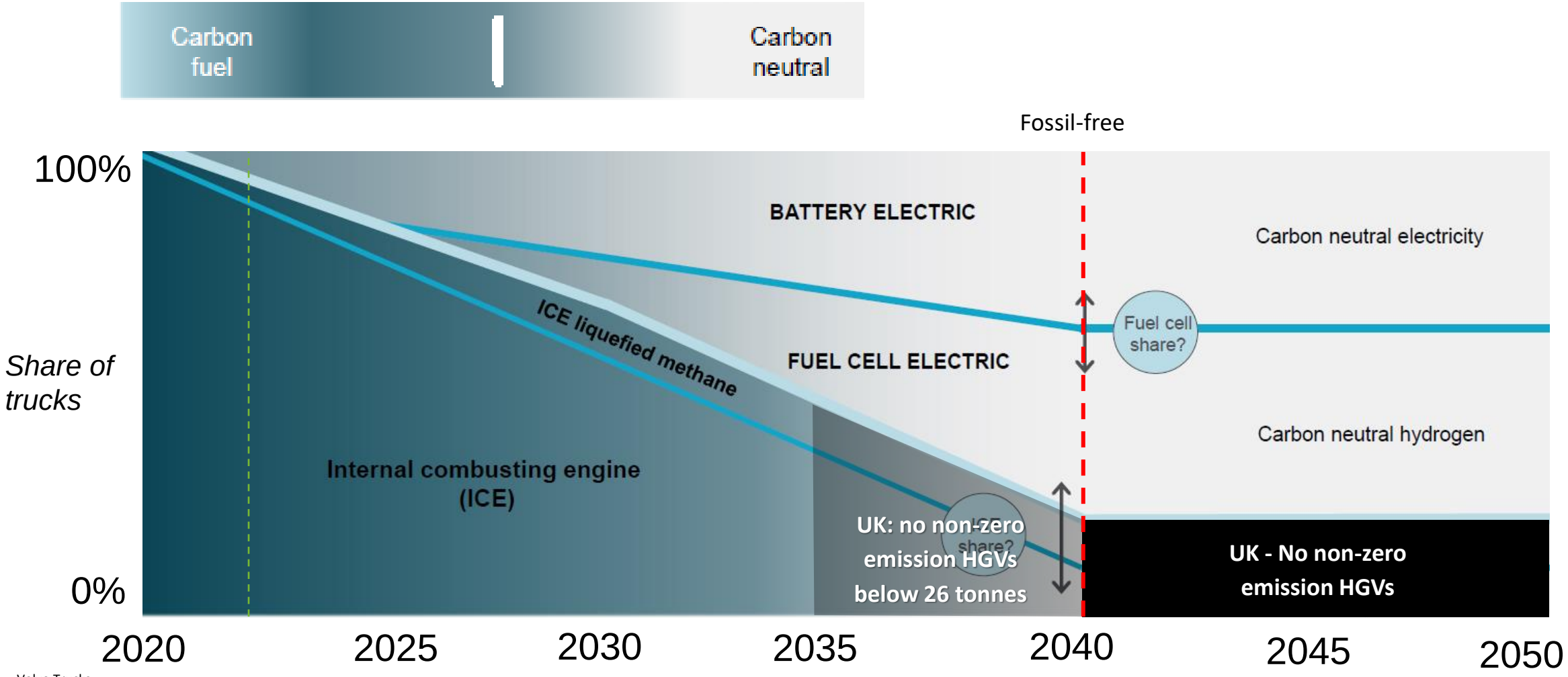
Liquified methane/biomethane



Electric



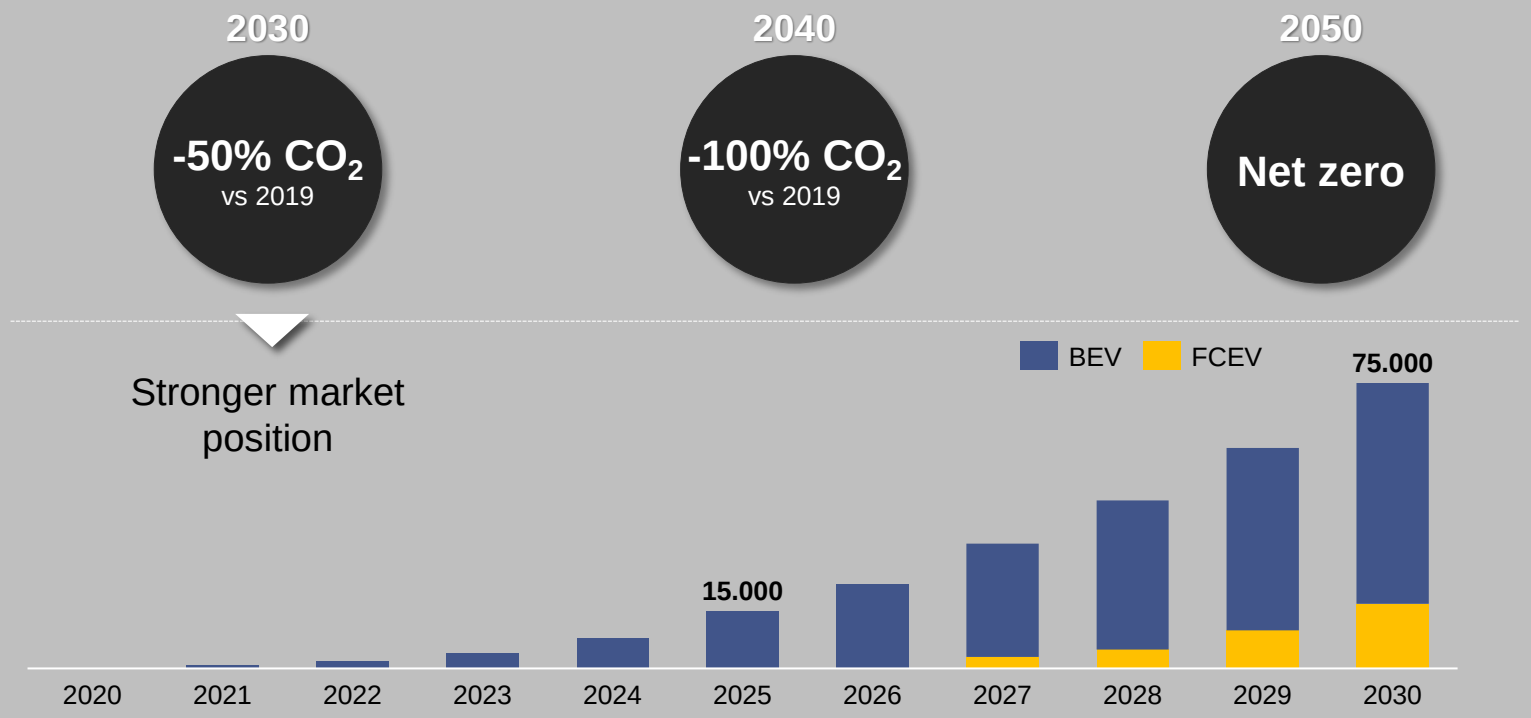
The Volvo Roadmap



Volvo Trucks

The Transition to Electric

Europe Volume Ambitions



41

2030 target equals ~45-50% electrified trucks

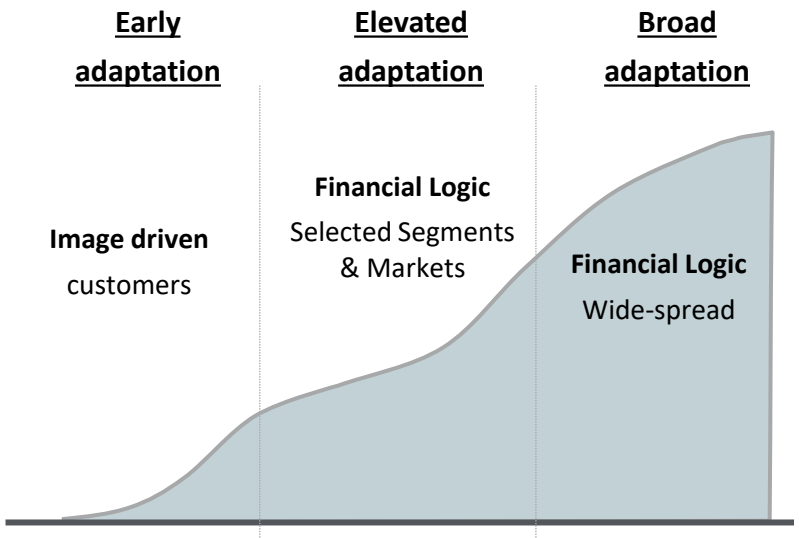
Key Enablers for the Transition

AN EFFICIENT TRANSPORT SYSTEM

RANGE | **PAYLOAD** | **CHARGING**

SUBSIDIES FROM GOVERNMENTS

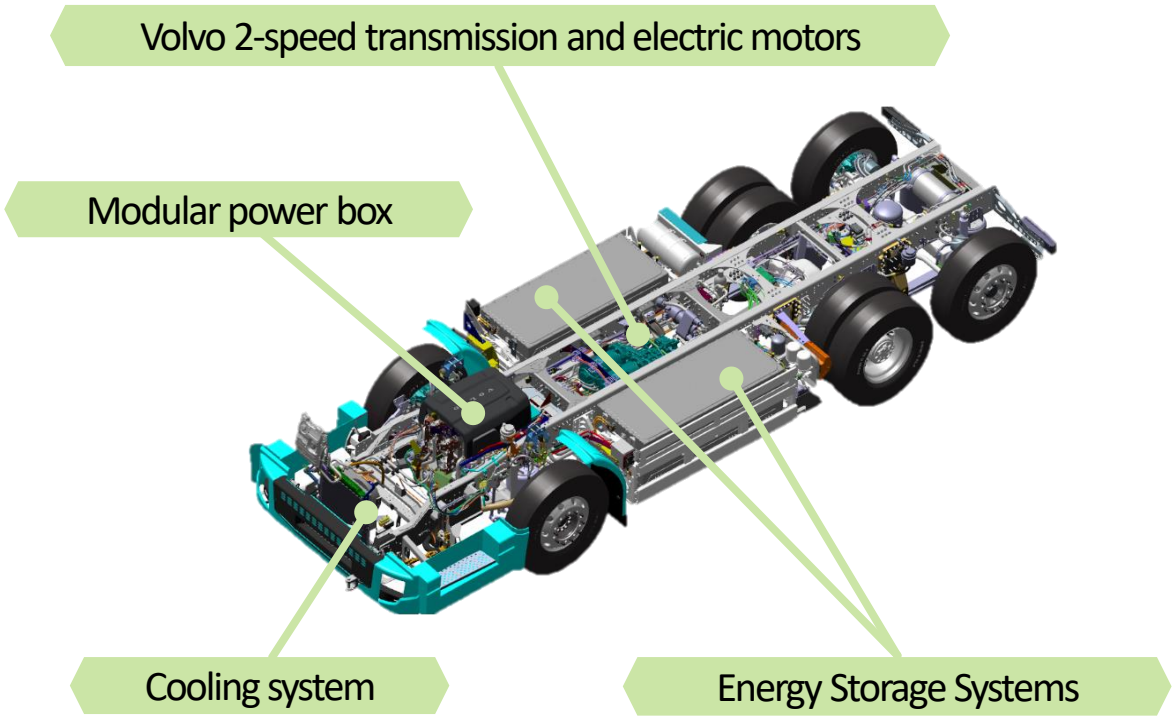
PURCHASE OF VEHICLES | **INFRASTRUCTURE** | **TAXES**



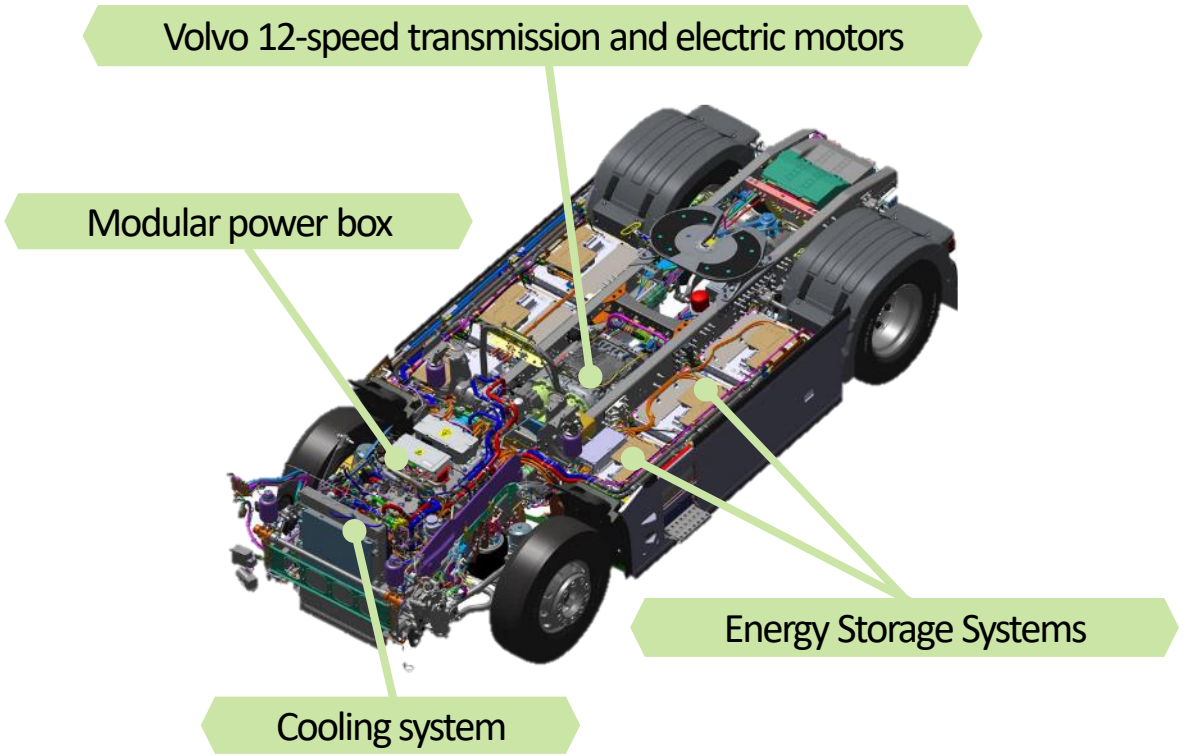
Volvo Trucks

Battery Electric Vehicles

Medium Duty Vehicles



Heavy Duty Vehicles



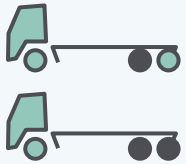
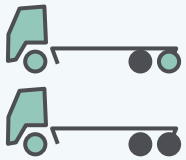
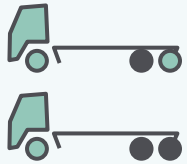
Volvo Battery Electric Rigids



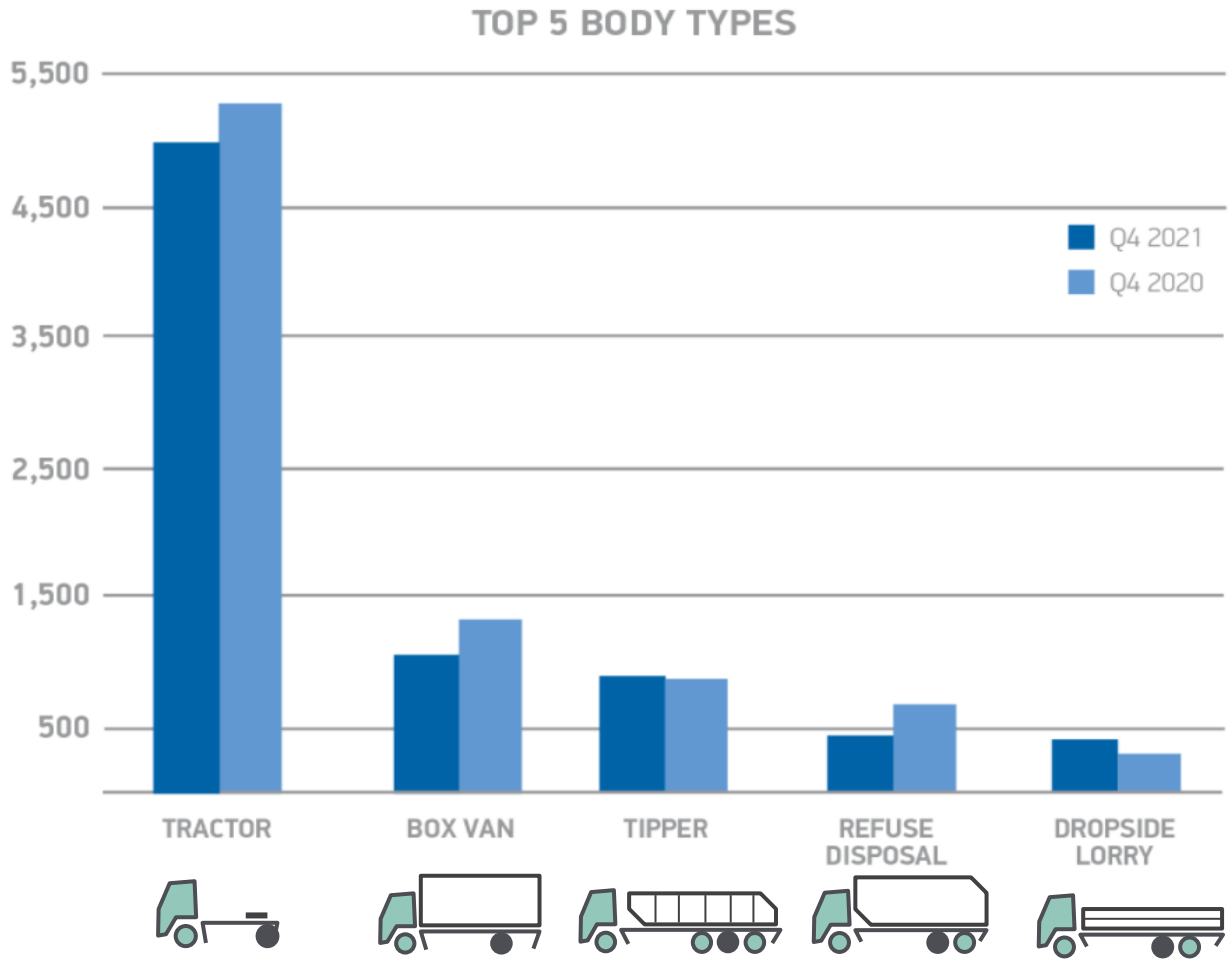


GVW tonne	GVW Incentive - tonne*	FL**	FE	FM	FMX	FH
16	2 axle up to 1 tonne					
18						
26	3 axle up to 1 tonne					
32	No incentive for 4 axles					

Volvo Battery Electric Tractors

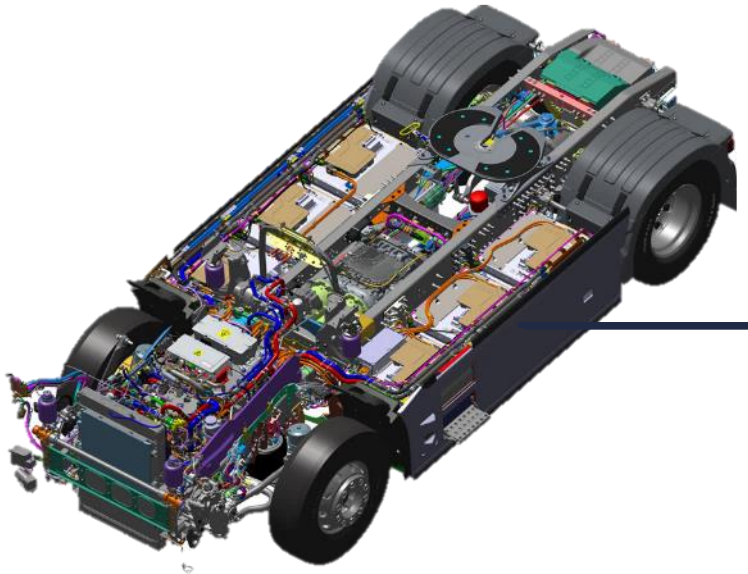
GCW tonne	GCW Incentive - tonne	FM	FMX	FH
40	No incentive for 40 tonne			
44	No incentive for 44 tonne			

Electrifying the Industry



Energy Density

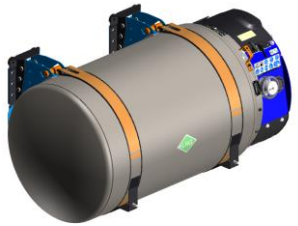
What's required for 300km of range?



Scale Comparison

100 litres of diesel + tank

Approximate mass = 130kg

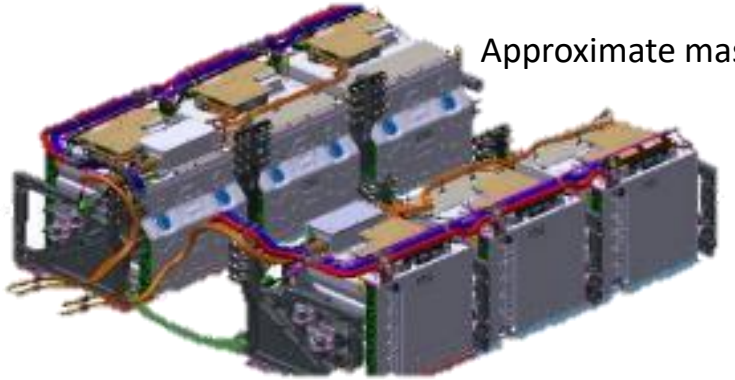


70kg LNG + tank

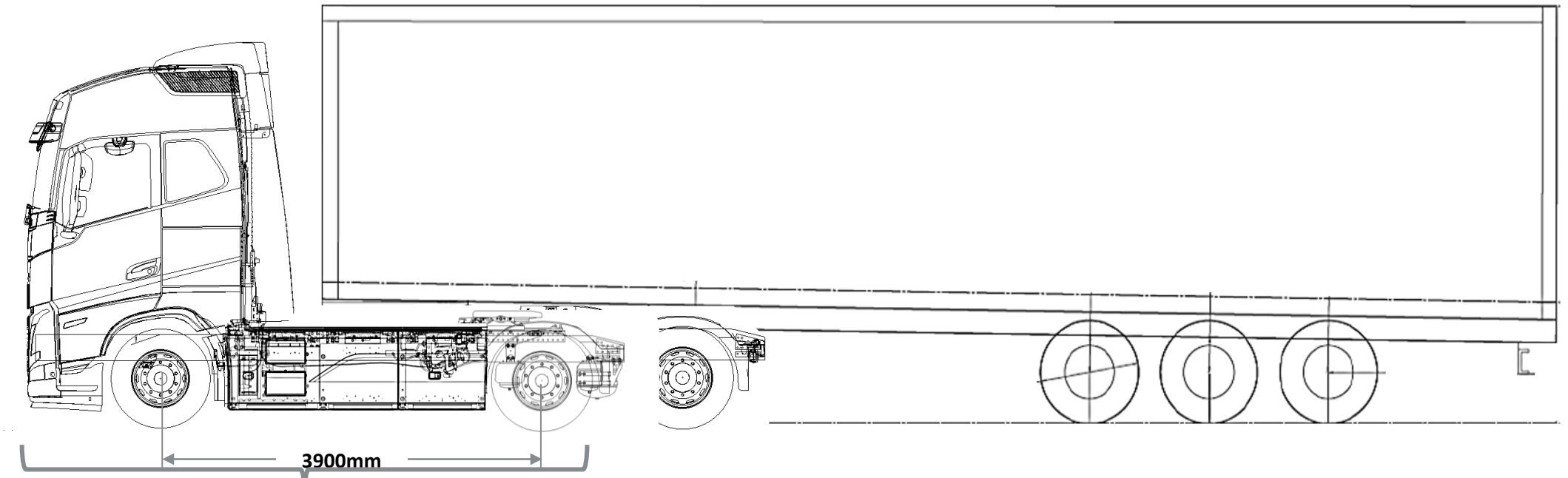
Approximate mass = 150kg

x6 Energy Storage Systems
432kWh of useable energy

Approximate mass = 3000kg

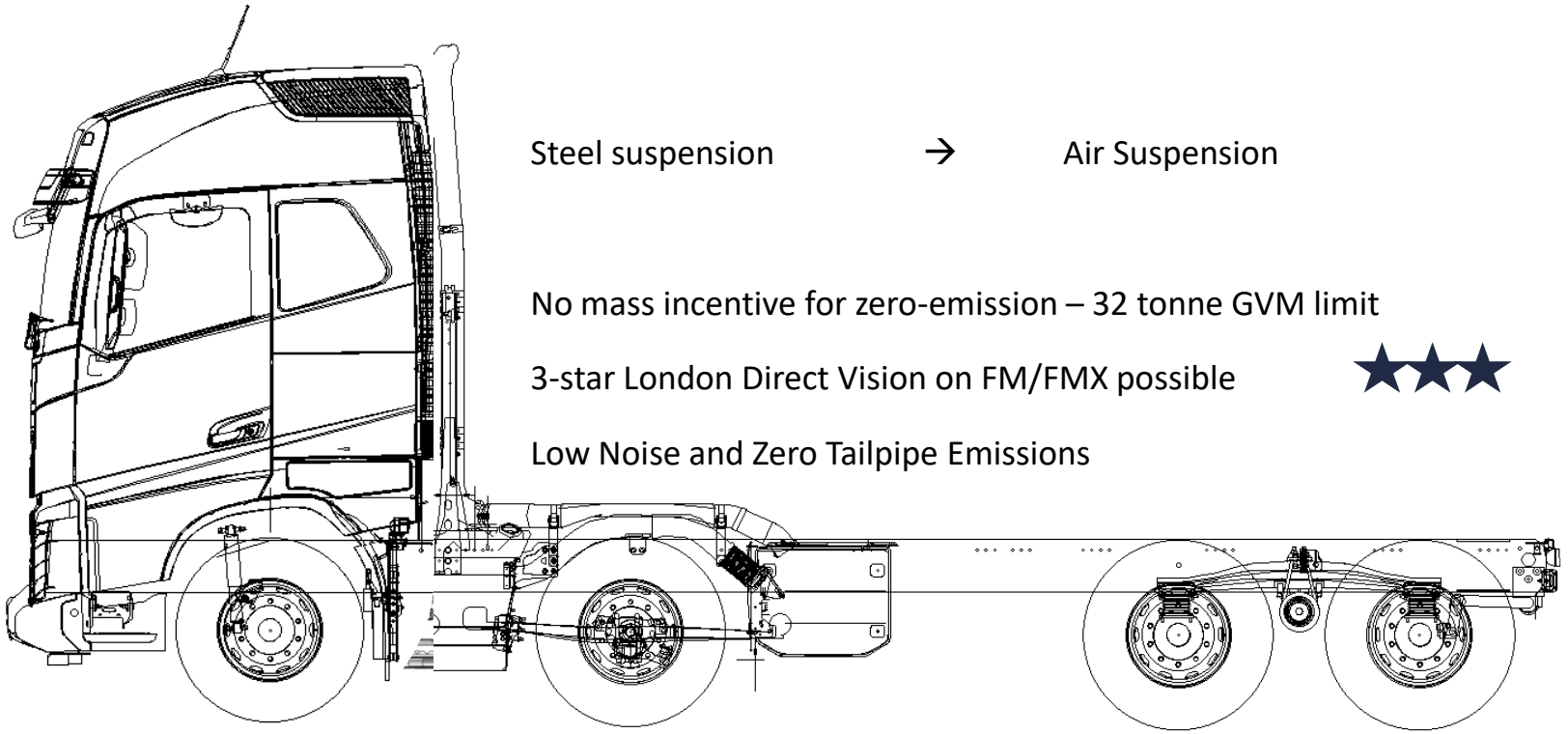


Vehicle Architecture



8x2/4 Rigid Units

32 Tonne Gross Combination Mass



Steel suspension → Air Suspension

No mass incentive for zero-emission – 32 tonne GVM limit

3-star London Direct Vision on FM/FMX possible ★★★

Low Noise and Zero Tailpipe Emissions

VOLVO

A Collaborative Approach

ROUTE SIMULATIONS | ELECTRIC TRUCKS | FINANCIAL SERVICES | CHARGING INFRASTRUCTURE | MAINTENANCE & REPAIR

FINANCE | LEASING | RENTAL | SUBSCRIPTION

VOLVO

eHighway
Reducing emissions of road freight

In line with the National Infrastructure Strategy, fairer, faster, greener

SIEMENS

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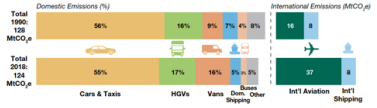
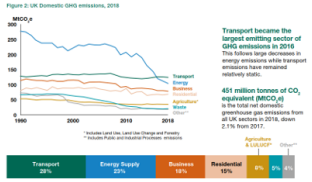
Zoom Summary

eHighway
Reducing emissions of road freight

The problem statement

UK Transport GHG emissions by mode, 1990 and 2018





HGVs are the largest polluters outside of private cars in the transport industry producing approximately 21million tonnes per annum; 17% of the total in transport

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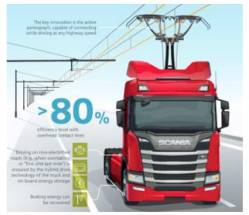
eHighway
Reducing emissions of road freight



eHighway is being successfully trialled by Siemens in Frankfurt, Overhead cables for road freight is a proven technology that maximizes the reduction in HGV emissions.

eHighway is an established Siemens technology on trial across Europe since 2016. Sweden, Denmark and France have advanced plans to implement this solution – the start of a pan European option to decarbonise road freight.

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Current status on the eHighway

- Installed on two sections of German freeways (A1, A5) and one federal road (B462)
- In regular transport operation
- With tractor units of an OEM (Scania)

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eHighway
Reducing emissions of road freight

Climate Change Committee

Context

Accelerating the shift to zero emission vehicles:

"We will invest £20 million next year in freight trials to pioneer hydrogen and other zero emission lorries, to support industry to develop cost-effective, zero-emission HGVs in the UK."

Innovate UK

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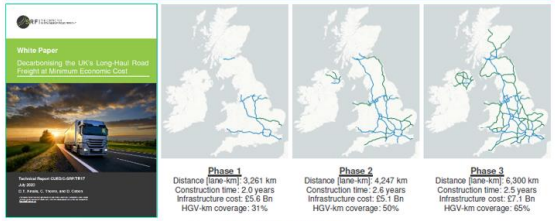
Analyses for other countries also find catenary cost-effective UK Example: report on published July, 2020

*"Overhead catenaries and compatible HGV's are the **most energy-efficient and cost-effective solution** to fully decarbonise the UK's road freight network. Their deployment is essential if the UK is to achieve its Carbon budgets through to net-zero GHG emissions by 2050. **The technology is proven and the transition** from the current diesel-centric approach to catenary-powered electric vehicles **can be handled with hybrid vehicles**."*



Source: Centre for Sustainable Road Freight

Recent Podcast !

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eHighway is an essential solution for climate protection in heavy road freight transport

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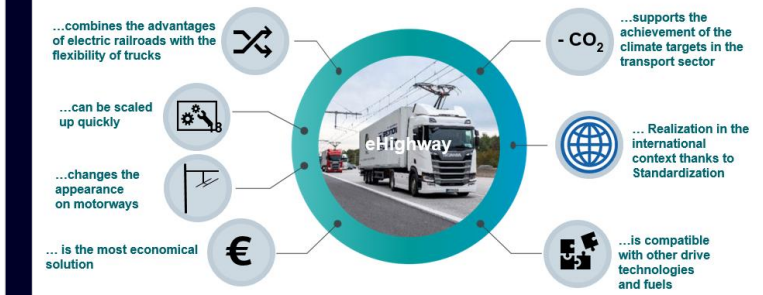
Ingenuity for life



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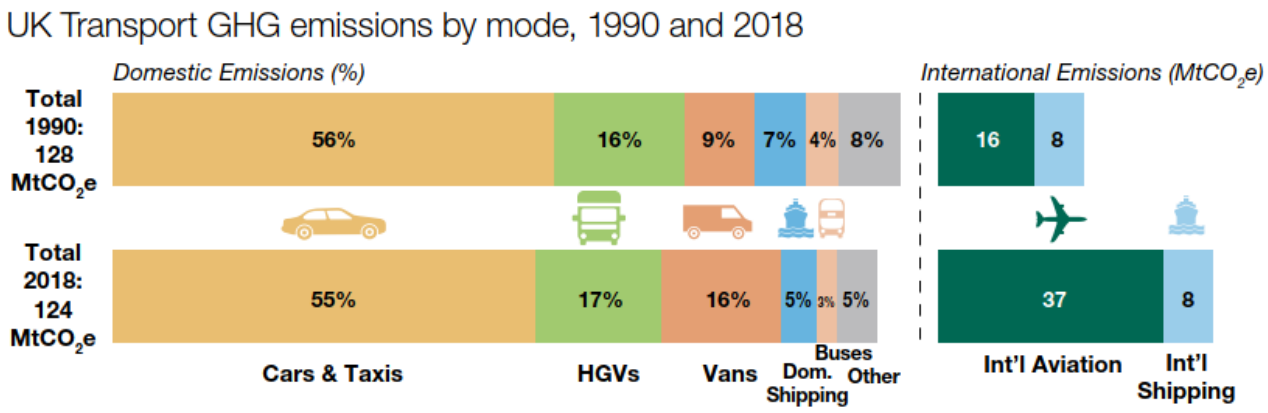
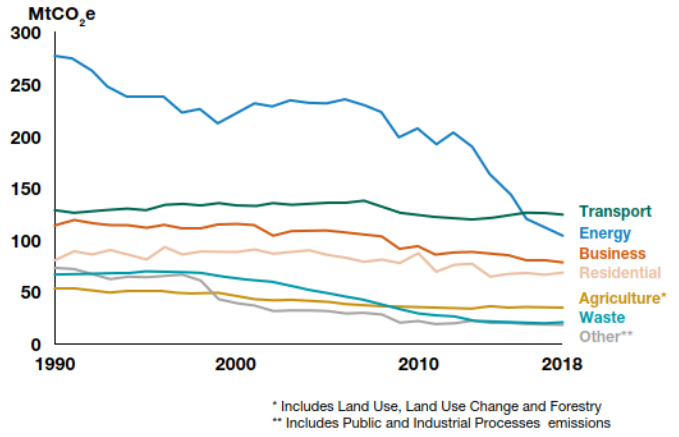
eHighway
Reducing emissions of road freight

The problem statement



Source: 2018 UK greenhouse gas emissions[12]

Figure 2: UK Domestic GHG emissions, 2018



* Includes Land Use, Land Use Change and Forestry
** Includes Public and Industrial Processes emissions

Transport became the largest emitting sector of GHG emissions in 2016
This follows large decreases in energy emissions while transport emissions have remained relatively static.

451 million tonnes of CO_2 equivalent ($MtCO_2e$)
is the total net domestic greenhouse gas emissions from all UK sectors in 2018, down 2.1% from 2017.

HGVs are the largest polluters outside of private cars in the transport industry producing approximately 21million tonnes per annum; 17% of the total in transport

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eHighway
Reducing emissions of road freight – potential solutions

Zero emission trucks are possible with renewable energy, but efficiency varies greatly

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Ingenuity for life

Pathway	Range Cost per km	Efficiency WTW	Example vehicle
Electric Road Systems e⁻ → Grid (incl. catenary) → e⁻ → eTruck (Catenary-Hybrid) 96 kWh, 12 ct/kWh; 1,6 kWh/km	**60 km** 19 ct/km	**77%**	
Battery e⁻ → Grid → e⁻ → eTruck (Battery) 96 kWh, 10 ct/kWh; 2 kWh/km	**48 km** 20 ct/km	**62%**	
Hydrogen e⁻ → Electro-lysis η = 70% → H_2 → H_2-network[1] → H_2 → CH_2-fuel station → $C.H_2$ → Fuel cell truck 2 kWh, 5 kWh 93 kWh; 65 kWh, 15 ct/kWh; 65 kWh, 18 ct/kWh; 65 kWh, 20 ct/kWh; 2.7 kWh/km	**24 km** 55 ct/km	**29%**	
Power-to-Gas e⁻ → Electro-lysis η = 70% → H_2 → Methanation η = 80% → CH_4 → NG-network[1] → NG → CNG-fuel station → CNG → Gas-truck 2 kWh 98 kWh; 69 kWh, 15 ct/kWh; 55 kWh, 19 ct/kWh; 55 kWh, 20 ct/kWh; 55 kWh, 22 ct/kWh; 3.2 kWh/km	**17 km** 70 ct/km	**20%**	

1) Including storage
Source: German Ministry of Environment

The solutions on this diagram show that well to wheel (WTW) is most efficient using electric road systems i.e. eHighway

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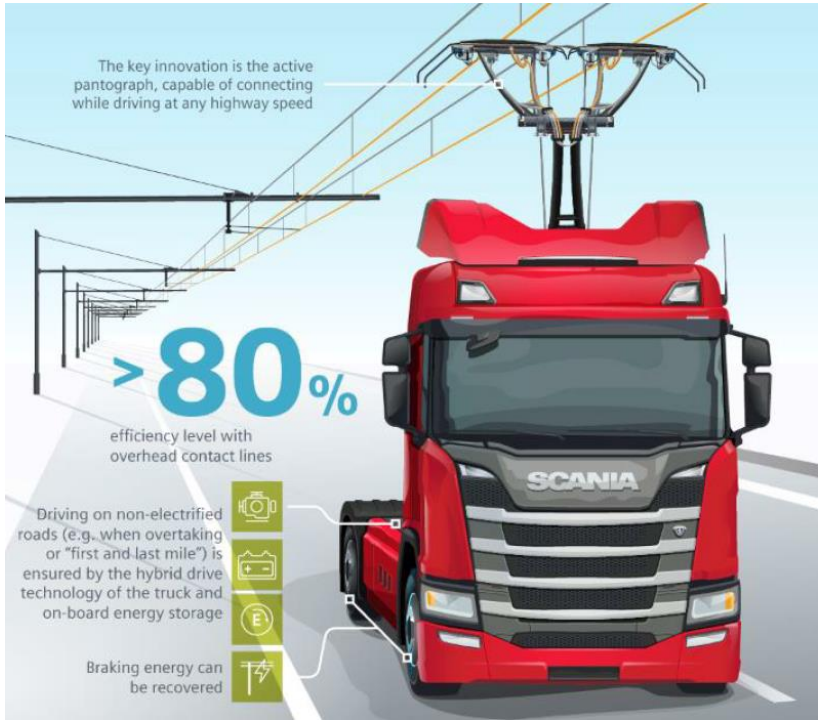
eHighway
Reducing emissions of road freight



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eHighway is an established Siemens technology on trial across Europe since 2016. Sweden, Denmark and France have advanced plans to implement this solution – the start of a pan European option to decarbonise road freight.

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Dynamic charging via catenary is compatible with other alternative drive technologies and fuels

Truck types	Drive system	On-board source of electricity	Combustion engine	Non-electrical source of energy
Artic truck (2 axles)	Parallel-hybrid	Battery (small)	Engine (small)	Diesel
Artic truck (3 axles)	Serial-hybrid	Battery (medium)	Engine (medium)	Bio fuel
Rigid truck (2 axles)	Full electric	Battery (large)	Engine (large)	CNG/LNG
Rigid truck (3 axles)		Fuel cell		Hydrogen

Showing combinations already realized in projects so far

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Truck manufacturers are electrifying their vehicle platforms – tractor units such as this hybrid truck are already available

Source: **Scania Press relaese**

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Current status on the eHighway

Copyright Spedition Bode

- Installed on two sections of German freeways (A1, A5) and one federal road (B462)
- In regular transport operation
- With tractor units of an OEM (Scania)

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ELISA project: Completion on schedule - with minimal disruption to traffic flow

Ground surveys

Rammed the steel pipes

Setting up the poles

Attachment of the cantilevers

Pulling the contact wire

Arrival of the substations

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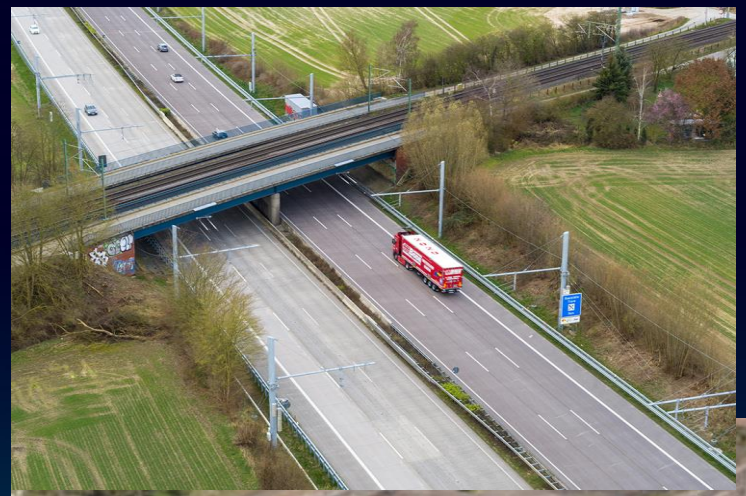
All three field tests show that the overhead line for trucks can be integrated into the existing road infrastructure



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eHighway
Reducing emissions of road freight

Climate Change Committee

Context

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UKRI Innovate UK

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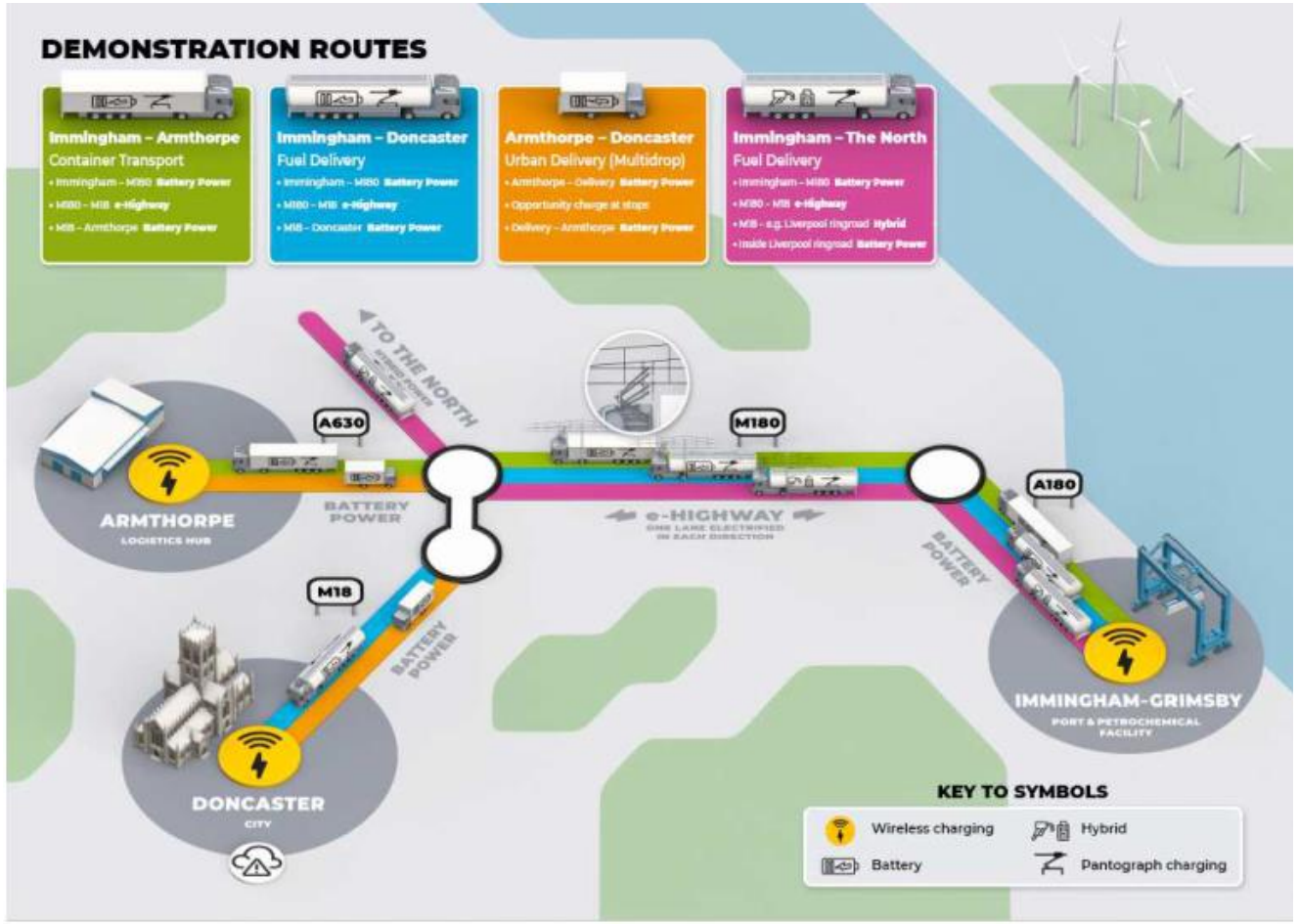
eHighway
Reducing emissions of road freight



1. The only feasible way to get UK road freight to 80%+ CO_2 reduction by 2050 is to electrify long haul.
2. eHighway is the highest TRL technology available:
   - Well tested and proven ➔ ready for prime time
   - Lowest energy and carbon emissions
   - Small batteries
   - Interoperable with Europe
   - Practical roll-out/transition scenarios
   - Attractive business cases
   - Full fuel tax recovery
3. UK pilot project is needed to de-risk remaining issues prior to roll-out.

Proposed UK Trial on High HGV traffic route between Immingham / Grimsby & Doncaster

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Analyses for other countries also find catenary cost-effective UK Example: report on published July, 2020

*"Overhead catenaries and compatible HGV's are the **most energy-efficient and cost-effective solution** to fully decarbonise the UK's road freight network. Their deployment is essential if the UK is to achieve its Carbon budgets through to net-zero GHG emissions by 2050. **The technology is proven and the transition** from the current diesel-centric approach to catenary-powered electric vehicles **can be handled with hybrid vehicles**."*

Phase 1
Distance [lane-km]: 3,261 km
Construction time: 2.0 years
Infrastructure cost: £5.6 Bn
HGV-km coverage: 31%

Phase 2
Distance [lane-km]: 4,247 km
Construction time: 2.6 years
Infrastructure cost: £5.1 Bn
HGV-km coverage: 50%

Phase 3
Distance [lane-km]: 6,300 km
Construction time: 2.5 years
Infrastructure cost: £7.1 Bn
HGV-km coverage: 65%

Recent Podcast !

Source: Centre for Sustainable Road Freight

eHighway is an essential solution for climate protection in heavy road freight transport

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Ingenuity for life

…combines the advantages of electric railroads with the flexibility of trucks

…can be scaled up quickly

…changes the appearance on motorways

… is the most economical solution

- CO_2

…supports the achievement of the climate targets in the transport sector

… Realization in the international context thanks to Standardization

…is compatible with other drive technologies and fuels

Questions?
Your contact for questions about the eHighway

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#eHighway

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The Supply Chain Network

European Union
European Regional Development Fund

Any Questions?

EAST RIDING OF YORKSHIRE COUNCIL