

Biogas as a Vehicle Fuel

**Presented by: T L Fletcher, BSc
17th April 2008**

**IEA Task 37
UK**

Focusing on Gas



The times are changing in our quest to reduce CO₂ emissions

HARDSTAFF

are the most prominent producer and long term participants in the natural gas vehicle market, after identifying natural gas as a viable and cost effective alternative fuel for light and heavy commercial vehicles

HARDSTAFF

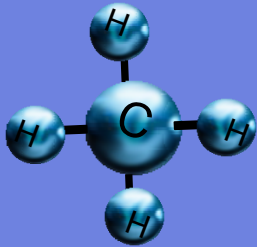
pioneered the development of natural gas vehicles in the UK, and have since gained international recognition in the field



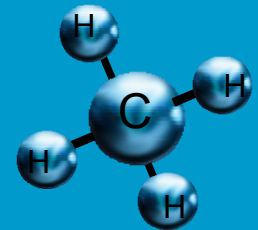
Motivating Forces

The move to Natural Gas is not solely driven by reduced operating costs:

The economic and environmental climate is the greatest motivating factor

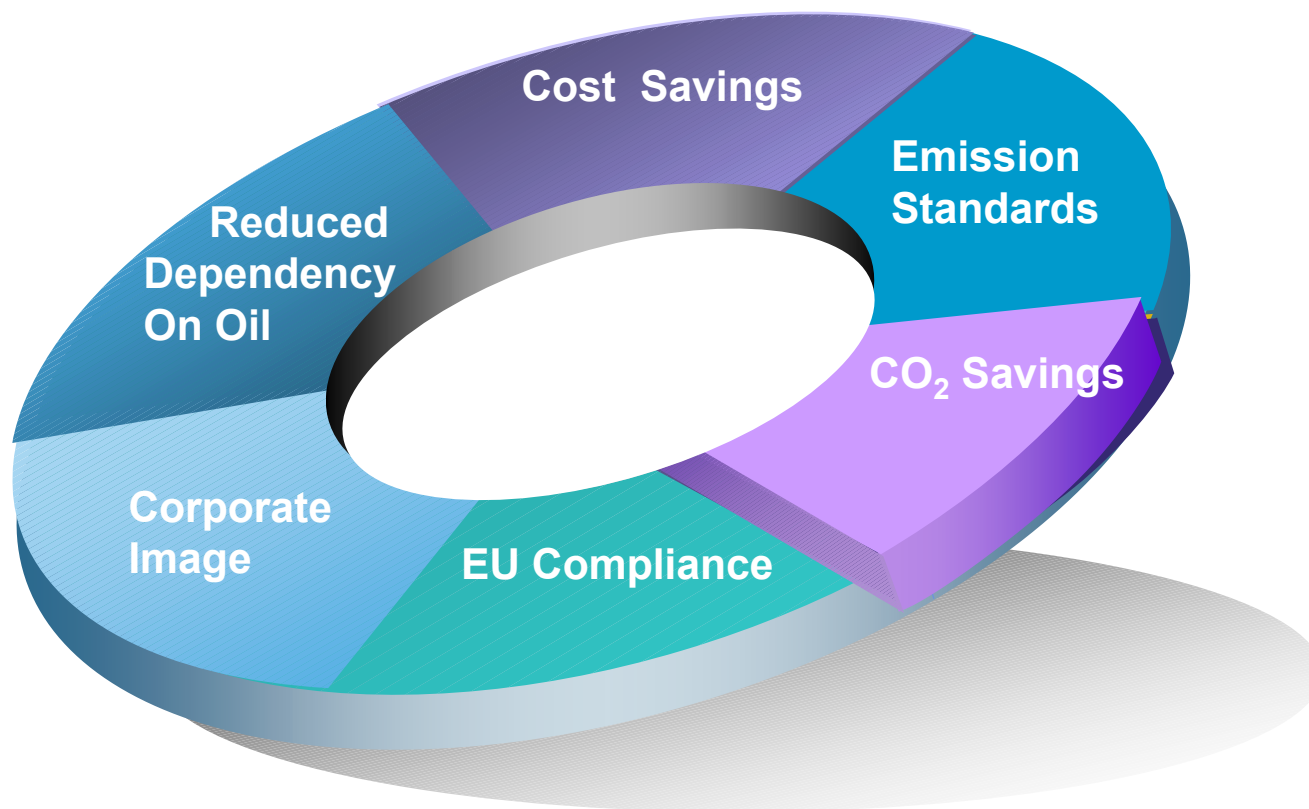


Escalating fuel costs and possible disruption in supply of imports from politically unstable countries accelerated the demand for alternative fuelled vehicles



Government initiatives

Advantages



Available Vehicles



HARDSTAFF are in a unique position:

Current production includes:

- ▶ **DAF 55, 65, 75, 85 Series**
- ▶ **Volvo 12 litre**
- ▶ **Mercedes Benz AXOR**



Current developments in progress include:

- ▶ **Mercedes Benz ACTROS**
- ▶ **DAF LF45**
- ▶ **Refuse Collection Vehicles Euro 3 to 5**
- ▶ **Other models at Euro 4 and 5, including automatic gearboxes**

CO₂ Emission Reduction



Substitution Rate %	CO2 reduction%	Saving per vehicle per Year (Kg)
50%	13.75%	16315
55%	15.08%	17893
60%	16.42%	19483
65%	17.83%	21156
70%	19.17%	22746
75%	20.58%	24419
80%	21.92%	26009
85%	23.33%	27682
90%	24.67%	29272

Long Haul Vehicle: based on 75,000 miles per year and 7.5 mpg

Note: 1 litre of diesel emits 2.61Kg CO2

In our experience substitution of diesel by natural gas is typically 70% - 85%.

Substitution Levels are equal with either CNG or LNG storage.

**7.5 tonne
vehicles**



**Buses &
Coaches**



**Refuse
Vehicles**



**18 tonne
vehicles**



Dual Fuel components are ECE R110 certified and in alignment with ISO standards

OIGI® Dual Fuel Technology



- CO₂ savings of 20%
- 35% to 65% reduction in NOx
- Hardstaff Exhaust System will meet Euro IV and Euro V emissions
- 98% reduction in CO
- 3 dB reduction in noise levels using Hardstaff exhaust technology



Storage

LNG Tank



Cryogenic, -160°C , 100psi

CNG Tank



High pressure ambient
temperature 3600psi

or

Umbilical Trailer



The umbilical design allows the vehicle to fully jack knife and contains safety break away units for operational safety



Allows a 6x2 tractor configurations to use CNG as fuel source or as an alternative or addition to LNG



Range of combined tractor unit and trailer is 620 miles (1,000 kms) approx.
dependent on substitution ratio



Designed in answer to poor refuelling infrastructure in UK

Biomethane



Natural Gas technologies are fully compatible with Biomethane

Fuel source can be CNG from Anaerobic Digester or LNG from Landfill

UK will be first in Europe to create landfill gas (upgraded to LNG for use in vehicles)

Methane from Landfill is cleaner than pipeline gas and has a very high energy content

Transported economically in liquefied state – well established legislation and standards

Ideal for dual-fuel use!

Biomethane

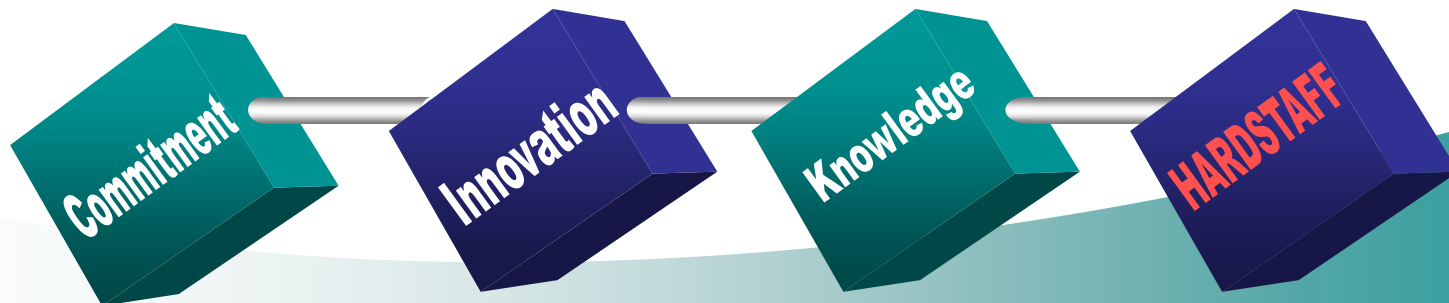


Biomethane is widely used as a vehicle fuel - worldwide

Contributes towards meeting Renewable Transport Fuel Obligations

100% renewable fuel source fully compatible with current mainstream production engines

Creates opportunities to supply own fuel



Liquefied & Compressed Natural Gas Station



These stations can be built and sited relatively quickly and the semi-transportable design specification prevent the asset becoming stranded offering real flexibility.



Infrastructure



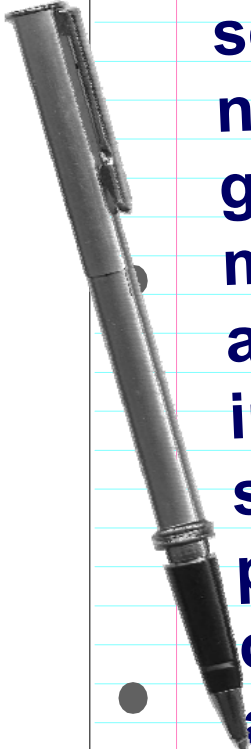
LNG Storage & Dispensing



Gas storage facility capable of storing 12-tons of LNG, designed to support outbased fleet operations







- **Hardstaff are well placed to serve both a nationwide and global marketplace with a wide range of interactive services that provide its customers with a ONE STOP SHOP (complete package)**

- Full backing & support from manufacturer
- Repair & maintenance contracts
- Technical help line
- Driver Training provisions
- Actual performance against Diesel
- Range capabilities maximised with LNG and CNG
- Extremely low additional maintenance costs






Warranty Parts



- ✖ Hardstaff warrant all dual fuel components and offer a comprehensive warranty package
- ✖ Manufacturer warranty unaffected
- ✖ Warranty procedure will be carried out through existing authorised dealer network



ESTIMATED PAYBACK TIME

-  Cost of Natural Gas against diesel
-  Fuel economy
-  Grant incentives
-  Value of CO₂ credits
-  **Exemption from congestion charging**

Safety & Training



Natural Gas safety in the UK is well formulated and managed

Driver training, education and transfer of knowledge essential

Installation staff must be IGE trained

Company must be Quality Registered and working towards ECE R115



Hardstaff offer training in all disciplines for management, drivers and vehicle technicians

TRANSPORT EMERGENCY CARD (Road)

Load **NATURAL GAS (LNG)** (deeply refrigerated liquid)
Colourless refrigerated liquefied gas - usually odourless

Nature of Danger
Highly flammable
Spilled liquid has very low temperature and evaporates quickly
The gas is lighter than air. Production of mist on contact with moist air
May burn explosively on contact with air, particularly in empty enclosed receptacles
Heating will cause pressure rise, severe risk of bursting and subsequent explosion
The gas is suffocating without warning
Contact with liquid causes severe damage: to skin (frostburns), to eyes

Personal Protection
Suitable respiratory protective device
Goggles giving complete protection to eyes
Leather or thick textile gloves, Anti-static boots

GENERAL ACTIONS BY THE DRIVER
● Stop the engine.
● No naked lights. No smoking.
● Warn road users and wear other road users or passengers.
● Keep public away from danger area. Keep yourself.
● Notify police and fire brigade as soon as possible.
● Use low-voltage hand tools and explosion-proof electrical equipment.
● Prevent liquids entering water courses, sewers, basements and road drains. Vapour may create explosive atmosphere.
● Remove or make safe all sources of ignition.
● Where necessary - Extinguish hazard.
● Allow to evaporate.
● If substance has entered a water course or sewer or been split or spilled on vegetation, advise police.

ADDITIONAL AND/OR SPECIAL ACTIONS BY THE DRIVER
● Any action only if without personal risk.
● Avoid direct contact with substance.
● Stop leaks if without risk.
● Use low-voltage hand tools and explosion-proof electrical equipment.
● Prevent liquids entering water courses, sewers, basements and road drains. Vapour may create explosive atmosphere.
● Remove or make safe all sources of ignition.
● Where necessary - Extinguish hazard.
● Allow to evaporate.
● If substance has entered a water course or sewer or been split or spilled on vegetation, advise police.

FIRE (information for the driver in case of fire)
● Do not attempt to deal with any fire involving the load

First Aid
● In case of contact with liquid, then transfer parts with water, then remove clothing carefully. Wash with soap and water.
● Seek medical treatment when anyone has symptoms apparently due to inhalation or contact with skin or eyes.
● In case of burns immediately cool affected skin as long as possible with cold water.

SUPPLEMENTARY INFORMATION FOR EMERGENCY SERVICES
● Do not use water jet on a leak of the tank.
● In case of the tank explosion, explosion hazard!
● Keep containers cool by spraying with water if exposed to fire.
● The substance may burn with almost invisible flame.
● Do not extinguish a leaking gas flame. Extinguish secondary fire. Do not use water jet.
● Avoid light fire from protected position.

Additional Information
Emergency Telephone..... UN No: 1972
HI No: 223

This card has been prepared from the best knowledge available. No responsibility is accepted that the information is sufficient or correct in all cases.

Sign Supplied by
DESIGNED FOR SAFETY
Aurul Harnstead (01442) 875071

Applies only during road transport - English
Issued 1999

OIGI® Dual Fuel technologies can be adapted to any fully electronically controlled fuel injection system, including: -

- ▶ Euro 2,3,4 and 5 light and heavy duty vehicles
- ▶ Refuse Collection Vehicles (RCV)
- ▶ Buses and Coaches
- ▶ OIGI® technologies can also be adapted to passenger vehicles



Summary



- Fuel Supply
- Gas Stations
- Technology
- Vehicles
- After Sales



Parallel Paths Process and Integrated Strategies
(collaboration behaviour removing barriers to optimal performance)

Why Hardstaff?



Turn-key concept incorporating:

- LCNG Station
- Hardstaff OIGI® Dual Fuel Technologies
- Fuel Supply (Biogas option)
- After Sales Support
- Warranty
- Health & Safety
- Training Programme





As the leading authorities in this field, let us help you

Biogas as a Vehicle Fuel

© The Hardstaff Group
Hillside, Gotham Road, Kingston-on-Soar, Nottingham, NG11 0DF, UK
Tel: 0044 (0)115 983 2300 Fax: 0044 (0)115 983 1075