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Annex 1: Emissions Limits For New Vehicles

(Source: DTI 2000)

The *regulated pollutants* are carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x) and particulates (PM). The emissions limits given in the tables below are the limits which must be met by individual vehicles on their date of first use - which is usually defined as the date the vehicle is first registered at DVLA.

Most vehicles are also subject to “type approval” i.e. the manufacturer must submit particular model types to be tested and approved to the limits before they are put into production. Type approval limits usually need to be met by new model types one year in advance of first use requirements. The emissions limits are those which must be met when the vehicle is tested according to an EU approved “test-cycle”.

Pre-1992/4 “Euro 1” limits for passenger cars or light commercial vehicles are not shown in the tables below. However, emissions limits for these vehicles were first set at EU level in directive 70/220/EEC which was adopted in the UK for vehicles first used on or after 1 April 1981. Subsequent directives, also incorporated in UK law, gradually tightened these limits.

Emission limit levels for new passenger cars (with 6 seats or less and weighing less than 2.5 tonnes (see also footnote to LCV table below).

Pollutant	CO		HC		NO _x		HC+NO _x		PM
	Pet	Dies	Pet	Dies	Pet	Dies	Pet	Dies	Dies
Type	g/km ³		g/km		g/km		g/km		g/km
31 Dec 1992 (Euro 1) 91/441/EEC	3.16						1.13		0.18
1 Jan 1997 (Euro 2) 94/12/EC	2.20	1.00					0.50	IDI ^b 0.70 DI 0.90	IDI 0.08 DI ^c 0.10
1 Jan 2001 (Euro 3) 98/69/EC	2.30	0.64	0.20		0.15	0.50		0.56	0.05
1 Jan 2006 ^a (Euro 4) 98/69/EC	1.00	0.50	0.10		0.08	0.25		0.30	0.025

a. Subject to confirmation by the EU Commission; b. IDI=indirect injection diesel; c. DI=direct injection.

Emission limit levels for new heavy diesels (diesel engined vehicles over 3.5 tonnes)

Pollutant	CO	HC	NO _x	PM
1 April 1991 (Pre-Euro 1) 88/77/EEC	12.3 ^a	2.6	15.8	-
1 October 1993 (Euro 1) 91/542/EEC	4.9	1.23	9.0	0.4
1 October 1996 (Euro 2) 91/542/EEC	4.0	1.1	7	0.15 ^b
[1 October 2001 (Euro 3)] ^c	2.1	0.66	5.0	0.10 ^b
[1 October 2006 (Euro 4)] ^c	1.5	0.46	3.5 ^c	0.02

a. Grammes per kilowatt hour (g/kWh) - a measurement related to engine power.
b. 0.25g/kWh until 30/9/97 and 0.13 g/kWh from 1/10/01 to 30/9/06 for certain of the smallest engines in this range
c. Common position on EU Commission proposal agreed by EU Environmental Ministers 21 December 1998. Subject to European Parliament Agreement.
e. From 1/10/09 the NO_x limit to be 2.0 g/kWh

Separate limits apply for advanced diesel and gas engines based on a new ‘transient test cycle’ which is designed to reflect on-road driving conditions.

Date	CO	NMHC ^b	M ^{c/d}	NO _x	PM ^e
1 October 2001	5.45 ^a	0.78	1.6	5.0	0.16 0.21 ^f
1 October 2006	4.0	0.55	1.1	3.5 ^g	0.03

a. Grammes per kilowatt hour (g/kWh) - a measurement related to engine power.
b. Non methane hydrocarbons
c. Methane d. natural gas engines only e. diesel engines only
f. for certain of the smallest engines in this range g. From 1/10/09 the NO_x limit to be 2.0 g/kWh

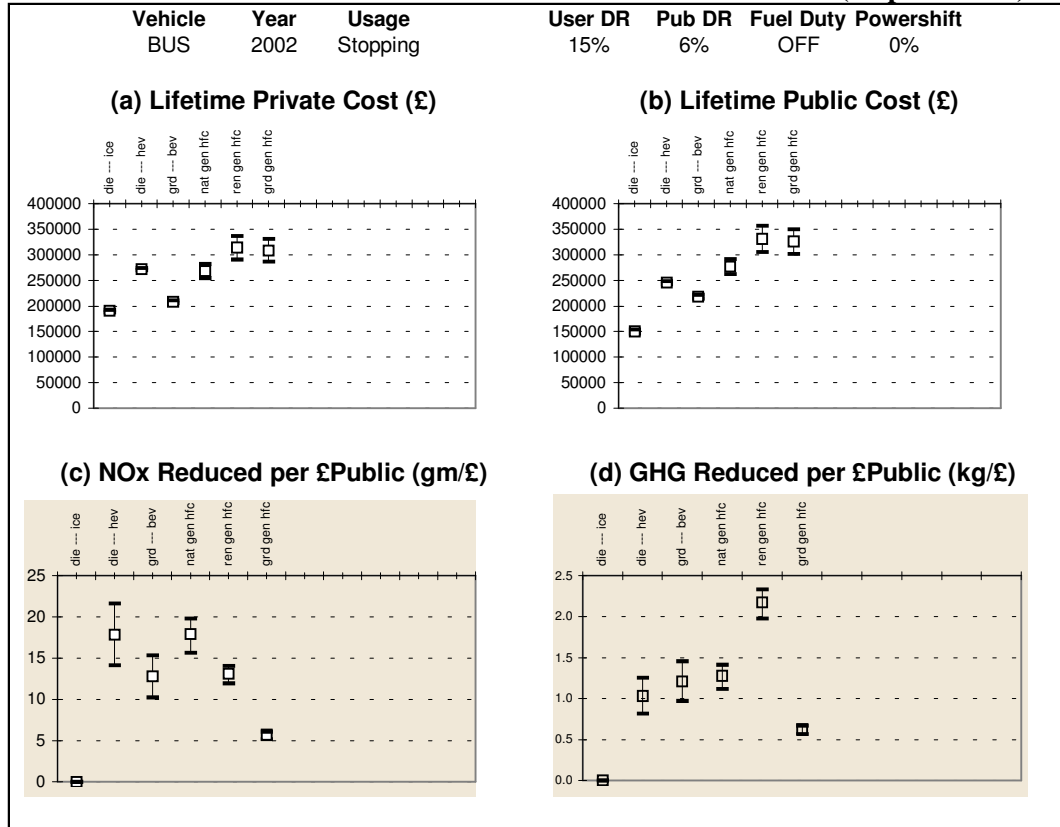
Emissions limit levels for new light commercial vehicles

Pollutant	CO		HC		NO _x		HC+NO _x		PM
	Pet	Dies	Pet	Dies	Pet	Dies	Pet	Dies	Dies
Type	g/km		g/km		g/km		g/km		g/km
> 1.25 tonnes^a									
1 Oct 1994 (Euro 1) 93/59/EEC	3.16		-	-	-	-	1.13		0.18
1 Oct 1997 (Euro 2) 96/69/EC	2.2	1.0	-	-	-	-	0.5	0.7	0.08
1 Jan 2001 (Euro 3) 98/69/EC	2.3	0.64	0.20	-	0.15	0.50	-	0.56	0.05
1 Jan 2006 (Euro 4) 98/69/EC	1.0	0.50	0.10	-	0.08	0.25	-	0.30	0.025
1.25 > 1.70 tonnes^a									
1 Oct 1994 (Euro 1) 93/59/EEC	6.0		-	-	-	-	1.6		0.22
1 Oct 1998 (Euro 2) 96/69/EC	4.0	1.25	-	-	-	-	0.6	1.0	0.12
1 Jan 2002 (Euro 3) 98/69/EC	4.17	0.80	0.25	-	0.18	0.65	-	0.72	0.07
1 Jan 2006 (Euro 4) 98/69/EC	1.81	0.63	0.13	-	0.10	0.33	-	0.46	0.06
1.70 > 3.5 tonnes^a									
1 Oct 1994 (Euro 1) 93/59/EEC	8.0		-	-	-	-	2.0		0.29
1 Oct 1998 (Euro 2) 96/69/EC	5.0	1.5	-	-	-	-	0.7	1.2	0.17
1 Jan 2002 (Euro 3) 98/69/EC	5.22	0.85	0.29	-	0.21	0.78	-	0.86	0.10
1 Jan 2006 (Euro 4) 98/69/EC	2.27	0.74	0.15	-	0.11	0.39	-	0.46	0.06

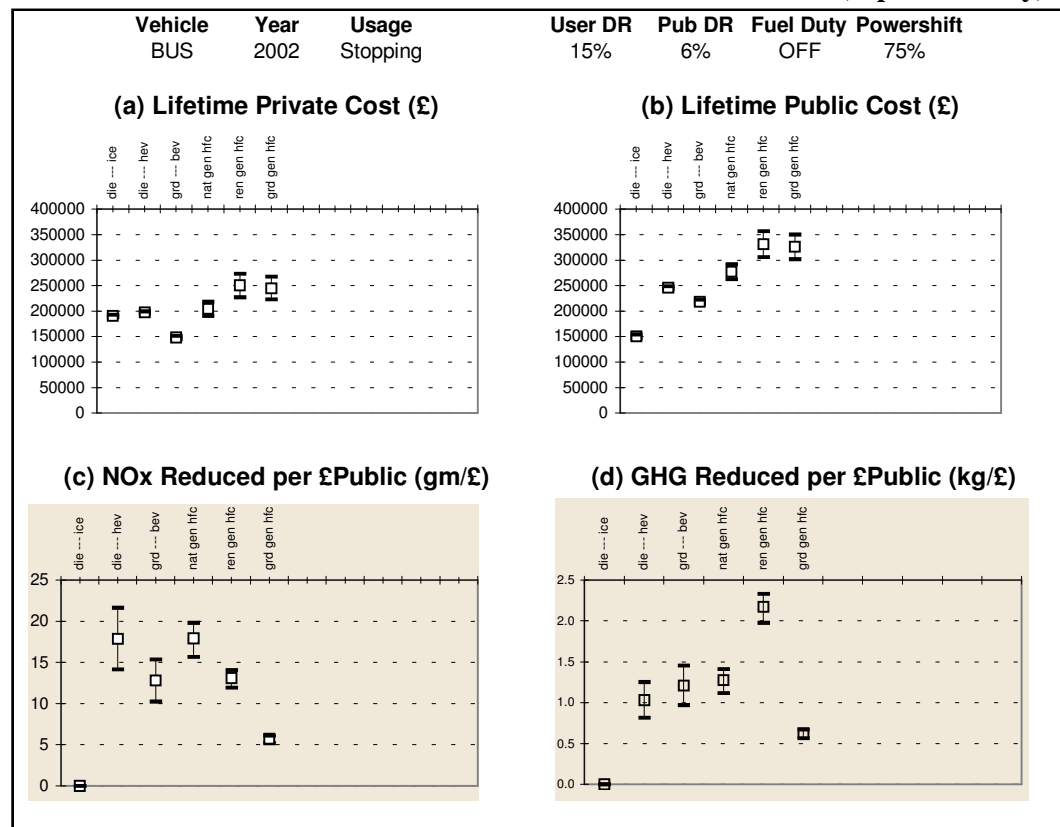
a. Category limits change to 1305 and 1760 tonnes from Jan 2001.
Note- Passenger cars with more than six seats or weighing in excess of 2.5 tonnes are subject to the same emission limits as vans over 1.25 tonnes. By virtue of directive 98/69/EC these passenger cars will meet the same standards as passenger cars with six seats or less from 1 January 2003. Diesel passenger cars over 2 tonnes which are either designed to carry more than 6 occupants or are off-road vehicles are treated as light goods vehicles until 1/1/03.

Annex 2: Costs and cost-effectiveness of fuel cell bus 2002-

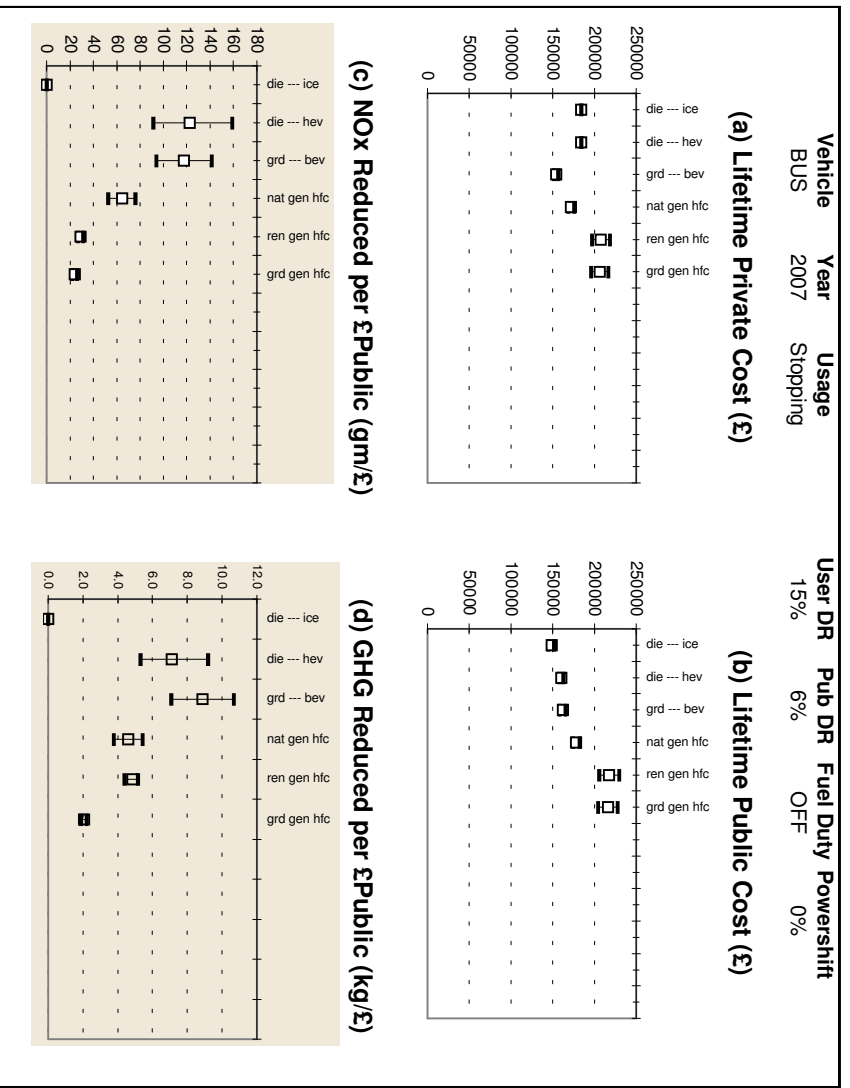
Annex 2.1 : Costs and cost-effectiveness of fuel cell bus 2002-2007 (no protection)



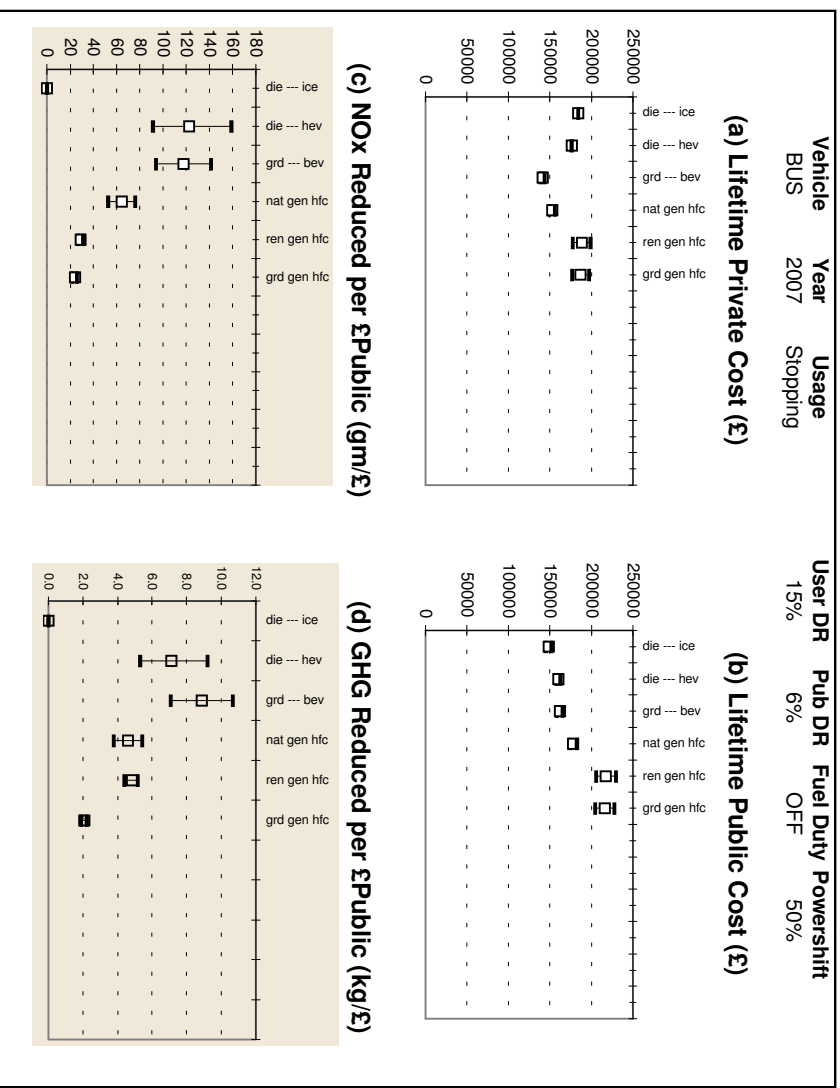
Annex 2.2 : Costs and cost-effectiveness of fuel cell bus 2002-2007 (capital subsidy)



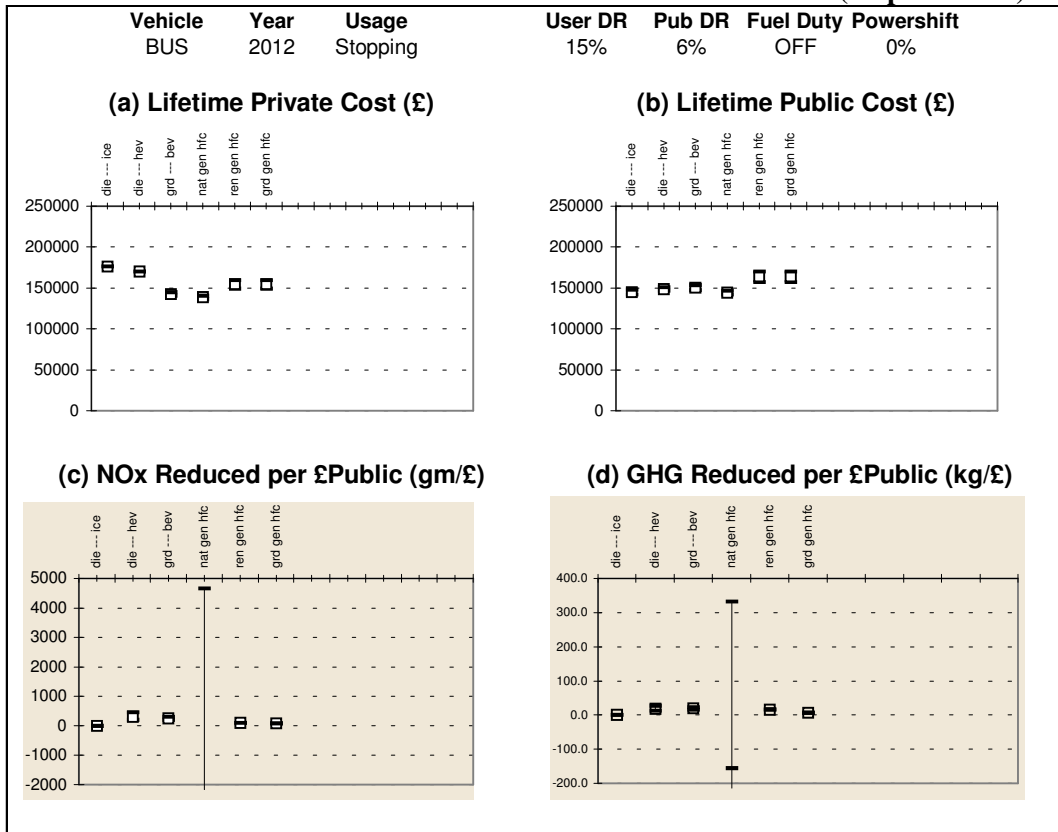
Annex 2.3 : Costs and cost-effectiveness of fuel cell bus 2007-2012 (no protection)



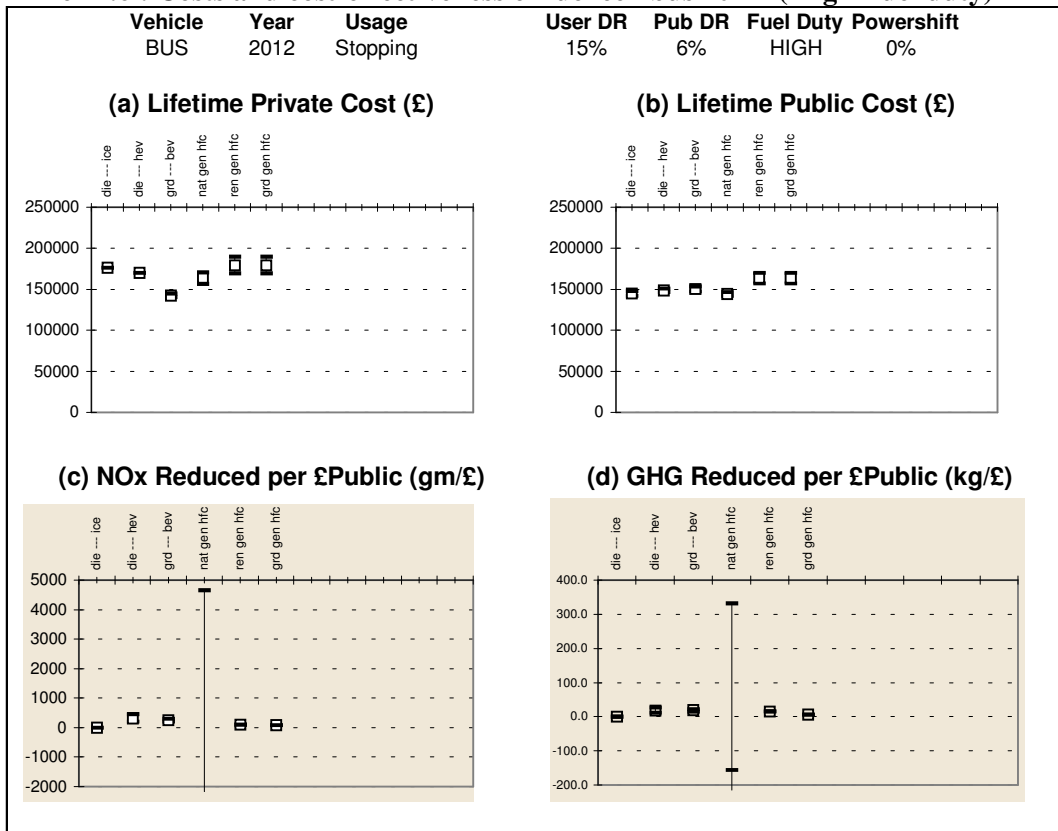
Annex 2.4 : Costs and cost-effectiveness of fuel cell bus 2007-2012 (capital subsidy)



Annex 2.5 : Costs and cost-effectiveness of fuel cell bus from 2012 (no protection)



Annex 2.6 : Costs and cost-effectiveness of fuel cell bus 2012- ('high' fuel duty)



Annex 3: Vehicle Performance and Emissions - Car

Petrol ICE Car

Year		PMs			NOx			CH4			CO2			GHG			Fuel Use	Mnt. Cost	Veh Cost
		Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	MJ/km	p/km	£
2002	max	0.02	0.00	0.02	0.26	0.15	0.41	0.00	0.06	0.06	240	37	277	240	38	278	3.60	2.50	£10,000
	med	0.01	0.00	0.01	0.15	0.11	0.26	0.00	0.04	0.04	181	28	209	181	29	210	2.70	2.50	£10,000
	min	0.01	0.00	0.01	0.05	0.08	0.13	0.00	0.03	0.03	160	21	181	160	22	182	2.08	2.50	£10,000
2007	max	0.00	0.00	0.00	0.06	0.12	0.18	0.00	0.05	0.05	204	32	236	204	33	237	3.06	1.50	£10,300
	med	0.00	0.00	0.00	0.05	0.08	0.13	0.00	0.03	0.03	153	21	174	153	22	175	2.08	1.50	£10,300
	min	0.00	0.00	0.00	0.04	0.07	0.11	0.00	0.03	0.03	136	18	154	136	19	155	1.77	1.50	£10,300
2012	max	0.00	0.00	0.00	0.05	0.11	0.17	0.00	0.04	0.04	184	28	212	184	29	213	2.75	1.35	£10,300
	med	0.00	0.00	0.00	0.05	0.08	0.12	0.00	0.03	0.03	138	19	157	138	20	158	1.87	1.35	£10,300
	min	0.00	0.00	0.00	0.04	0.06	0.10	0.00	0.02	0.02	122	16	139	122	17	139	1.59	1.35	£10,300

Petrol Hybrid Car

Year		PMs			NOx			CH4			CO2			GHG			Fuel Use	Mnt. Cost	Veh Cost
		Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	MJ/km	p/km	£
2002	max	0.00	0.00	0.00	0.08	0.07	0.15	0.00	0.03	0.03	171	19	190	171	19	190	1.81	2.50	£15,000
	med	0.00	0.00	0.00	0.06	0.06	0.12	0.00	0.02	0.02	122	16	138	122	16	138	1.51	2.50	£15,000
	min	0.00	0.00	0.00	0.03	0.05	0.08	0.00	0.02	0.02	73	12	86	73	13	86	1.21	2.50	£15,000
2007	max	0.00	0.00	0.00	0.02	0.05	0.07	0.00	0.02	0.02	120	13	133	120	13	133	1.27	1.50	£13,000
	med	0.00	0.00	0.00	0.02	0.04	0.06	0.00	0.02	0.02	85	11	96	85	11	96	1.05	1.50	£13,000
	min	0.00	0.00	0.00	0.01	0.03	0.04	0.00	0.01	0.01	51	9	60	51	9	60	0.84	1.50	£13,000
2012	max	0.00	0.00	0.00	0.02	0.05	0.06	0.00	0.02	0.02	108	12	120	108	12	120	1.14	1.35	£11,500
	med	0.00	0.00	0.00	0.01	0.04	0.05	0.00	0.01	0.01	77	10	86	77	10	87	0.95	1.35	£11,500
	min	0.00	0.00	0.00	0.01	0.03	0.04	0.00	0.01	0.01	46	8	54	46	8	54	0.76	1.35	£11,500

Hydrogen Fuel Cell Car

Year		PMs			NOx			CH4			CO2			GHG			Fuel Use	Mnt. Cost	Veh Cost
		Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	MJ/km	p/km	£
2002	max	0.00	0.00	0.00	0.00	0.05	0.05	0.00	0.08	0.08	0	111	111	0	112	112	1.36	1.70	£18,500
	med	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.06	0.06	0	88	88	0	89	89	1.08	1.70	£18,500
	min	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.05	0.05	0	73	73	0	74	74	0.90	1.70	£18,500
2007	max	0.00	0.00	0.00	0.00	0.05	0.05	0.00	0.07	0.07	0	94	94	0	96	96	1.16	1.00	£15,100
	med	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.05	0.05	0	74	74	0	76	76	0.91	1.00	£15,100
	min	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.04	0.04	0	62	62	0	63	63	0.77	1.00	£15,100
2012	max	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.06	0.06	0	85	85	0	86	86	1.04	1.00	£11,600
	med	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.05	0.05	0	67	67	0	68	68	0.82	1.00	£11,600
	min	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.04	0.04	0	56	56	0	57	57	0.69	1.00	£11,600

Annex 4: Vehicle Performance and Emissions - Bus

Diesel ICE Bus

Year		PMs			NOx			CH4			CO2			GHG			Fuel Use	Mnt. Cost	Veh Cost
		Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	MJ/km	p/km	£
2002	max	0.13	0.00	0.13	6.50	0.50	7.00	0.00	0.23	0.23	1045	109	1154	1045	114	1159	15.60	10.00	£100,000
	med	0.11	0.00	0.11	5.42	0.42	5.83	0.00	0.19	0.19	871	91	962	871	95	966	13.00	10.00	£100,000
	min	0.09	0.00	0.09	4.33	0.33	4.67	0.00	0.15	0.15	697	73	770	697	76	773	10.40	10.00	£100,000
2007	max	0.11	0.00	0.11	5.53	0.42	5.95	0.00	0.19	0.19	888	93	981	888	97	985	13.26	9.00	£104,000
	med	0.09	0.00	0.09	4.60	0.35	4.96	0.00	0.16	0.16	740	77	818	740	81	821	11.05	9.00	£104,000
	min	0.07	0.00	0.07	3.68	0.28	3.97	0.00	0.13	0.13	592	62	654	592	65	657	8.84	9.00	£104,000
2012	max	0.10	0.00	0.10	4.97	0.38	5.35	0.00	0.17	0.17	800	84	883	800	87	887	11.93	9.00	£102,000
	med	0.08	0.00	0.08	4.14	0.32	4.46	0.00	0.14	0.14	666	70	736	666	73	739	9.95	9.00	£102,000
	min	0.07	0.00	0.07	3.32	0.25	3.57	0.00	0.12	0.12	533	56	589	533	58	591	7.96	9.00	£102,000

Diesel Hybrid Bus

Year		PMs			NOx			CH4			CO2			GHG			Fuel Use	Mnt. Cost	Veh Cost
		Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	MJ/km	p/km	£
2002	max	0.03	0.00	0.03	1.63	0.37	2.00	0.00	0.17	0.17	784	82	866	784	85	869	11.70	10.00	£200,000
	med	0.02	0.00	0.02	1.35	0.31	1.67	0.00	0.14	0.14	653	68	722	653	71	724	9.75	10.00	£200,000
	min	0.02	0.00	0.02	1.08	0.25	1.33	0.00	0.11	0.11	523	55	577	523	57	580	7.80	10.00	£200,000
2007	max	0.02	0.00	0.02	1.38	0.32	1.70	0.00	0.14	0.14	666	70	736	666	73	739	9.95	9.00	£120,000
	med	0.02	0.00	0.02	1.15	0.27	1.42	0.00	0.12	0.12	555	58	613	555	61	616	8.29	9.00	£120,000
	min	0.01	0.00	0.02	0.92	0.21	1.13	0.00	0.10	0.10	444	46	491	444	48	493	6.63	9.00	£120,000
2012	max	0.02	0.00	0.02	1.24	0.29	1.53	0.00	0.13	0.13	600	63	662	600	65	665	8.95	9.00	£110,000
	med	0.02	0.00	0.02	1.04	0.24	1.27	0.00	0.11	0.11	500	52	552	500	54	554	7.46	9.00	£110,000
	min	0.01	0.00	0.01	0.83	0.19	1.02	0.00	0.09	0.09	400	42	442	400	44	443	5.97	9.00	£110,000

Hydrogen Fuel Cell Bus

Year		PMs			NOx			CH4			CO2			GHG			Fuel Use	Mnt. Cost	Veh Cost
		Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	Tpipe	Prodn	Life	MJ/km	p/km	£
2002	max	0.00	0.00	0.00	0.00	0.33	0.33	0.00	0.47	0.47	0	673	673	0	682	682	8.25	6.00	£185,000
	med	0.00	0.00	0.00	0.00	0.27	0.27	0.00	0.39	0.39	0	560	560	0	569	569	6.88	6.00	£185,000
	min	0.00	0.00	0.00	0.00	0.22	0.22	0.00	0.31	0.31	0	448	448	0	455	455	5.50	6.00	£185,000
2007	max	0.00	0.00	0.00	0.00	0.28	0.28	0.00	0.40	0.40	0	572	572	0	580	580	7.01	5.00	£143,000
	med	0.00	0.00	0.00	0.00	0.23	0.23	0.00	0.33	0.33	0	476	476	0	483	483	5.84	5.00	£143,000
	min	0.00	0.00	0.00	0.00	0.18	0.18	0.00	0.27	0.27	0	381	381	0	387	387	4.68	5.00	£143,000
2012	max	0.00	0.00	0.00	0.00	0.25	0.25	0.00	0.36	0.36	0	515	515	0	522	522	6.31	5.00	£117,000
	med	0.00	0.00	0.00	0.00	0.21	0.21	0.00	0.30	0.30	0	429	429	0	435	435	5.26	5.00	£117,000
	min	0.00	0.00	0.00	0.00	0.17	0.17	0.00	0.24	0.24	0	343	343	0	348	348	4.21	5.00	£117,000

Annex 5: Fuel Characteristics and Production Emissions

energy source			Typical pressure (bar)	Energy Content (MJ/kg)	Typical density (kg/litre)	Energy Content (MJ/litre)	Fuel NOx (gms/GJ)		Fuel NMHCs (gms/GJ)		Fuel CH4 (gms/GJ)		Fuel CO2 (gms/GJ)	
							on-board fuel	storage method	2002	2007	2002	2007	2002	2007
Crude oil	ULSP	Liquid	1	43.9	0.738	32.4	40.50	40.50	211.90	211.90	15.60	15.60	10,300	10,300
Crude oil	ULSD	Liquid	1	43.0	0.830	35.7	32.00	32.00	91.60	91.60	14.50	14.50	7,000	7,000
Gas field	CNG	Gas	n/a	47.6	n/a	n/a	11.78	11.78	13.18	13.18	38.16	38.16	5,475	5,475
Gas field	LPG	Liquefied	8	46.4	0.508	23.6	39.50	39.50	64.20	64.20	16.90	16.90	7,600	7,600
Gas field	Methanol	Liquid	1	19.9	0.791	15.7	32.74	32.74	41.50	41.50	52.01	52.01	17,682	17,682
Renewables	Electricity	Battery	n/a	n/a	n/a	n/a	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Generating Mix	Electricity	Battery	n/a	n/a	n/a	n/a	745.91	242.30	15.49	29.50	422.41	87.50	145,048	122,310
Renewable elec	Hydrogen	Gas	n/a	120.0	n/a	n/a	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Generating Mix	Hydrogen	Gas	n/a	120.0	n/a	n/a	491.08	159.52	10.20	19.42	278.10	57.61	95,494	80,524
Gas field	Hydrogen	Gas	n/a	120.0	n/a	n/a	39.47	39.47	19.54	19.54	56.74	56.74	81,512	81,512

Annex 6: Pre-Tax Fuel Costs and Fuel Price

energy source																	
	on-board fuel	Unit	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2034		
Crude oil	ULSP	Price inc VAT	p/litre	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0		
		Fuel Duty	p/litre	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	
		Underlying price	p/litre	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
Crude oil	ULSD	Price inc VAT	p/litre	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0		
		Fuel Duty	p/litre	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	
		Underlying price	p/litre	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
Gas field	CNG	Price inc VAT	p/kg	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	49.4	49.4	49.4		
		Fuel Duty	p/kg	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	0.0	0.0	0.0		
		Underlying price	p/kg	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	
Gas field	LPG	Price inc VAT	p/litre	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	34.1	34.1	34.1		
		Fuel Duty	p/litre	4.57	4.57	4.57	4.57	4.57	4.57	4.57	4.57	4.57	0.0	0.0	0.0		
		Underlying price	p/litre	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	
Gas field	Methanol	Price inc VAT	p/litre	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6		
		Fuel Duty	p/litre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		Underlying price	p/litre	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	
Renewables	Electricity	Price inc VAT	p/kWh	5.4	5.4	5.4	5.4	5.4	5.2	5.2	5.2	5.2	5.2	4.9	4.9	4.9	
		Fuel Duty	p/kWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Underlying price	p/kWh	5.2	5.2	5.2	5.2	5.2	4.9	4.9	4.9	4.9	4.9	4.7	4.7	4.7	
Generating Mix	Electricity	Price inc VAT	p/kWh	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	
		Fuel Duty	p/kWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		Underlying price	p/kWh	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	
Renewables	Hydrogen	Price inc VAT	p/kg	825	825	825	825	825	372	372	372	372	372	245	245	245	
		Fuel Duty	p/kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Underlying price	p/kg	702	702	702	702	702	317	317	317	317	317	208	208	208	
Generating Mix	Hydrogen	Price inc VAT	p/kg	786	786	786	786	786	361	361	361	361	361	245	245	245	
		Fuel Duty	p/kg	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Underlying price	p/kg	669	669	669	669	669	307	307	307	307	307	208	208	208	
Gas field	Hydrogen	Price inc VAT	p/kg	2370	2370	2370	2370	2370	408	408	408	408	408	121	121	121	
		Fuel Duty	p/kg	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Underlying price	p/kg	2017	2017	2017	2017	2017	347	347	347	347	347	103	103	103	