# **Policy levers for low carbon fuels**

- REA Transport Fuels
- 3<sup>rd</sup> Dec 2019 Osborne Clarke





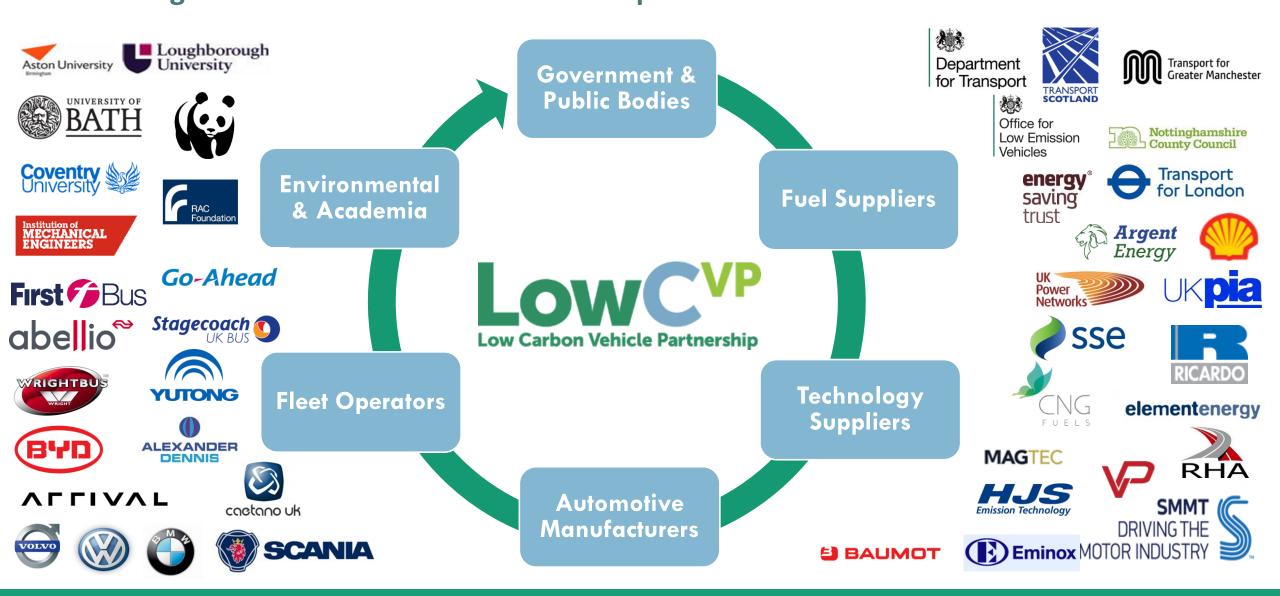
Connect | Collaborate | Influence

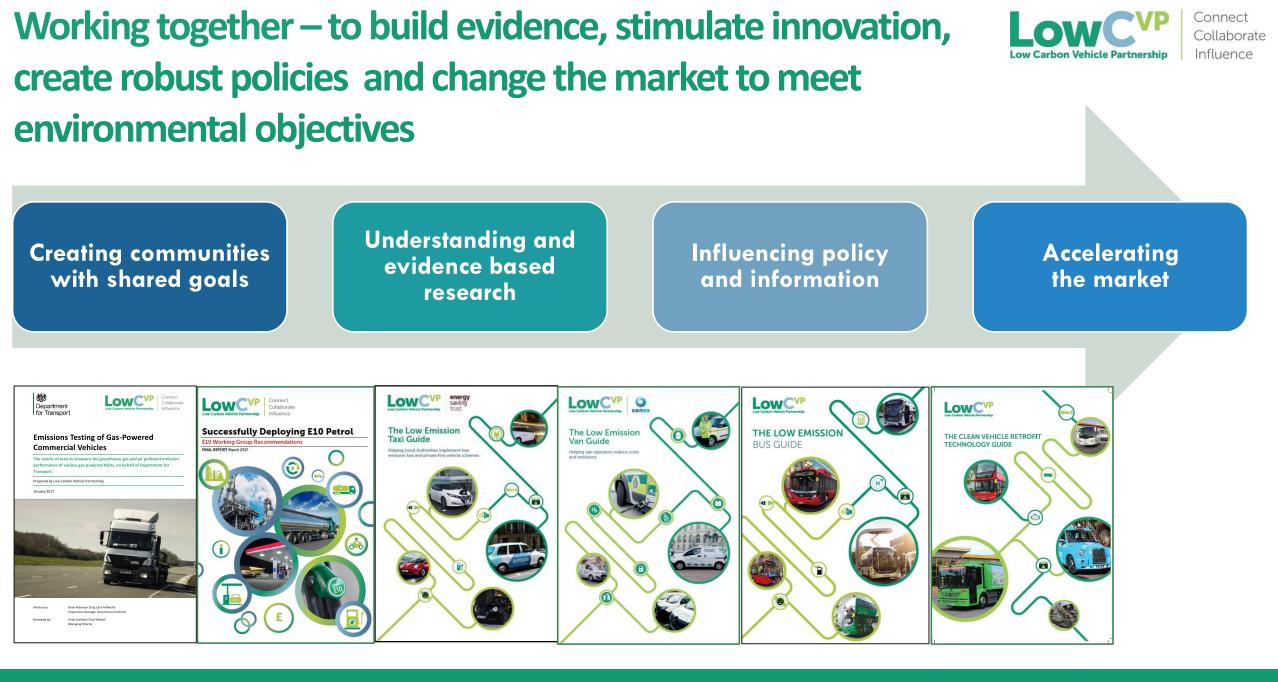


Andy Eastlake Managing Director LowCVP is a unique public-private membership organisation tasked with "accelerating the shift to low carbon road transport" in the UK.

## Low Carbon Vehicle Partnership

Connect Collaborate Influence





### Two environmental challenges facing us all right now





# **Policy opportunities**



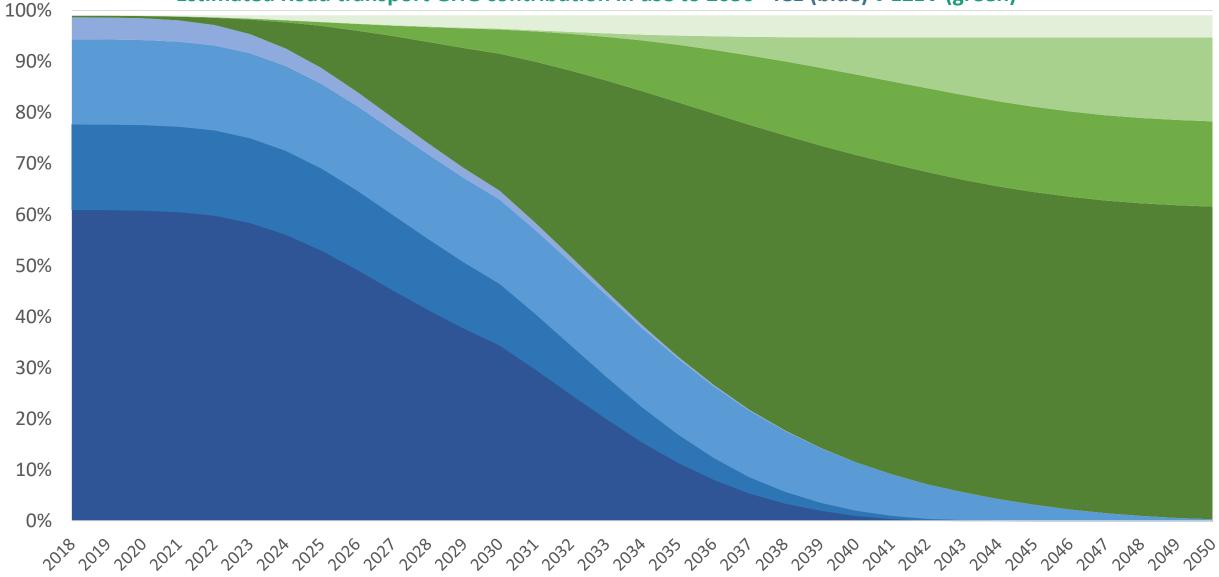
- Carbon reporting company requirements and CSR agenda
- Operator information (LowCVP Fuels guide)
- Renewable fuel supply requirements RTFO
- Voluntary Freight GHG reduction commitment (15% by 2025)
- The Alternative Fuel Labelling and Greenhouse Gas Emissions Regulations 2019
- Fuel Duty??
- Bus Service Operators Grant (BSOG)
- Key is Policy clarity Road to Zero (tailpipe), Net Zero (GHG) and Zero (tailpipe emissions) HGV options for the future
- No doubt we're heading to zero, but when and what now?

# **Combustion fuels will need to decarbonise**



Connect Collaborate Influence





Cars ICE Vans ICE HGV ICE Othe Low Carbon Vehicle Partnership Vans EZEV HGV EZEV

Other EZEV

## **ULEVs, ULCFs and transport solutions**

Clean and Efficient vehicles Certified ULEVs, Representative Testing, Emissions and Energy use

arbon Vehicle Partnership					Approved Test		~			
	Ultro	a Low I	Emissi	on Bus	Schen	ne Cer	tificate	?		
Customer:	Alexander Der	ole 1 fd								
Customer Address:	Dennic Way, G		W OUT TAE							
Test Purpose:	ULEB Testing							NAMOMETER SE	TTINGS	
Vehicle Manufacturer:		Lander Dennis L	M.	Unladen weight	(kp)	12060.0	Test Weight	14515		
Vehicle Type & Number:		Alexander Dennis Ltd. Uhladen weight (kg) 12080.0 ADL E400H, 0445 Gross Weight (kg) 18000.0						F" 43.42 N		
Engine:	Cummins/BAE Euro VI Hybrid Stated Capacity 70 F* 11.3821 N/mh									
Transmission:										
Euro VI certificate Y/N	uro V/ certificate Y/N Manufacturer Certified 6/W Check OK F <sup>3</sup> 0.0008470 Nikmh <sup>3</sup>								N/kmh <sup>3</sup>	
				s and source			octors			
Net Heating Value:		38.		MJ / Litre	Fuel P			UK market stan		
WelHto-Tank Factor:		16.		g CO2e / MJ	WTTe			3HG reporting fac		
Well-to-Tank Factor:		143		g CO2e / MJ	Fuel			mp Diesel, UK Gr	d Electricity	
	Emission	s and Energy	consumptio	on results fron	n approved to	est facility - i	Average 3 te	sts Fuel		
Test Phase	HC (g/km)	CO (g/km)	NOx (g/km)	PM (g/km)	CO <sub>2</sub> (g/km)	CH <sub>e</sub> (g/km)*	N <sub>2</sub> O (g/km)*	Consumption (I/100 km)	Fuel used over phase/cycle (litres	
Outer London	0.002	0.017	0.120	N/A	664.7	0.000	0.053	25.10	1.608	
Inner London	0.002	0.033	0.229	N/A	924.3	0.000	0.088	34.90	0.869	
Rural	0.000	0.010	0.224	N/A	582.4	0.000	0.057	21.99	1.624	
MLTB Average	0.002	0.022	0.151	N/A	736.9	0.000	0.064	27.82	2.748	
UKBC Average	0.001	0.016	0.184	0.0029	667.1	0.000	0.060	25.18	4.101	
			0.510				10.1			
				e: Energy con Distance in Z.						
Total measured energy			N/A			NIA		Capacity (kWh)	N/A	
Measured grid ener	KA onunk cusukui	(KWN)*	N/A	Charging ef	ticlency (%)	NA	Max Theoretic	al Z.E. Range (km)	NA	
			Total Tank	to-Wheel GH	6 CO 2 equiv	alent				
Test Phase		CO <sub>2</sub> (g/km)		CH, (g/k	m x 251*	N O Ie/k	m x 298)*		W** GHG	
				1.0		(CO2 Equ			valent g/km)	
Outer London		664.7		0.0						
Inner London		924.3		0.0			.076		50.4	
Rural	<u></u>	582.4		0.0			862 185		99.2 56.1	
MLTB Average				0.0						
UKEC Average 667.1 0.000 17.877 684.9									04.3	
		alculated tot	al Well-to-V	Vheel GHG CO	2 equivalent	emissions o	wer test			
	0				Electricity	WTT* GHG		el TTW** GHG	Total WTW***	
	1		E Emissions				Emissions		GHG Emissions	
Test Phase	Fuel Energy	Feel WTT*GH		Electrical Energy	Emis					
	Fuel Energy (MJ /km)	Fuel WTT*GH	:/ km)	(MJ / km)	(g CO./	r / km)	(g CO	,e/km)	(g CO <sub>2</sub> e / km)	
Test Phase Outer London	Fuel Energy	Feel WTT*GH	: / km) 1.3			/ km) /A	(g CO 6	ye / km) 80.6 50.4		
Outer London	Fuel Energy (MJ /km) 9.03 12.56	Feel WTT*GF (g CO <sub>2</sub> e 135	1.3 1.7	(MJ / km) N/A N/A	La CO <sub>2</sub> O	/ km) /A /A	(g CO 6 9	80.6 50.4	(g CO <sub>2</sub> e / km) 819.9 1144.1	
Outer London Inner London Rural MLTB Average	Fuel Energy (MJ /km) 9.03	Fuel WTT*GH (g CO <sub>2</sub> e 135 195	1/km) 1.3 1.7 1.1	(MJ / km) N/A	(g CO,4	/ km) /A /A	(g CO 6 9	80.6	(g CO <sub>2</sub> e / km) 819.9	
Outer London	Fuel Energy (MJ /km) 9.03 12.56	Fuel WTT*GH (g CO <sub>2</sub> e 139 199 122	1/km) 1.3 1.7 1.1 1.5	(MJ / km) N/A N/A N/A	La CO <sub>2</sub> O	r / km) /A /A /A /A	(g CD 6 9 	80.6 50.4	(g CO <sub>2</sub> e / km) 819.9 1144.1 721.3	
Outer London Inner London Rural MLTB Average UKBC Average	Fuel Energy (MJ /km) 9.03 12.56 7.92 10.02 9.07	Fuel WTT*GH (g CO <sub>2</sub> e 135 195 122 154	: / km) 1.3 1.7 1.1 1.5	[MJ / km] N/A N/A N/A N/A	(g CO <sub>2</sub> N N N N	r / kom) /A /A /A /A /A	(g CO 6 9 5 7 8	80.6 50.4 99.2	(g CO <sub>2</sub> e / km) 819.9 1144.1 721.3 910.6	
Outer London Inner London Rural MLTB Average UKBC Average	Fuel Energy (MJ /km) 9.03 12.56 7.92 9.07 9.07 alf of Test facility):	Fuel WTT*GH (g CO <sub>2</sub> 4 133 139 122 123 139 139 139 139 139 139 139 139 139 13	r/ km) 1.3 1.7 1.5 1.8	(MJ / km) N/A N/A N/A N/A N/A	(g CO <sub>4</sub> N N N Data Approved	/ km) /A /A /A /A by: J Summary	1 ( 1 00	80.6 50.4 99.2 58.1 84.9	(g CO <sub>2</sub> e / km) 819.9 1144.1 721.3 930.6 824.7	
Outer London Inner London Rural MLTB Average UKBC Average	Fuel Energy (MJ /km) 9.03 12.56 7.92 10.02 9.07 stf of Test facility): GHG We	Fuel WTT*GH (g CO <sub>4</sub> 133 193 193 193 193 193 193 193 194 194 194 194 194 194 194 194 194 194	/ km) 13 17 15 18 18 10 15	(MJ / km) N/A N/A N/A N/A N/A Dote: 18.04.2018	(g CO <sub>4</sub> N N N Data Approved	/ km) /A /A /A /A by: J Summary 8	(x 00 6 9 7 6 9 7 6 9 7 6 9 7 2 4.7	80.6 50.4 99.2 58.1 84.9	(g CO <sub>2</sub> e / km) 819.9 1144.1 721.3 920.6 824.7 g CO2e / km	
Outer London Inner London Rural MTB Aversage UKBC Aversage Data Generated by [On beh	Fuel Energy           (MJ /km)           9.03           12.56           7.92           10.02           9.07           alf of Test facility):           GHG We           Euro VI Average	Fuel WTT*GH (g C0,4 139 139 139 139 139 139 139 139 0 <i>Ultra</i> II-to-Wheel Diesel Equivale	r/ km) k3 k7 k1 k3 k3 k3 k8 Low Emi:	INJ / km) N/A N/A N/A N/A N/A Date: 18.04.2018 ssion Bus C	(g CO <sub>4</sub> N N N Data Approved	// km) /A /A /A /A /A /A /A /A /A /A /A // /A // //	(x 00 6 9 7 7 6 9 9 9 9 9 9 9 5	80.6 50.4 99.2 58.1 84.9	(g CO2e / km) 819.9 1144.1 721.3 920.6 824.7 g CO2e / km g CO2e / km	
Outer London Inner London Rural MITB Average URSC Average Data Generated by (Do belo	Fuel Energy (MJ /km) 9.03 12.56 7.32 30.02 9.07 at of Test facility): GHG We Euro VI Average saving [compared	Fuel WTT*GH (g CO, t 33 33 33 35 35 35 35 35 35 35 35 35 35	r/ km) k3 k7 k3 k3 k8 Low Emis st ssel equivalent	[MJ / km] N/A N/A N/A N/A N/A Dote: 18.04.2018 ssion Bus C	(g CO <sub>4</sub> N N N Data Approved	/ km) /A /A /A /A /A /A /A Summary 8 22 47	(x 00 6 9 	80.6 50.4 99.2 58.1 84.9	(g CO <sub>2</sub> e / km) 819.5 1344.1 721.3 930.6 824.7 g CO2e / km g CO2e / km g CO2e / km	
Outer London Inner London Rural MUTB Avenue URBC Avenue Data Generated by (On behy Data Generated by (On behy WTW GHG	Fuel Energy (MJ /km) 9.03 12.56 7.92 10.02 9.07 aff of Test facility): GHG We Euro VI Average saving (compare saving (compare	Fuel WTT*GF (g C0,4 233 233 225 254 234 235 235 235 235 235 235 235 235 255 255	r/ km) 1.3 1.7 1.1 1.5 1.5 1.5 1.5 1.5 1.5 1.5	[MJ / km] N/A N/A N/A N/A N/A Dote: 18.04.2018 ssion Bus C	(g CO <sub>4</sub> N N N Data Approved	/ km) /A /A /A /A /A /A /A //A //A //A // //	(1 00 6 9 7 7 8 7 7 8 9 9 9 9 9 9 9 9 9 9 9 9 9	80.6 50.4 99.2 58.1 84.9	(g CO <sub>2</sub> e / km) 819.5 1144.1 721.3 920.6 824.7 g CO2e / km g CO2e / km g CO2e / km	
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Outer London Inner London Will Average UNBC Average UNBC Average Data Generated by (On Beh WTW Grist WTW Grist WTW Grist WTW Grist WTW Grist WTW Grist WTW Grist Contactor State State State State State WTW Grist Approved to COMMINIST:	Fuel Energy (MJ /km) 9.03 12.256 7.92 10.02 9.67 31 of Test facility: Barro VI. Average avving (compare 2 avving (compare))))))))))))))))))))))))))))))))))))	Fuel WTT*GH (# CO_C 1870 1991 1991 1992 1992 1992 1993 1994 1994 1994 1994 1994 1994 1994	1/ km) 1.3 1.3 1.7 1.1 1.5 1.5 1.6 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	(MJ / km) N/A N/A N/A N/A N/A N/A Date: 18.04.2018 sssion Bus C 1 1 1 1 1 1 1 1 1	(g CO, N, N, N, N, Data Approved iertificate	r / km) (A (A (A (A (A (A (A (A (A (A	(1200 6 9 9 7 7 8 9 9 9 9 9 9 9 9 9 9 9 9 9	80.5 50.4 99.2 58.1 Date: 18.04.2018	(g CO2e / km) 813-5 1344.1 721.3 920.6 824.7 g CO2e / km g CO2e / km g CO2e / km g CO2e / km g CO2e / km	

+ Low carbon fuels/energy Ultra Low Carbon Fuel assurance scheme, Well-to-Tank factors

For biofuels and bioliquids according to Quality Directive (FQD), both amended	the Renewable Energy Dire	ctive (RED) and the Fuel					
Unique Number of Sustainability Declaration:	EU-ISCC-Cert-DE						
Place and date of dispatch:	GL55 6UR - 10/07/2018	3	International Scatainability & Garbon Centification				
Date of Issuance:	11/07/2018		www.iscc-system.org				
Supplier		Recipient					
Name: Northwick Electricity Ltd		Name: Air Liquide UK Ltd					
Address: Westington Hill Stanley's Quary Chipping Campden, United King GL55 6UR Certification System: ISCC EU		Address: Westington Hill Stanle Chipping Campden, U United Kingdom, GL55 6UR					
Certificate Number: EU-ISCC-Cert-DE110-7518007	5	Contract Number: 161213 P0067 BPA_N	Northwick				
1. General information							
Type of Product:	Biogas / Biomethane						
Type of Raw Material	Food waste						
Additional Information (voluntary):							
Country of Origin (of the raw material):	UK						
Quantity:	5.033	mt 🗌 m <sup>3</sup> 🗹	metric tons				
Energy content (MJ):	251,652	842 ·					
2. Sustainability criteria of	the biomass accord	ding to Article 17 R	ED:				
The material complies with the sus		<b>0</b> ( <i>n</i> ()					
The sustainability criteria accordin		) RED were not taken into	o account 2) Ves 🗹 M				
3. Greenhouse Gas (GHG)			Yes V				
Total default value according	to HED applied		Yes 🗹 No				
	p + Etd + Eu 4 + 4.6 + 0		Eccr - Eee - = 6				
		eq/MJ) 92.9% produced started physical	(for heat production 77 gCO2eq/M) (for cogeneration 85 gCO2eq/MJ) al Yes No				
	mpliance with the requireme		all information made on this Proof nd that the biofuel or bioliquid has				



= Low Carbon Transport

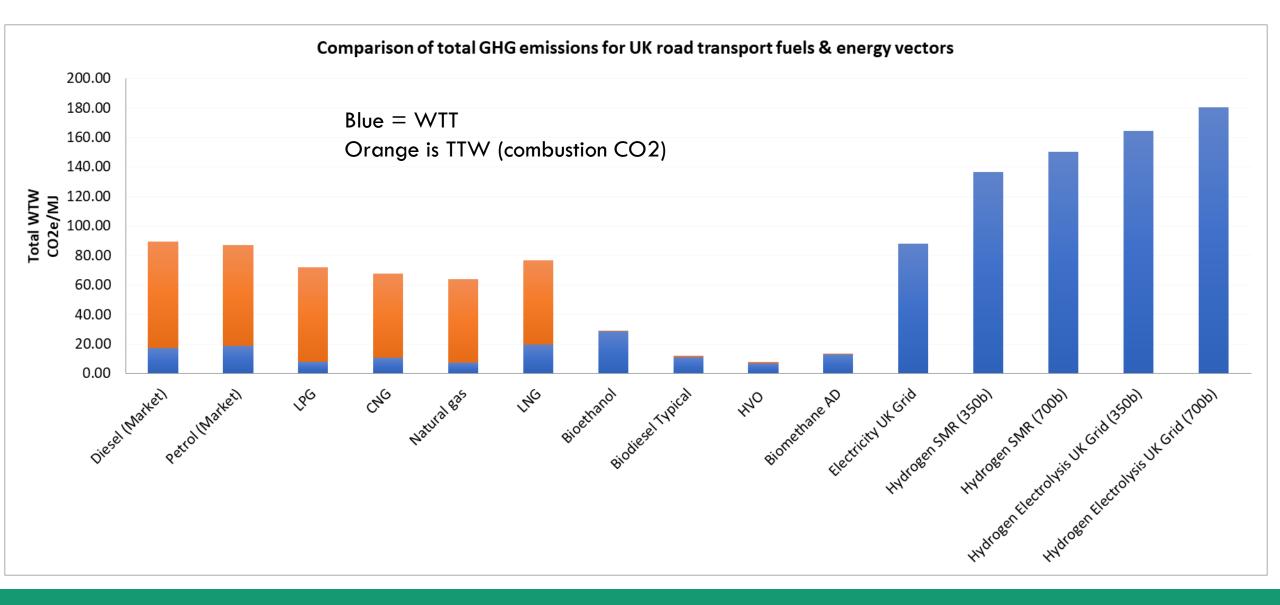
Control         Numeric (control			Low E	missio	n Bus wit	h Ultra	Low C	arbon Fu	el			
Chickel Statistic         Description         Description <thdescription< th=""></thdescription<>												
Print Price         List Brief         List Brief         Dire         Confidence         Confidence </td <td></td> <td>TINGS</td>											TINGS	
State Backstore         State County         State Coun			Tongwell, Milb	on Keymes, Bi							12207	
bits/bits/bits/bits/bits/bits/bits/bits/		ULEB Testing 7							Equivalent test pessengers		35	
Engle         Base 00 01 MORE VI         Descende networks (p)         1000         (p)         0.0.000         0.000           Col Ling Part of Ling		Scania						70 Test		Weight	1466234g	
Party P		Scania N280UD 4x2 , DD18 GAS			Passenger Capacity				P <sup>a</sup>	251.60	N	
Big of a gring to the second		Scania OC9 101 9000cc VI			Declared Kerb Weight (kg)					-10.4732	NAmh	
Description of the properties o		6AP1202B Automatic								0.50000	Nonh	
Interface         Restance         Due Source           extension of the second se	Euro VI certificate Y/N	Man	ufacturer Certifi	ed				K.	P	-0.003499	NO.11	
Image: Section of the secti				Declared Jue			rbon conversa	on factors				
mini-data         Marcal Marca         Marcal Marca         Marcal Marca         Marcal Marca         Marcal Marca         Marcal Marca         Marca <thmarca< th=""> <th< td=""><td></td><td></td><td></td><td></td><td>Re</td><td>newable Fuel</td><td></td><td></td><td>Data</td><td></td><td></td></th<></thmarca<>					Re	newable Fuel			Data			
No.60 (2) (2) (2) (2) (2) (2) (2) (2) (2) (2)						Biomethane Fossil Fusi					1	
Text-Schulzer, Rock         Bioinstand over set         2000 r.g.         6.11         Bioinstand O.G.           Text Flame         Including and Darge consumption stuft, form approximation of the processing stuft, form approximation of the processing stuft, form approximation of the processing stuff, for approxim	Net Heathy Value:			MJ/kg	48.0	00	MJ / kg	Renewable Fuel		RTFO		
Induce of the grower of the fight, when go when the fight of		10.89 g CO2e / MJ							UKG	HG reporting facto	rs 2019	
Test Plane         Life (bpm)         Col (bpm)         For (bpm)         Col (bpm)         Col (bpm)         Col (bpm)         Col (bpm)         For (bpm)	Tank-to-Wheel Factor:	n/a - measured over test g CO2e / kg			6.11 g		g CO2e / kg	Fuel Type				
Test Them         Ki (µk)         Oil (µk)         No (µk)			Emissions	and Energy	consumption resu	its from oppro	oved test focil	ity - Average 3 te	sts			
Test Them         Ki (µk)         Oil (µk)         No (µk)											i	
start start         6.0.0	Test Phase	HC (g/km)	CO (g/km)	NOx (g/km)	PM (g/km)	CO <sub>1</sub> (g/km)	CH <sub>e</sub> (g/km)*	N <sub>2</sub> O (g/km)*	Consumption		Fuel used over phase/cycle (kg)	
Image: Instrument of USE of the State of USE of U	Outer Urban	0.011	1.585	0.482	N/A	1254.7	0.000	0.000	N/A	45.83	2.992	
Image: State of the s					N/A		0.001					
Link Annya         Link	Rural	0.008	2.484	0.177	N/A		0.000	0.000		32.80		
0.000 mm	LBC Average	0.013	2,020	0,475	N/A	1405.2	0.000	0.000	N/A	51.34	4,665	
Description of description           Test colspan="2">Description of description           Description of description         Description           Description of description         Description <th coc<="" td=""><td></td><td></td><td></td><td></td><td></td><td>1176.1</td><td>0.000</td><td>0.000</td><td></td><td></td><td></td></th>	<td></td> <td></td> <td></td> <td></td> <td></td> <td>1176.1</td> <td>0.000</td> <td>0.000</td> <td></td> <td></td> <td></td>						1176.1	0.000	0.000			
Index species of grange and stable https://dx.     A.B.     Defective if a conder https://dx.     A.B.     Defective if a conder https://dx.     A.B.       Balance of a conder https://dx.     B.B.     Defective it it is a species of a conder https://dx.     B.B.     Defective it it is a species of a conder https://dx.     B.B.       Balance of a conder https://dx.     B.B.												
Index species of grange and stable https://dx.     A.B.     Defective if a conder https://dx.     A.B.     Defective if a conder https://dx.     A.B.       Balance of a conder https://dx.     B.B.     Defective it it is a species of a conder https://dx.     B.B.     Defective it it is a species of a conder https://dx.     B.B.       Balance of a conder https://dx.     B.B.				Zero Emission	s (Z.E.) Range: Ene	vgy consumptio	on and charging	efficiency				
Name of all on ongo for information (and being the line)         A.M.         Name manual L. Stapp (and being the line)         A.M.           Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4"         Colspan="4">Colspan="4"         Colspan="4"         Colspan="4">Colspan="4"         Colspan="4"         Colspan="4">Colspan="4"         Colspan="4"         Colspan="4">Colspan="4"         Colspan="4"         Colspan="4" <td>Total measured energy o</td> <td>onsumed on veh</td> <td>nicke (kWh)</td> <td>NA</td> <td>Distance in Z.E</td> <td>. mode (km)</td> <td></td> <td>N/A</td> <td>Usable Battery</td> <td>Capacity (kWh)</td> <td></td>	Total measured energy o	onsumed on veh	nicke (kWh)	NA	Distance in Z.E	. mode (km)		N/A	Usable Battery	Capacity (kWh)		
Table barden bard (C), queded at the second of the second	Measured grid energy	during charging	(kwh)*	NA	Charging effi	ciency (%)		N/A	Max Theoretic	al Z.E. Range (km)	N/A	
Table barden bard (C), queded at the second of the second												
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Terr Tensor         MM. Ann.         LE CSp./ Juni         (MK / Hm)         LE US (Sp./ Juni)	UKEC Average UKEC Average UKEC Average UKTW CHI to  WTW CHI to  WTW CHI to  WTW CHI to  WTW CHI to  UKE The  Children Familie Children Familie Children Familie Test Phase Test Phase Test Phase	(MJ /km) 19.28 Well-to-Wheel as Euro VI Average wing (compared 2HG saving again pretical Zero Emi 5, per passenger	(g CO <sub>2</sub> 9 210 ing UK Grid Aver Dissel Equivalen With Euro VI dies tators VI di visis visis visis visis visis visis visis visis	/ km) .0 age Fuel et seal equivalent Bange (km) 5.12 0.643 82 82	Bectrical Energy (MJ / km) N/A Informance of bus Informance of bus	Electricit GHG En (a CO2) N uning Elit GHZ A Uning Elit G	by WITT* ibalions //A //A //A //A //A //A //A //A //A //	N 1386.0 1224.8 -122.3 -145. 0/0 17.8 or (Annual Average amber / Reference 0.007 0.007 sover test	GPG Emissions (g CO <sub>2</sub> e / km) 1178.1	B Green Low 201 Fuel TTV 2	GPE Envisions (g CD <sub>p</sub> / km) 2386.0 g CD <sub>p</sub> / km g CD <sub>p</sub> / km km g CD <sub>p</sub> / km km km km km km km km km km km km km k	
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045 Web for Web and using Lose Cachelon First         255.4         (50%/Ym)           Tareo W. Annergo Elone Tare Indevided         222.4.7         (50%/Ym)           WW G With Landerg Long Long Long         100%/Ym)         100%/Ym)         100%/Ym)           WW G With Landerg Long Long         100%/Ym)         100%/Ym)         100%/Ym)           WW G With Landerg Long Long         70%         100%/Ym)         100%/Ym)           WW G With Landerg Long         100%/Ym)         100%/Ym)         100%/Ym)           WW G With Landerg Long         100%/Ym)         100%/Ym)         100%/Ym)           WW G With Landerg Long         100%/Ym)         100%/Ym)         100%/Ym)           March Marcella Z With Landerg Long         100%/Ym)         100%/Ym)         100%/Ym)           Marcella Z With Landerg Long         100%/Ym)         1.3         100%/Ym)           MW G Long         10%/Ym)         100%/Ym)         100%/Ym)           MW G Long         10%/Ym)         10%/Ym)         10%/Ym)	UBC Average Test Phase UBC Average	(MJ /km) 19.28 Viel to-Wheel or Raro VI Annegative Viel to-Wheel or Viel to VI Annegative Viel to VI Annegative Viel to VI Annegative Fuel Energy (MJ /km)	(g CO <sub>2</sub> 4 210 Deset Equivalent with Euro VI dies table Turo VI dies CO <sub>3</sub> (g/km) 2.20 Fuel WTT*OH (g CO2	/ km) .0 spe fuel sel equivalent Range (km) Capacity/ Bio 5.11 0.643 82 Colouieted to Colouieted to Colouieted	Bectrial Drargy (MJ / km) N/A Informance of Sou Informance of Sou Informance of Sou Information Color Ma ECCOR	Exercicle GHG III (g CDy N) auting DK Child A Cover (cale boot GHG serving vs Fuel Supplier Daw Carbon Fu Valida for Year New Carbon Fu Valida for Year Daw Carbon Fu Valida for Year	by WTT* bisions p WTT* Fool Fool RED Comparat equivalent exclusions exclusions ex / km )	N 1386.0 1224.8 -122.3 -145. 0/0 17.8 or (Annual Average amber / Reference 0.007 0.007 sover test	GHC Emissions (g CO <sub>2</sub> / km) 1176.1 e from RTFO) P e from RTFO)	B Green Low 201 Fuel TTV 2	EVE Envisions           (g CO <sub>2</sub> / km)           2386.0           g CO <sub>2</sub> / km           km           g CO <sub>2</sub> / km           km           g CO <sub>2</sub> / km shm           km           km           km           km           km           km           g CO <sub>2</sub> / km shm           Km           Km           Km           Km           Km           Km           K           Total WTW***           GHE Enviations           G CHE Considers	
Enry Watersport Sheel Equivalent         1224.4         120/4 /m           WW 000 (unsequer with Sheet Vision equivalent)         BDL 4         620% /m           WW 000 (unsequer with Sheet Vision equivalent)         DDL 4         620% /m           WW 000 (unsequer with Sheet Vision equivalent)         DDL 4         620% /m           WW 000 (unsequer with Sheet Target Vision equivalent)         DDL 4         620% /m           WW 000 (unsequer with Sheet Target Vision equivalent)         3.3         g COupleme tow           The Kneisen [W/A         Cardition Aground by         WIT Feature Adulated.70 (unsequer vision equivalent)         WIT Feature Adulated.70 (unsequer vision equivalent)	UBC Average Test Phase UBC Average	(MJ /km) 19.28 Viel to-Wheel or Raro VI Annegative Viel to-Wheel or Viel to VI Annegative Viel to VI Annegative Viel to VI Annegative Fuel Energy (MJ /km)	(g CO <sub>2</sub> 4 210 Deset Equivalent with Euro VI dies table Turo VI dies CO <sub>3</sub> (g/km) 2.20 Fuel WTT*OH (g CO2	/ km) .0 .7 .7 .7 .7 .7 .7 .7 .7 .7 .7	Bectrial Dreegy (M/ Jrm) N/A srytemenes of Box srytemenes of Box srytemenes of Box srytemenes account of Box account of Box ac	Exercicle GHG Im (gr CDy) N() and gr CDy (gr CDy) N() Control (gr CDy) Control (gr CDy) Control (gr CDy) Control (gr CDy) Control (gr CDy) N() N() N() N() N() N() N() N() N() N(	by WTT* historia e / km) /A  Reerage Fuel  RED Comperat RED Comperat reulestent reulestent reulestent exclose tentbulon ty WTT* historia	N 1386.0 1224.8 -122.3 -145. 0/0 17.8 or (Annual Average amber / Reference 0.007 0.007 sover test	GHC Emissions (g CO <sub>2</sub> / km) 1176.1 e from RTFO) P e from RTFO)	B Green Low 201 Fuel TTV 2	(#C Emissions     (g CO <sub>2</sub> / km)     (g CO <sub>2</sub>	
Enry Watersport Sheel Equivalent         1224.4         120/4 /m           WW 000 (unsequer with Sheet Vision equivalent)         BDL 4         620% /m           WW 000 (unsequer with Sheet Vision equivalent)         DDL 4         620% /m           WW 000 (unsequer with Sheet Vision equivalent)         DDL 4         620% /m           WW 000 (unsequer with Sheet Target Vision equivalent)         DDL 4         620% /m           WW 000 (unsequer with Sheet Target Vision equivalent)         3.3         g COupleme tow           The Kneisen [W/A         Cardition Aground by         WIT Feature Adulated.70 (unsequer vision equivalent)         WIT Feature Adulated.70 (unsequer vision equivalent)	UBC Average Test Phase UBC Average	(MJ /km) 19.28 Viel to-Wheel or Raro VI Annegative Viel to-Wheel or Viel to VI Annegative Viel to VI Annegative Viel to VI Annegative Fuel Energy (MJ /km)	(g CO <sub>2</sub> 4 210 Deset Equivalent with Euro VI dies table Turo VI dies CO <sub>3</sub> (g/km) 2.20 Fuel WTT*OH (g CO2	/ km) .0 .7 .7 .7 .7 .7 .7 .7 .7 .7 .7	Bectrial Dreegy (M/ Jrm) N/A srytemenes of Box srytemenes of Box srytemenes of Box srytemenes account of Box account of Box ac	Exercicle GHG Im (gr CDy) N() and gr CDy (gr CDy) N() Control (gr CDy) Control (gr CDy) Control (gr CDy) Control (gr CDy) Control (gr CDy) N() N() N() N() N() N() N() N() N() N(	by WTT* historia e / km) /A  Reerage Fuel  RED Comperat RED Comperat reulestent reulestent reulestent exclose tentbulon ty WTT* historia	N 1386.0 1224.8 -122.3 -145. 0/0 17.8 or (Annual Average amber / Reference 0.007 0.007 sover test	GHC Emissions (g CO <sub>2</sub> / km) 1176.1 e from RTFO) P e from RTFO)	B Green Low 201 Fuel TTV 2	(#C Emissions     (g CO <sub>2</sub> / km)     (g CO <sub>2</sub>	
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Mar Theoretra' Line Trainine Operating Tanga (ko) n/k (ko) WW C Operating Tanga (ko) (ko) WW C Operating Tanga (ko) (ko) (ko) (ko) (ko) (ko) (ko) (ko)	URE Average URE Av	(btl /km) 19.28 Veli to-Wheel or Bro VI Average Weils to-Wheel or Bro VI Average Weils of Average States for Poel Deergy (Btl /km) 19.28 Veli to Wheel Weils to Wheel	(g CO <sub>2</sub> e 210 Desat (galvate with hare Vi (galvate sinon Operating) with (g Max Past CO <sub>2</sub> (g/sm) 2.20 Fuel WTT*GH (g CO <sub>2</sub> e 2.30 Fuel WTT*GH (g CO <sub>2</sub> e 2.30 Fuel WTT*GH (g CO <sub>2</sub> e 2.30	/ km) .0 .1 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2	Bectrial Energy (M/ Im) N/A verformance of Jour setting ecoson // ecoson //	Exercicle GHG Im (gr CDy) N() and gr CDy (gr CDy) N() Exercicle Control (GHG Service) CHG Service CHG	by WTT* historia e / km) /A  Reerage Fuel  RED Comperat RED Comperat reulestent reulestent reulestent exclose tentbulon ty WTT* historia	N 1386.0 1294.8 -27.3 -348 -48 -27.3 -348 -48 -27.4 -348 -48 -27.5 -27.5	GHC Emissions (g CO <sub>2</sub> / km) 1176.1 e from RTFO) P e from RTFO)	B Green Low 201 Fuel TTV 2	(14) Emissions     (14) Emissions     (14)	
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### The Low Carbon Vehicle Partnership

## CO<sub>2</sub> of Fuels (WTT and TTW) per unit Energy (MJ)



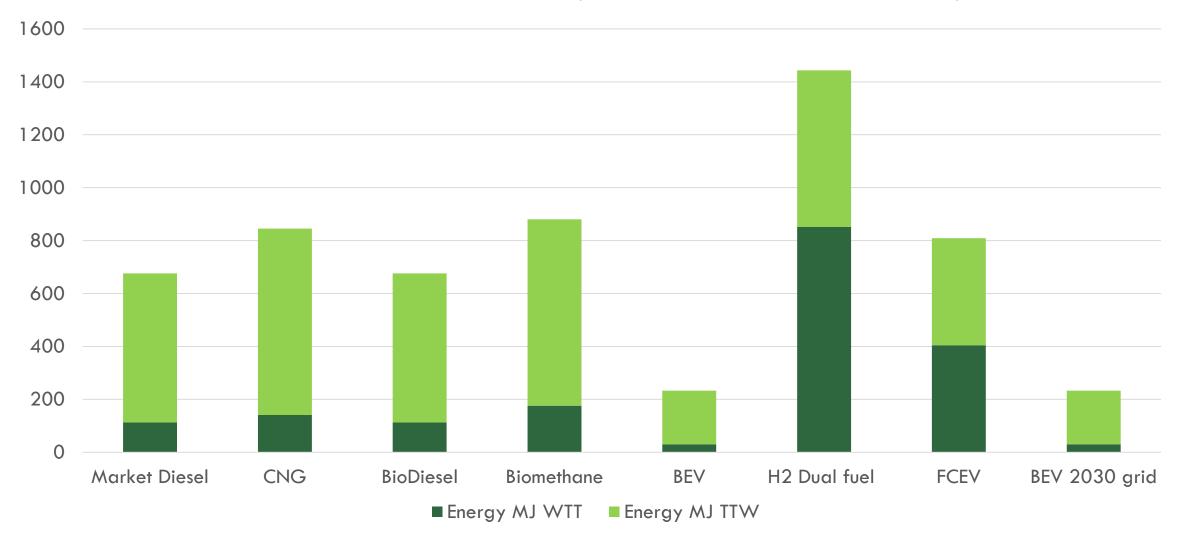
Connect Collaborate Influence



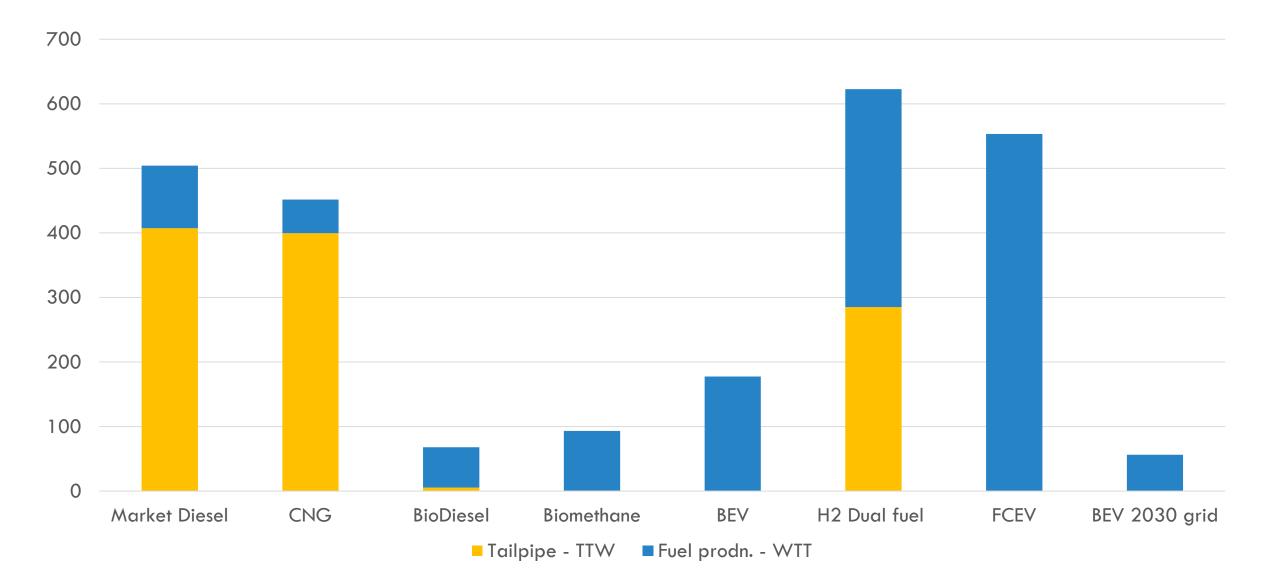


### 7.5t Truck in use – Typical energy consumption

Illustrative Energy consumption MJ/100km for 7.5t Truck by powertrain/fuel combination



### 7.5t Truck – typical WTW $CO_2$ g/km for variety of options



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Collaborate Influence

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# Trucks – example of "joined up" approach

Testing/guidance

Low Carbon Vehicle Partnership Connect Influence

LCA assessment

- LowCVP cover aspects across the whole innovation spectrum from designing the programmes for funding to producing reports to promote low carbon in the market and develop market support policy
- The independent assessment and support to government with a view across all carbon impacts (Life Cycle approach) will be critical in delivering the Road to Net Zero for 2050
- Understanding of Vehicles (use patterns and technology), Fuels (production, delivery and storage), Production impacts and future mobility systems is critical
- LOWCVP TRUCK RELATED PROJECTS
- Setting up LEFT trial



Low Carbon Vehicle Partnership

Fuels parameters

## **Renewable Fuels Guide – coming soon**



Connect Collaborate Influence

LowCVP Low Carbon Vehicle Partnership



### The Renewable Fuels Guide

Helping fleet operators cut carbon emissions



Bodalmar Alhough have named specific vehicles in His guide, Canoa and Low-CIP do nos andorae any particular makes and models. Core and embolore data are illustrated only: Rese should undersite or commission het own analysis to desemble likely financial and environmenta policimance. Al Scice and Igance are cores a the time of writing (September 2019).

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Topic Sheet 3 -Biomethane

#### Fuel overview

Biomethane is chemically identical to natural gas when used as a renewable and can be easily substituted as a biofuel for natural gas vehicles both CNG and LNG. When used as renewable vehicle fuel in the UK, biomethane is made from a variety of organic waste materials via the process of anaerobic digestion. It requires upgrading to a quality suitable for use in gas vehicles then typically injected into the National Gas Grid for distribution. The RTFO scheme allows biomethane producers to inject biomethane into the grid and an equivalent mass of methane to be extracted from the grid at a refuelling station. Biomethane (LBM).

UK suppliers of biomethane include CNG Fuels, Air Liquide and Gas Alliance.

#### GHG Emissions Performance

The table below shows the GHG emissions performance of the primary feedstocks used for producing biomethane supplied in the UK<sup>2</sup>. Data has been sourced from Government's RTFO statistics and interviews with biofuel suppliers. When a high proportion of biomethane is produced from marure it can achieve a negative GHG emission intensity. This is because methane is released to the atmosphere when manue is is tored in the open environment. Methane is twenty five times (by mass) more powerful as a greenhouse gas than carbon dioxide. By using manure as feedstock, methane can be captured giving rise to a carbon neutral or negative biofuel. Currently the RTFO does not report negative renewable fuels, however this is likely to materialize over the next tweek months.

	Biomethane Range
WTW GHG emission intensity	5 - 15 gCO <sub>2</sub> e/MJ
WTW GHG emission savings	82% - 94%
Average GHG emission savings	88%
Primary sustainable feedstocks	Food waste, manure, agricultural residues

#### Current Deployment

Biomethane is relatively widely used in the UK with increasing take up by the freight sector. As the accompanying case studies highlight, it is used by John Lewis Partnership, London Borough of Camden and Kuehne + Nagel. Other fleets include Ada, Hovand Tenens, DHL, Ocado, Hermes, DPD, London Borough of Islington, Veolia, and Lawanos building mechants. It is estimated that approximately 400 HDVs operate on biomethane in the UK. Biomethane has been popular in the bus sector due to specific incentives via BSOG requirements to mandate the use of biomethane in gas buses. There are 365 biomethane buses in operation in cities such as Notlingham, Bristol and Reading. Based on current gas vehicles running biomethane, it is estimated that approximately 15,000 tonnes of GHG emissions have been asved over the last 12 months.

#### **Refueling Infrastructure**

Both public access and depot-based refuelling are available for CBG and LBM. For more information refer to the next chapter on biomethane infrastructure.

#### Vehicle Compatibility and Availability

Gas heavy duty vehicles can run interchangeably on natural gas and biomethane with no impact on fuel consumption or warranty considerations. The engines are either dedicated spark ignition (LNG or CNG) or High-Pressure Direct Injection dual fuel (Volvo – LNG only).

Both CBG and LBM vehicles are available as rigid and artic HGVs up to 44t GVW. Example vehicles include the lveco Stralis NP, lveco Eurocargo, two, three and four axle rigids plus 4x2 artics with 280, 340 and 410hp engines, Mercedes Benz Econic, Volvo FH and Volvo FM.

### Topic Sheet 3 -Biomethane

#### Costs

Vehicle Costs: Gas HGVs can cost around 25% more than a conventional diesel equivalent when purchased outright. A number of companies offer gas vehicles on a lease contract.

Fuel Costs: Biomethane is cheaper than diesel on a pence per mile basis, partly driven by the fuel duty. Treasury has committed to maintaining the fuel duty differential between natural gas and diesel through to 2032. This rate difference is 50% lower than conventional diesel. Fleets which have high annual mileages, such a long haul logistics companies, achieve the greatest cost and carbon savings.

Maintenance Costs: Maintenance costs of gas vehicles are 20%-25% more diesel vehicles.

Infrastructure Costs: Costs vary depending on whether fleets use public access or depot refuelling. The capital costs of depot refuelling station can be recovered through lower fuel operating costs. Alternatively, some providers will provide infrastructure and recover costs through the fuel price directly (wet lease).

#### Case Study: John Lewis Partnership

Sustainability is at the core of John Lewis Partnership's (JLP) operation. It has implemented ambitious measures to reduce their carbon emissions, with a target of a zero carbon fleet by 2045.

The commercial vehicle fleet consists of 1,600 vans, 400 light trucks, and 600 heavy duty trucks. JLP is reducing road transport carbon emissions by driving fewer miles, improving fuel efficiency and switching to alternative fuels.

In 2010 JLP and Imperial College London reviewed 30 alternative fuels and technologies. Using criteria covering sustainability, availability and the long-term business case, JLP concluded that biomethane was the best option for its heavy fleet. The process of introducing biomethane began with a trial of one demonstration vehicle. JLP rolled the fuel out gradually over the past eight years and now uses it in 85 Scania P 340 trucks. It has committed to changing the whole fleet of 600 trucks to dedicated gas HDVs fuelled by biomethane by 2028.

The gas trucks cost around 25% more than diesel vehicles to purchase. This is offset by fuel savings, as they are paying around 30-40% less for biomethane than diesel on a pence per mile basis. This means they recover the investment in no more than how years. Over the lifetime of a vehicle the total cost is about 24% lower than an equivalent diesel truck, through payback deepends on factors such as fuel price and miles driven.

Vehicles are refuelled with RTFO-approved, and ISCC-certified, methane at the CNG Fuels stations at Leyland and Northampton. The biomethane sourced, which is produced from feedstocks including food waste and manure, can reduce well-to-wheel greenhouse gas emissions by 84%, compared to mineral diesel.

Other fleets using Leyland include Hermes, Argos and HPH Group. CNG Fuels also operate a refuelling station at Crewe and Northampton, and will be opening new sites at Warrington, Erdington, Knowsley, Larkhall and Bellshill between late 2019 and summer 2020.

In total CNG Fuels supplies an annualised amount of more than 10 million kilograms of biomethane. This figure is growing rapidly as existing customers order additional gas trucks and new customers order their first gas trucks. CNG Fuels expects annual growth rates of dispensed volume of biomethane of up to 150%, sovering up to 300 vehicles by early 2020.

The carbon intensity of biomethane varies depending on where on the gas grid the stations are connected, with the lowest intensity for stations connected to the high pressure grid. All existing CNG Fuels stations and the majority of their planned stations are on high pressure grid.

The vehicles and refuelling infrastructure have been extremely reliable, helping JLP gas trucks cover over 10 million miles. The organisation now works to encourage other businesses to switch to biomethane by participating in programmes such as TfL's LoCITY to disseminate the benefits to other freight and logistics operators.



### Low Carbon Vehicle Partnership

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# Thank you. Any questions?





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**Interested in joining the Partnership?** 

Collaborating to develop the vehicles, energy and supporting infrastructure for future mobility