THE HARDSTAFF GROUP

ALTERNATIVE TECHNOLOGY FOR TRUCKS

Presented by Trevor Fletcher, Managing Director

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NATURAL GAS AS A VEHICLE FUEL

Natural Gas is a clean burning, abundant fuel;

In both compressed (CNG) and liquefied (LNG) form, natural gas is a viable alternative vehicle fuel - **available today;**

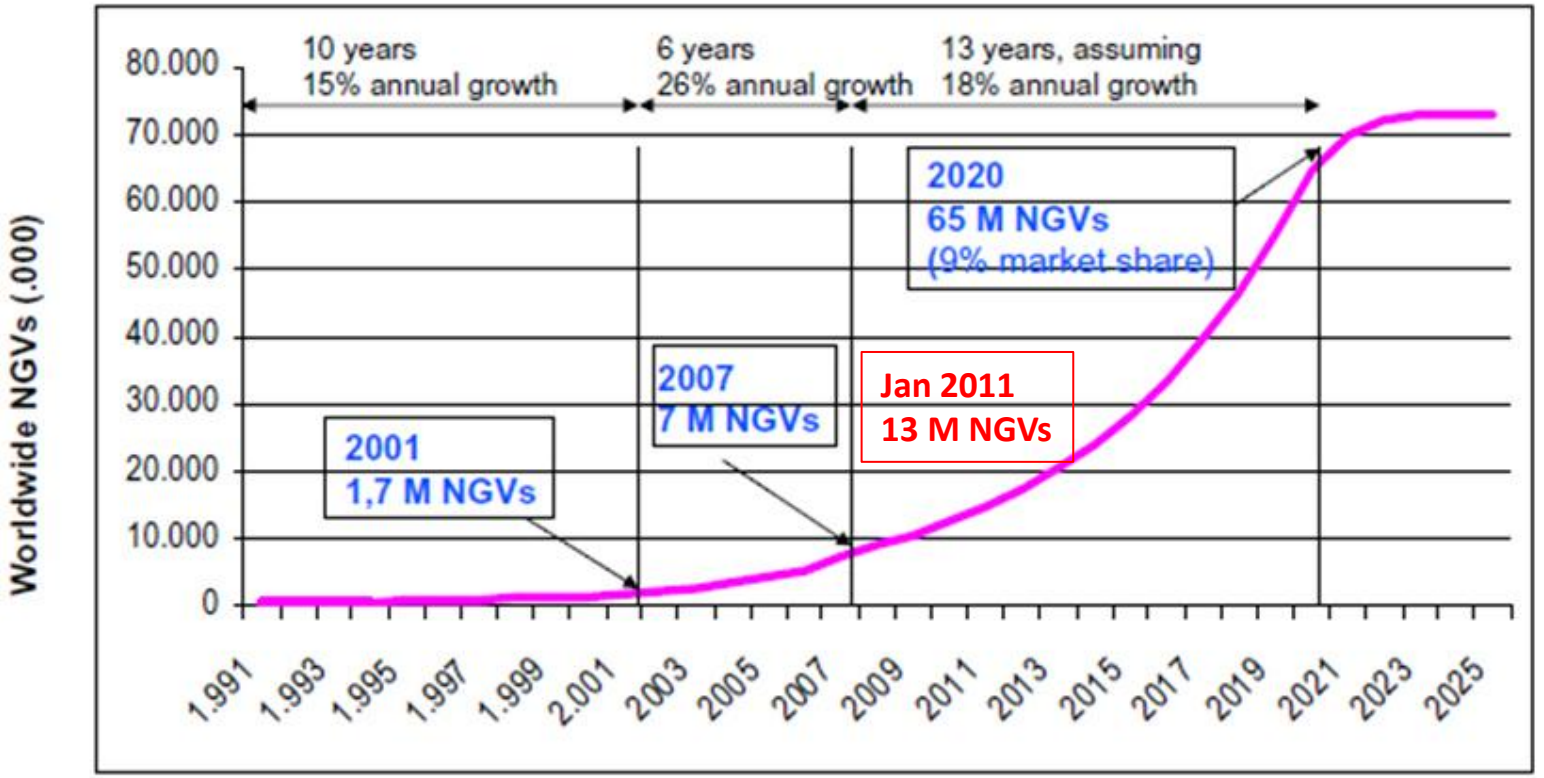
When compared to diesel and petrol natural gas powered vehicles produce less CO_2 and other greenhouse gas emissions per vehicle mile travelled;

Biomethane is chemically more or less identical to natural gas and fully interchangeable;

Natural gas is therefore an ideal choice in the medium-long term transition to a more sustainable energy source.

Dual Fuel vehicle technology supports the EU and UK Policy to reduce carbon emissions in road transport, and actively promotes the use of sustainable fuel.

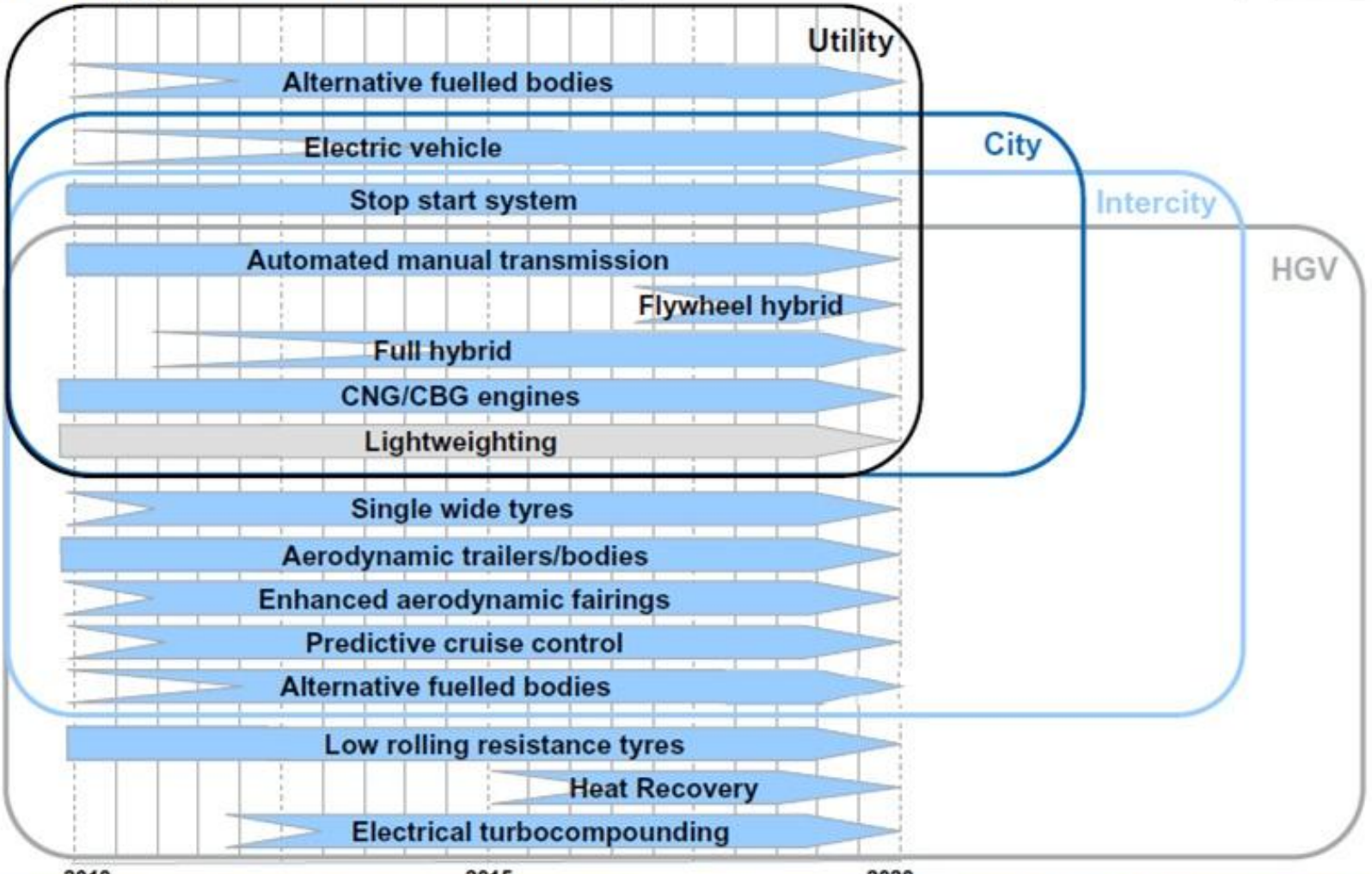
NGVS WORLD MARKET GROWTH 1991-2020



Source NGVA Europe

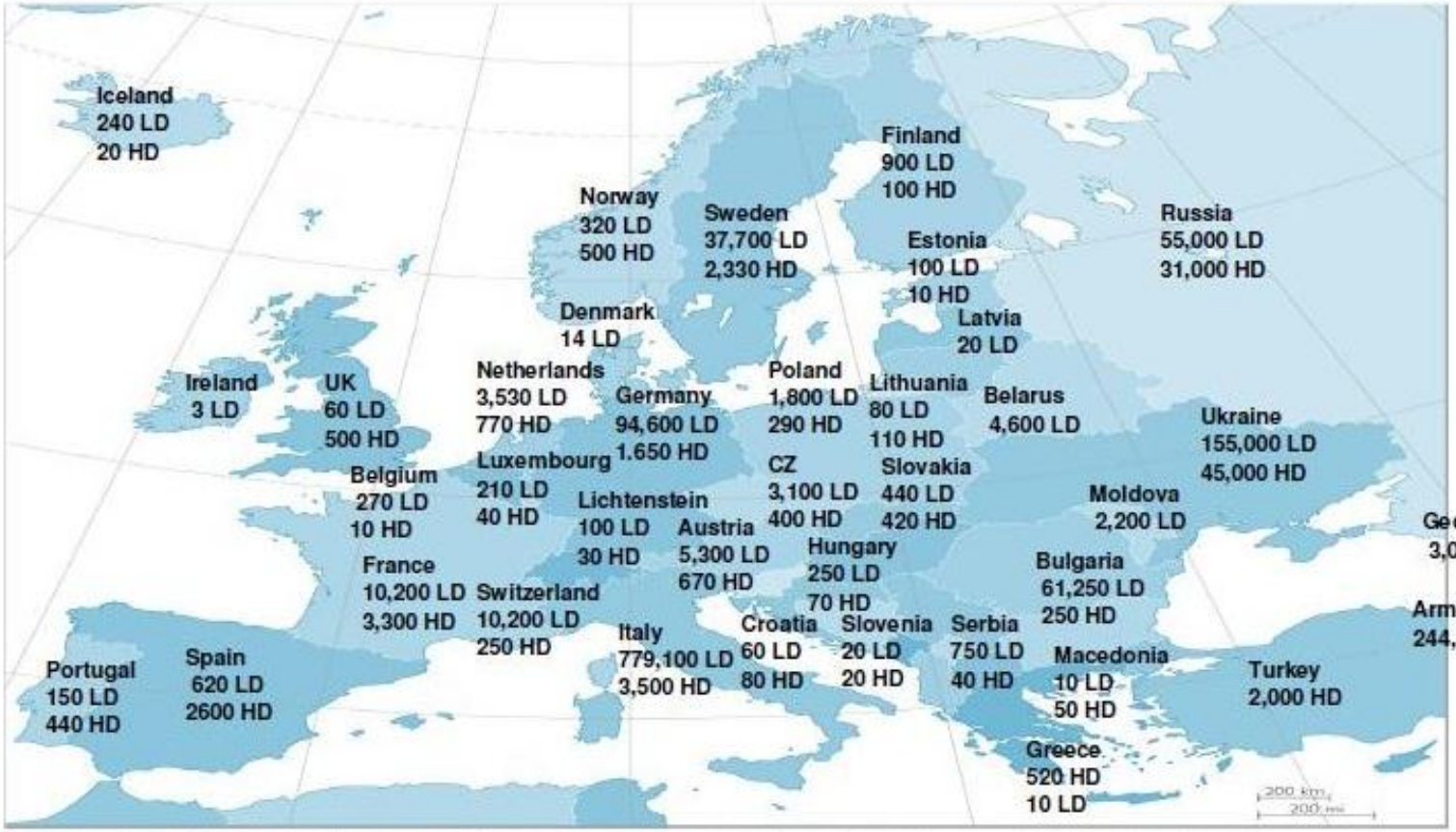
2020 Technology Roadmap Summary – Challenging scenario

Technology gives > 5% reduction in CO_2



1.6 million NGVs in Europe at the end of 2011
(500,000 at the end of 2003)

for sustainable mobility
NGVA europe



1,470,800 cars, 46,100 buses, 50,800 trucks and 800 other NGVs

4020 filling stations

6.7 billion Nm3 (5.5 Mtoe)
52 % consumed in HD vehicles

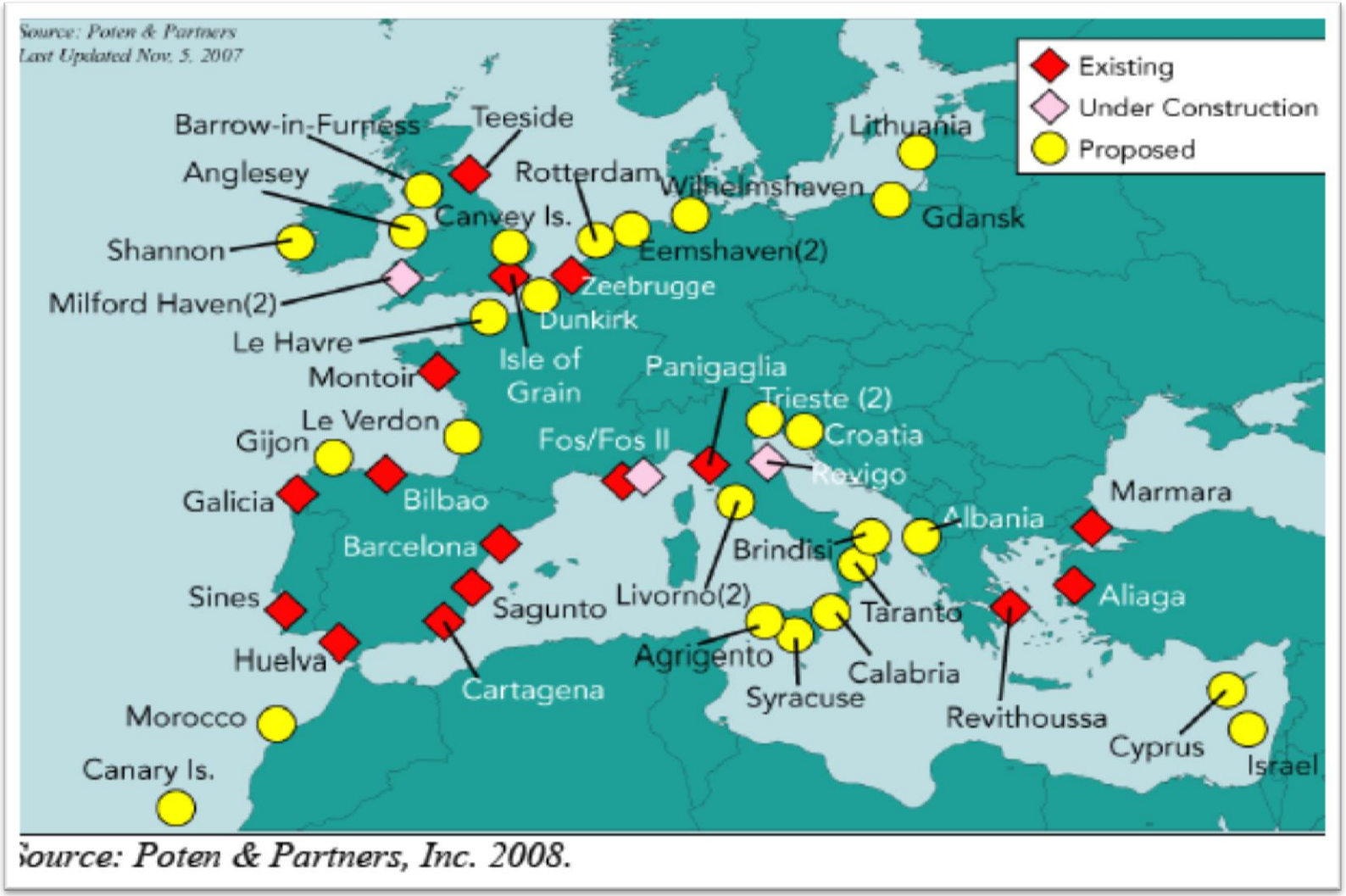
14,5 million NGVs worldwide at the end of 2011 (4 million at the end of 2004)

for sustainable mobility
NGVA europe

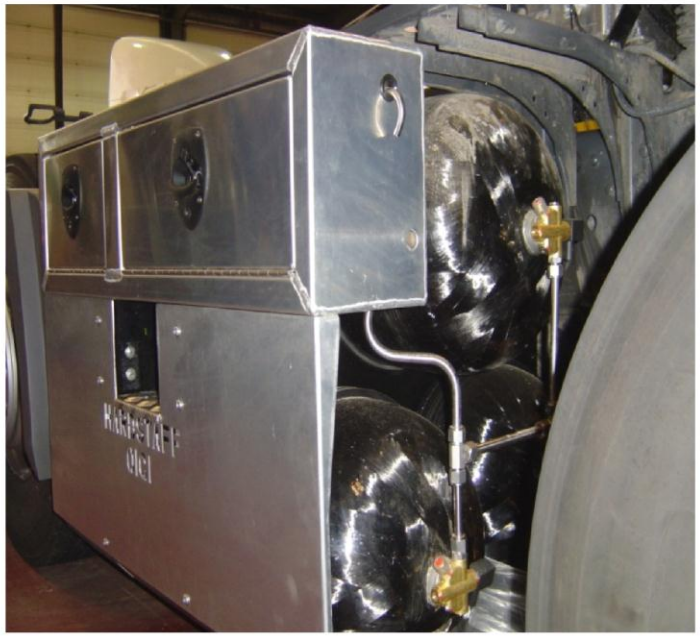
Source: The GVR, adjusted

13,772,500 cars, 321,600 buses, 159,000 trucks, and 265,100 other vehicles now running on NG/ biomethane, using 47.3 billion Nm3 of methane annually (39.1 Mtoe). A total of 20,600 filling stations worldwide.

LNG SUPPLY TO EUROPE

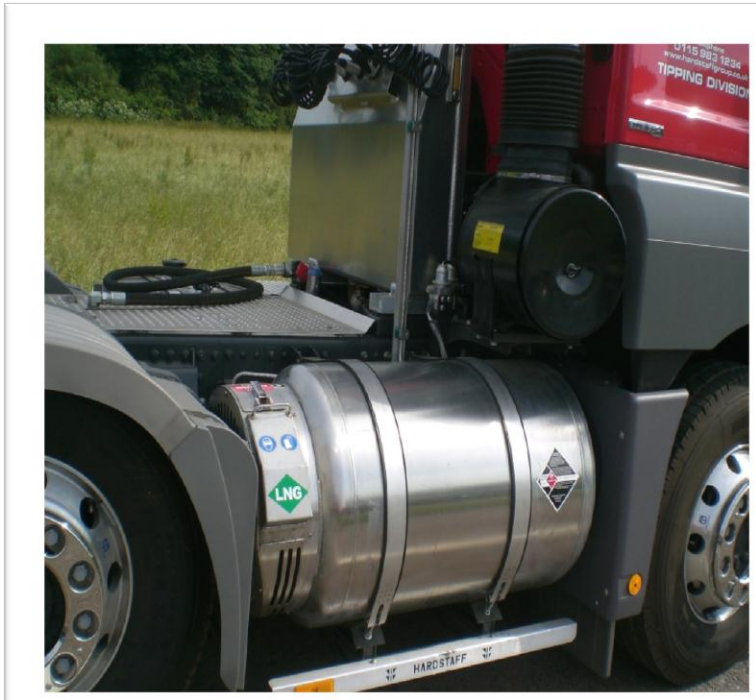


VEHICLE FUEL CONTAINMENT



CNG stored in pressurised cylinder containment

LNG stored in cryogenic tank containment



VEHICLE TYPES AND FUEL ALTERNATIVES

Vehicle type	Present fuel	LPG	Liquid bio fuels	Full electric	Hybrids (energy recuperation)	Bio-natural gas (CNG & LNG)
Cars	Petrol & diesel	Yes (conv.)	Yes (%)	Yes (city cars)	Yes	**Yes (CNG)**
Vans	Diesel	Yes (conv.)	Yes (%)	No	Yes	**Yes (CNG)**
Delivery trucks	Diesel	No	Yes (%)	No	Yes	**Yes (CNG)**
Urban buses	Diesel	No	Yes (%)	Yes (wired)	Yes	**Yes (CNG)**
Coaches	Diesel	No	Yes (%)	No	No	**Yes (LNG)**
Heavy on road trucks	Diesel	No	Yes (%)	No	No	**Yes (LNG)**
Heavy off road trucks	Diesel	No	Yes (%)	No	No	**Yes (LNG)**
Railway locomotives	Diesel & electric	?	Yes (%)	Yes (wired)	No	**Yes (LNG)**
Ships	Diesel	?	Yes (%)	No	No	**Yes (LNG)**

AVAILABLE VEHICLES

Medium Duty

AVAILABLE VEHICLES

Heavy Duty

AVAILABLE VEHICLES

Heavy Duty

HARDSTAFF EXPERIENCE IN DUAL FUEL

- Operate 120 mixed fleet, major focus on construction
  - 58%+ fleet utilising Dual Fuel technology
- Introduced Dual Fuel technology to UK in 1998/99
- Hardstaff fleet has completed 62+ million miles to prove the technology and develop reliability
- Typical substitution between 50 – 70%
- Typical CO_2 savings 12 – 18%



MARKET INTEREST

HARDSTAFF
DUAL FUEL TECHNOLOGY

"Long term sustainability of technology through its wide range of application"






7.5 tonne – 44-tonne, Buses & Coaches, Refuse Vehicles, Passenger Cars, Vans, Taxis, Trains, Marine….

- Bakeries
- Food Delivery/Supermarkets
- Waste Management
- City and County Councils
- Bus and Coach
- Home Delivery
- Construction Industry
- Road Transport

MOVING FORWARD

- NGVs are now widely recognised.
- As volumes increase more product will be available.
- Coordinated Government stimulus
- Incentives for the Infrastructure
- NGVs are available NOW with immediate benefits to the environment
- Methane powered vehicles recognised for their CO_2 and air quality benefits.

ENGAGING SUPPORT

We have established technologies that are within the criteria of the LCV Technology Roadmap for low carbon HGV's.

Motivated by industry economic challenges, energy availability and the environmental impact, interest in the Hardstaff Dual Fuel technology continues to grow worldwide.

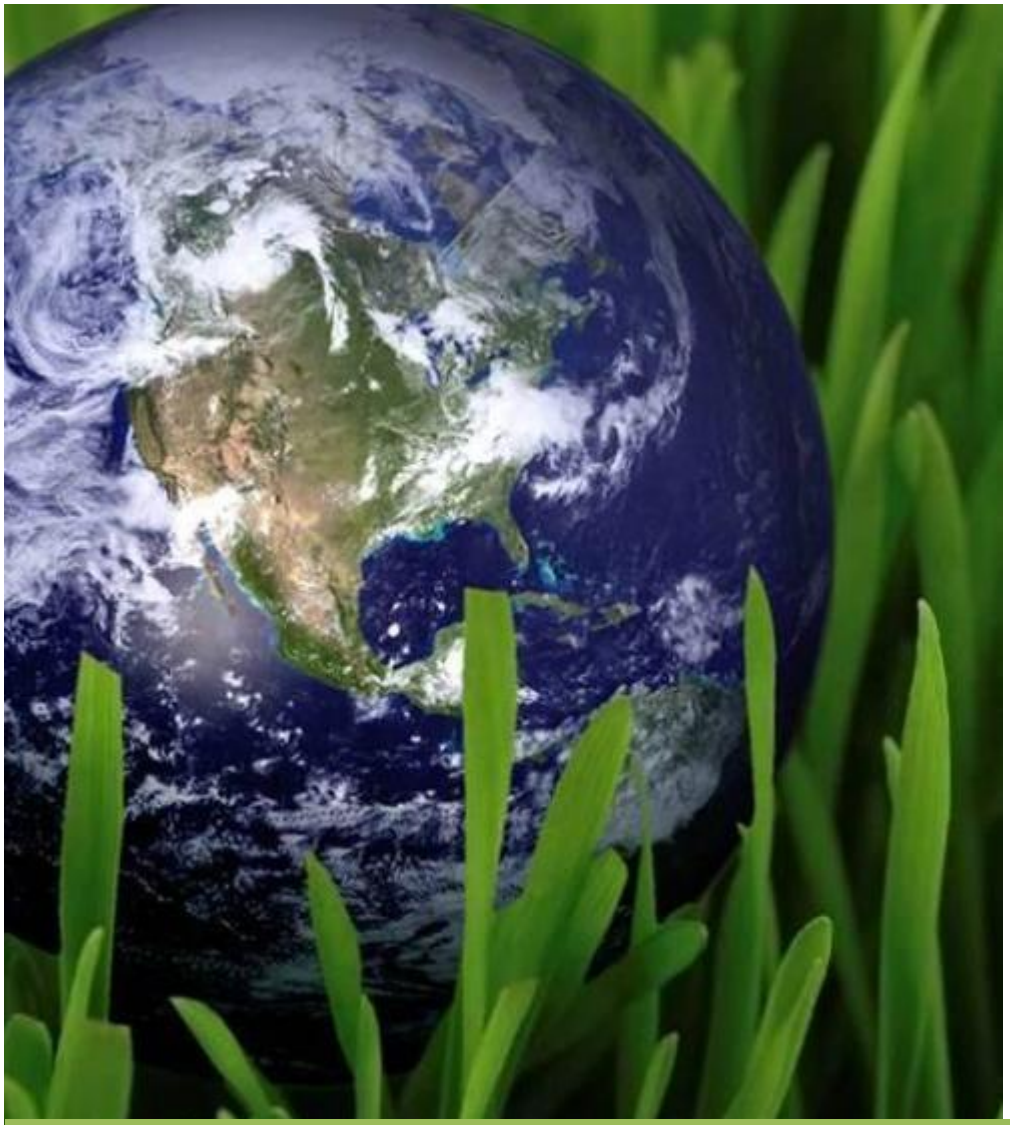
The key to developing the initiatives next step is to engage support from governments, stakeholders and end-users with a view to developing paths that achieve the commercial realisation of the product in the most economic and environmentally responsible way.

Working collectively, stakeholders efforts will benefit both industry and the environment by limiting or significantly reducing the effect of road transport emissions.

THE FINAL PIECE OF THE JIGSAW

The design and installation of a range of refuelling facilities can enable the operator to move between different supply levels as their business and fleet numbers grow.

WORLDWIDE RECOGNITION



HARDSTAFF DUAL FUEL IS CURRENTLY SHIPPED WORLDWIDE

Product in:	Interest in:
UK	China
Brazil	Australia
Sweden	Italy
Germany	Croatia
Norway	Belgium
USA	Denmark
Austria	Turkey
Spain	South Africa
Holland	Finland
France	

NATURAL GAS POWERED VEHICLES

- Methane outperforms all other hydrocarbon fuels concerning CO_2
- The technology has been around for many years
- Utilises standard production vehicles - no requirement for specialist vehicles
- Gives an immediate reduction in GHG's
- Dual fuel offers easy integration for the heavy duty trucks and passenger bus markets
- Supports EU Policy
- Stepping stone to next-phase technology

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