



Alternative fuels for commercial vehicles

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A person is driving a Volvo truck, with their hands on the steering wheel. The truck's dashboard and a large wheel are visible. Overlaid on the image are green digital lines and binary code (0s and 1s) that appear to be flowing through the air, suggesting advanced technology or data processing. The background shows a lush green landscape with trees and bushes.

Corporate values

Safety

Quality

Environmental care

Sustainable transport solutions

- The Volvo Group's vision is to become the world's leading provider of sustainable transport solutions
- Volvo Group welcomes developments which allow our vehicles to run on non-fossil fuels



Timeline

1995
DME activities start

2004-2007
Strategy update

2007
7 trucks demonstration

2008-2012
BioDME project

2013-2014
Extended field test

4G truck 2015



1995

2005

2015

1G 1999



2G 2005



3G 2011



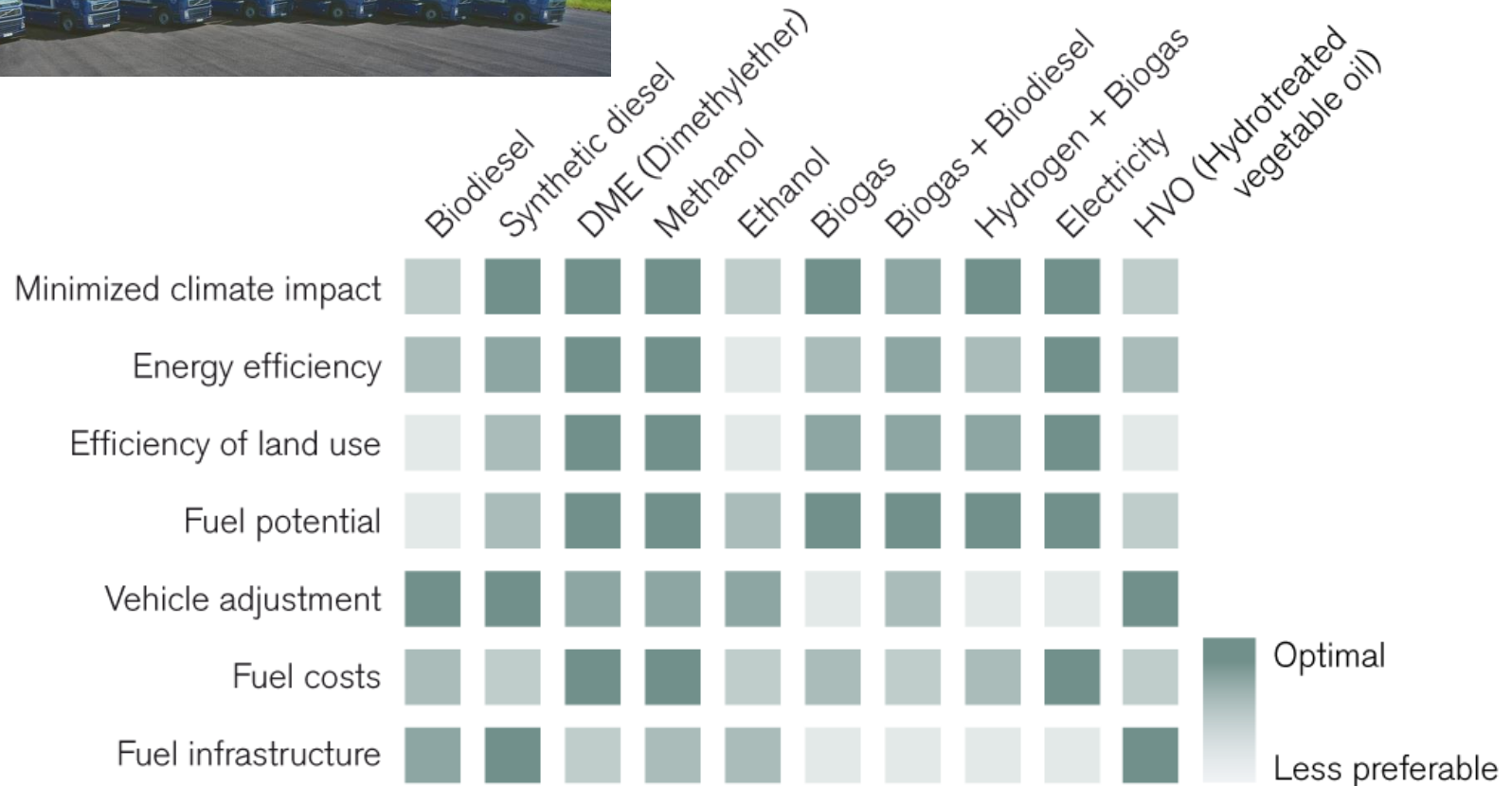
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Evaluation of fuel pathways

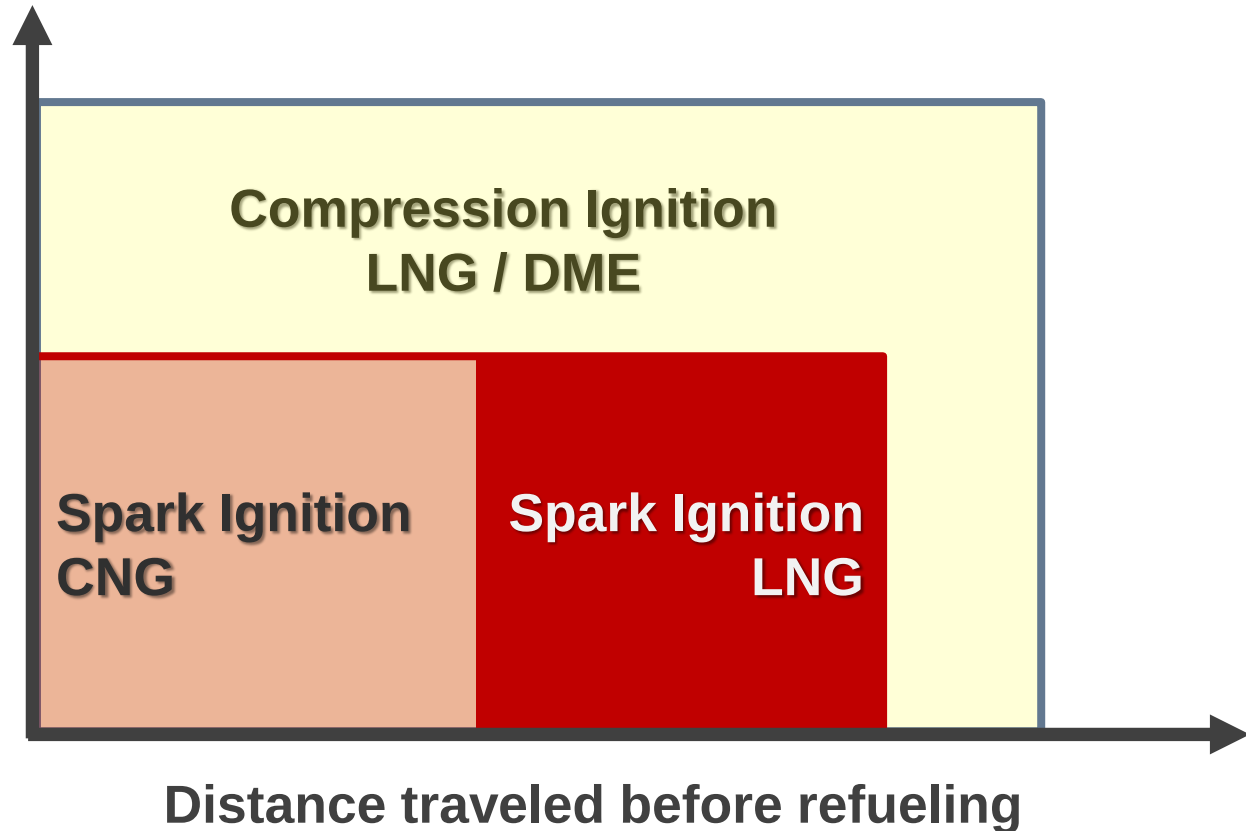


Source: Volvo Sustainability Report 2013

Trucks need range and power to deliver



Horsepower / Torque



Not to Scale

Energy density crucial for vehicles

Energy content per volume relative to conventional diesel fuel

Fuel	Pressure (bar)				
	1	5	200	350	700
Diesel	100	>	>	>	>
DME	0,17	55	>	>	>
CNG	0,10	0,5	21	37	73
Hydrogen	0,03	0,20	5,8	7,7	13

LNG at -163°C contains
~61% of diesel
Liquid hydrogen at -253°C
contains ~23% of diesel
Hydrides can increase
hydrogen densities by 30 -
60 % compared to liquid
hydrogen

Note: Effective volume will be restricted in case of high pressure or cryogenic tanks

DME- Highlights

- Main reasons behind interest in DME
 - One of the most promising fuels from GHG, efficiency and cost perspective on a WTW basis
 - Can in principle be applied in most applications
 - Potential for simple exhaust after-treatment due to absence of soot
- Successful field test results with DME in Sweden - BioDME Project
 - 10 trucks with a total mileage of ~1.5 million km
 - One truck ~ 380 000 km
 - 4 filling stations
 - 1 production plant from biomass



Summary: DME field test experience



- **Driver perception (compared to diesel truck)**
 - Less noise from the engine
 - Good engine response
 - Longer time to fuel the truck. Improved since then
 - Positive comments about locally produced fuel, environmental properties and absence of soot
- **Volvo perspective**
 - Trucks function well in commercial operation
 - Low fault rate given the early development stage – exceeds expectation
 - DME distribution and handling works well
 - Slightly shorter service intervals compared to diesel – to be improved
 - Because of inherent properties of DME, it has been possible to reach very far with a relatively limited development effort



DME Demo Trucks in South Texas, USA



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Operational efficiency

- Alternatives must be compatible with HD truck applications
 - Clear back of Cab
 - Fast fill
 - Same maintenance intervals as Diesel
- Truck efficiency in operations
 - No significant weight increase
 - Engine efficiency, DME today on par with diesel
 - Short wheelbase
- On-truck fuel stability and venting management to limit GHG impact (no venting preferred)



HPDI on FH - Europe



DME on VNL - US

Volvo's position on alternative fuels

Trucks and buses

- For long distance transport, crude-oil-based diesel fuel with increasing renewable and synthetic components will remain the dominant fuel
 - Liquid methane and DME are prioritized complements
- For regional transport, compressed and liquid methane will grow due to price and security of supply
- Short distance transport will lead the shift to electricity, especially in urban areas
 - City buses with plug-in or fully electric drives
 - Compressed methane, later followed by DME, will also be important alternatives



How to proceed

- Demonstration
 - Vehicles adapted for new fuels must be demonstrated to gain acceptance
 - Incentives and subsidies are often needed
- Collaboration
 - Many players have to work together
 - The Volvo Group can and will contribute to reach sustainable transport solutions



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Thank you!

Volvo's position on alternative fuels

Per fuel

- Biodiesel, preferred as low blend fuel
- Synthetic diesel, including HVO*, blended or pure
- Methane, natural gas and preferably biogas, important for urban applications. Liquefied gas to reach long distance transport
- DME, efficiency benefits, strong candidate long-term
- Electricity, for urban applications. Dynamic charging for long distance transport?
- Methanol, available volumes as low blend fuel
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- Hydrogen, remains questionable for HDV in the near and medium term future

*HVO = Hydrogenated Vegetable Oil

