

Non-Energy Uses Oil

Emissions and Storage Rates for Non-Energy Uses of Crude Oil & Natural Gas Liquids, 1980-2010

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Climate Mitigation Services
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EPA approach using both EIA and EPA data

EIA (2011) *Annual Energy Review, 2010, Table 1.15*

Table 1.15 Fossil Fuel Consumption for Nonfuel Use, 1980-2010

U.S.EPA (2011) *Inventory of U.S. Greenhouse Gas Emissions: 1990 - 2009*

Table A-252: 2009 Non-Energy Carbon Stored in Products

Note: This table lists non-energy uses of fossil fuels, amended by CMS to show percents and amounts subsequently emitted, and percent of total petroleum oxidised to the atmosphere

Petroleum Products

Asphalt and Road Oil					Liquified Petroleum Gases					Pentanes Plus					Lubricants					Petrochemical feedstocks				
Nonfuel use	Carbon Coefficient	Carbon Content	Quant emitted	Quant stored	Nonfuel use	Carbon Coefficient	Carbon Content	Quant emitted	Quant stored	Nonfuel use	Carbon Coefficient	Carbon Content	Quant emitted	Quant stored	Nonfuel use	Carbon Coefficient	Carbon Content	Quant emitted	Quant stored	Nonfuel use	Carbon Coefficient	Carbon Content	Quant emitted	Quant stored
QBtu	MtC/QBtu	MtC	MtCO2	MtCO2	QBtu	MtC/QBtu	MtC	MtCO2	MtCO2	QBtu	MtC/QBtu	MtC	MtCO2	MtCO2	QBtu	MtC/QBtu	MtC	MtCO2	MtCO2	QBtu	MtC/QBtu	MtC	MtCO2	MtCO2

Year	EIA	EPA	calculated	calculated	calculated	EIA	EPA	calculated	calculated	calculated	EIA	EPA	calculated	calculated	calculated	EIA	EPA	calculated	calculated	calculated	EIA	EPA	calculated	calculated	calculated
1980	0.96	20.55	19.73	-	72.35	0.78	17.06	13.31	20.01	28.79						0.35	20.25	7.09	23.65	2.34	1.43	19.35	27.68	38.06	63.43
1981	0.83	20.55	17.06	-	62.55	0.77	17.06	13.14	19.75	28.42						0.34	20.25	6.89	22.98	2.27	1.21	19.35	23.42	32.20	53.67
1982	0.83	20.55	17.06	-	62.55	0.87	17.06	14.84	22.31	32.11						0.31	20.25	6.28	20.95	2.07	0.88	19.35	17.03	23.42	39.03
1983	0.90	20.55	18.50	-	67.82	0.89	17.06	15.18	22.83	32.85						0.32	20.25	6.48	21.63	2.14	0.85	19.35	16.45	22.62	37.70
1984	0.99	20.55	20.35	-	74.61	0.84	17.06	14.33	21.55	31.00	0.05	19.10	0.95	1.44	2.07	0.35	20.25	7.09	23.65	2.34	0.82	19.35	15.87	21.82	36.37
1985	1.03	20.55	21.17	-	77.62	0.90	17.06	15.35	23.08	33.22	0.06	19.10	1.15	1.72	2.48	0.32	20.25	6.48	21.63	2.14	0.82	19.35	15.87	21.82	36.37
1986	1.09	20.55	22.40	-	82.14	0.85	17.06	14.50	21.80	31.37	0.08	19.10	1.53	2.30	3.31	0.31	20.25	6.28	20.95	2.07	0.95	19.35	18.39	25.28	42.14
1987	1.13	20.55	23.22	-	85.16	1.06	17.06	18.08	27.19	39.12	0.06	19.10	1.15	1.72	2.48	0.36	20.25	7.29	24.33	2.41	0.96	19.35	18.58	25.55	42.58
1988	1.14	20.55	23.43	-	85.91	1.11	17.06	18.94	28.47	40.97	0.10	19.10	1.91	2.87	4.13	0.34	20.25	6.89	22.98	2.27	0.97	19.35	18.77	25.82	43.03
1989	1.10	20.55	22.61	-	82.90	1.18	17.06	20.13	30.27	43.55	0.08	19.10	1.53	2.30	3.31	0.35	20.25	7.09	23.65	2.34	0.96	19.35	18.58	25.55	42.58
1990	1.17	20.55	24.04	-	88.17	1.18	17.06	20.13	30.27	43.55	0.08	19.10	1.53	2.30	3.31	0.36	20.25	7.29	24.33	2.41	1.12	19.35	21.68	29.81	49.68
1991	1.08	20.55	22.19	-	81.39	1.37	17.07	23.38	35.15	50.58	0.04	19.10	0.76	1.15	1.65	0.32	20.25	6.48	21.63	2.14	1.15	19.35	22.26	30.61	51.01
1992	1.10	20.55	22.61	-	82.90	1.39	17.07	23.73	35.68	51.34	0.06	19.10	1.15	1.72	2.48	0.33	20.25	6.68	22.30	2.21	1.20	19.35	23.22	31.94	53.23
1993	1.15	20.55	23.63	-	86.66	1.35	17.08	23.06	34.66	49.88	0.28	19.10	5.35	8.04	11.57	0.34	20.25	6.89	22.98	2.27	1.22	19.35	23.61	32.47	54.11
1994	1.17	20.55	24.04	-	88.17	1.54	17.08	26.31	39.56	56.92	0.26	19.10	4.97	7.46	10.74	0.35	20.25	7.09	23.65	2.34	1.26	19.35	24.39	33.53	55.89
1995	1.18	20.55	24.25	-	88.92	1.58	17.09	27.00	40.60	58.42	0.30	19.10	5.73	8.61	12.39	0.35	20.25	7.09	23.65	2.34	1.21	19.35	23.42	32.20	53.67
1996	1.18	20.55	24.25	-	88.92	1.64	17.10	28.04	42.16	60.67	0.32	19.10	6.11	9.19	13.22	0.34	20.25	6.89	22.98	2.27	1.21	19.35	23.42	32.20	53.67
1997	1.22	20.55	25.07	-	91.94	1.66	17.08	28.35	42.63	61.34	0.30	19.10	5.73	8.61	12.39	0.35	20.25	7.09	23.65	2.34	1.40	19.35	27.10	37.26	62.10
1998	1.26	20.55	25.89	-	94.95	1.73	17.08	29.55	44.43	63.93	0.20	19.10	3.82	5.74	8.26	0.37	20.25	7.49	25.01	2.47	1.40	19.35	27.10	37.26	62.10
1999	1.32	20.55	27.13	-	99.48	1.81	17.07	30.90	46.45	66.85	0.26	19.10	4.97	7.46	10.74	0.37	20.25	7.49	25.01	2.47	1.33	19.35	25.74	35.40	58.99
2000	1.28	20.55	26.31	-	96.46	1.66	17.09	28.37	42.65	61.38	0.24	19.10	4.58	6.89	9.92	0.37	20.25	7.49	25.01	2.47	1.35	19.35	26.13	35.93	59.88
2001	1.26	20.55	25.89	-	94.95	1.55	17.10	26.51	39.85	57.34	0.20	19.10	3.82	5.74	8.26	0.34	20.25	6.89	22.98	2.27	1.19	19.35	23.03	31.67	52.78
2002	1.24	20.55	25.48	-	93.45	1.61	17.09	27.51	41.37	59.53	0.17	19.10	3.25	4.88	7.02	0.33	20.25	6.68	22.30	2.21	1.27	19.35	24.58	33.80	56.33
2003	1.22	20.55	25.07	-	91.94	1.54	17.09	26.32	39.57	56.94	0.17	19.10	3.25	4.88	7.02	0.31	20.25	6.28	20.95	2.07	1.37	19.35	26.51	36.46	60.77
2004	1.30	20.55	26.72	-	97.97	1.57	17.07	26.80	40.29	57.98	0.17	19.10	3.25	4.88	7.02	0.31	20.25	6.28	20.95	2.07	1.59	19.35	30.77	42.32	70.53
2005	1.32	20.55	27.13	-	99.48	1.49	17.06	25.42	38.22	55.00	0.15	19.10	2.86	4.31	6.20	0.31	20.25	6.28	20.95	2.07	1.47	19.35	28.45	39.12	65.20
2006	1.26	20.55	25.89	-	94.95	1.52	17.06	25.93	38.99	56.10	0.11	19.10	2.10	3.16	4.54	0.25	20.25	5.06	16.90	1.67	1.48	19.35	28.64	39.39	65.65
2007	1.20	20.55	24.66	-	90.43	1.54	17.05	26.26	39.48	56.81	0.14	19.10	2.67	4.02	5.78	0.31	20.25	6.28	20.95	2.07	1.35	19.35	26.13	35.93	59.88
2008	1.01	20.55	20.76	-	76.11	1.45	17.06	24.74	37.19	53.52	0.12	19.10	2.29	3.45	4.96	0.29	20.25	5.87	19.60	1.94	1.17	19.35	22.64	31.14	51.90
2009	0.87	20.55	17.94	-	65.80	1.45	17.06	24.67	37.09	53.38	0.09	19.10	1.78	2.68	3.86	0.26	20.25	5.32	17.75	1.76	1.03	19.35	19.93	27.41	45.69
2010	0.88	20.55	18.08	-	66.32	1.61	17.06	27.47	41.30	59.42	0.11	19.10	2.10	3.16	4.54	0.29	20.25	5.87	19.60	1.94	1.09	19.35	21.10	29.01	48.35
average	1.12		22.99	-	84.29	1.34		22.85	34.35	49.43	0.16		2.59	3.89	5.60	0.33		6.67	22.24	2.20	1.18		22.92	31.52	52.53
% of total	24.4%		26.0%	0.0%	39.2%	29.3%		25.8%	31.4%	23.0%	3.4%		2.9%	3.6%	2.6%	7.2%		7.5%	20.3%	1.0%	25.9%		25.9%	28.8%	24.4%

[1] "Other" includes distillate fuel oil, residual fuel oil, waxes, and miscellaneous products.

[2] Pentanes Plus are included in LPG for 1980-1983.

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EPA approach using both EIA and EPA data

Note: This table lists non-energy uses of fossil fuels, amended by CMS to show percents and amounts subsequently emitted, and percent of total petroleum oxidised to the atmosphere

Petroleum Products																						
Petroleum coke					Special Naphthas					Other ¹					Total Non-energy Use				Total petroleum emissions	Non-energy emissions rate	Non-energy storage rate	
Non-energy use	Carbon Coefficient	Carbon Content	Quant emitted 70%	Quant stored 30%	Non-energy use	Carbon Coefficient	Carbon Content	Quantity emitted 41%	Quantity stored 59%	Non-energy use	Carbon Coefficient	Carbon Content	Quantity emitted 27.5%	Quantity stored 73%	Non-energy use	Carbon Content	Quantity emitted	Quantity stored	MtCO2	Percent of total emissions	Percent of total emissions	
Qbtu	MtC/Qbtu	MtC	MtCO2	MtCO2	Qbtu	MtC/Qbtu	MtC	MtCO2	MtCO2	Qbtu	MtC/Qbtu	MtC	MtCO2	MtCO2	Qbtu	MtC	MtCO2	MtCO2	MtCO2	Percent	Percent	
Year	EIA	EPA	calculated	calculated	calculated	EIA	EPA	calculated	calculated	calculated	EIA	EPA	calculated	calculated	calculated	EIA	calculated	calculated	calculated	EIA	calculated	calculated
1980	0.14	27.93	3.91	10.04	4.30	0.19	19.73	3.75	5.64	8.11	0.34	20.23	6.88	6.94	18.29	4.19	82	104	198	2,272	4.59%	8.70%
1981	0.17	27.93	4.75	12.19	5.22	0.14	19.73	2.76	4.15	5.98	0.31	20.23	6.27	6.32	16.67	3.77	74	98	175	2,122	4.60%	8.24%
1982	0.14	27.93	3.91	10.04	4.30	0.13	19.73	2.56	3.86	5.55	0.28	20.23	5.66	5.71	15.06	3.44	67	86	161	2,011	4.29%	7.99%
1983	0.06	27.93	1.68	4.30	1.84	0.16	19.73	3.16	4.75	6.83	0.26	20.23	5.26	5.30	13.98	3.44	67	81	163	1,995	4.08%	8.18%
1984	0.09	27.93	2.51	6.45	2.77	0.21	19.73	4.14	6.23	8.96	0.24	20.23	4.86	4.90	12.91	3.59	70	86	171	2,053	4.19%	8.33%
1985	0.09	27.93	2.51	6.45	2.77	0.16	19.73	3.16	4.75	6.83	0.24	20.23	4.86	4.90	12.91	3.62	71	84	174	2,035	4.15%	8.57%
1986	0.08	27.93	2.23	5.73	2.46	0.13	19.73	2.56	3.86	5.55	0.22	20.23	4.45	4.49	11.83	3.71	72	84	181	2,125	3.97%	8.51%
1987	0.14	27.93	3.91	10.04	4.30	0.14	19.73	2.76	4.15	5.98	0.21	20.23	4.25	4.28	11.29	4.06	79	97	193	2,152	4.52%	8.98%
1988	0.15	27.93	4.19	10.75	4.61	0.11	19.73	2.17	3.26	4.69	0.23	20.23	4.65	4.69	12.37	4.15	81	99	198	2,246	4.40%	8.81%
1989	0.14	27.93	3.91	10.04	4.30	0.11	19.73	2.17	3.26	4.69	0.23	20.23	4.65	4.69	12.37	4.15	81	100	196	2,246	4.44%	8.73%
1990	0.12	27.93	3.35	8.60	3.69	0.11	19.73	2.17	3.26	4.69	0.23	20.23	4.65	4.69	12.37	4.37	85	103	208	2,187	4.72%	9.50%
1991	0.11	27.93	3.07	7.89	3.38	0.09	19.73	1.78	2.67	3.84	0.26	20.23	5.26	5.30	13.98	4.42	85	104	208	2,134	4.89%	9.75%
1992	0.17	27.93	4.75	12.19	5.22	0.10	19.73	1.97	2.97	4.27	0.21	20.23	4.25	4.28	11.29	4.56	88	111	213	2,180	5.10%	9.77%
1993	0.08	27.93	2.23	5.73	2.46	0.10	19.73	1.97	2.97	4.27	0.20	20.23	4.05	4.08	10.76	4.72	91	111	222	2,184	5.08%	10.16%
1994	0.08	27.93	2.23	5.73	2.46	0.08	19.73	1.58	2.37	3.41	0.20	20.23	4.05	4.08	10.76	4.94	95	116	231	2,221	5.24%	10.39%
1995	0.08	27.93	2.23	5.73	2.46	0.07	19.73	1.38	2.08	2.99	0.20	20.23	4.05	4.08	10.76	4.97	95	117	232	2,207	5.30%	10.51%
1996	0.09	27.93	2.51	6.45	2.77	0.07	19.73	1.38	2.08	2.99	0.20	20.23	4.05	4.08	10.76	5.05	97	119	235	2,290	5.20%	10.27%
1997	0.04	27.93	1.12	2.87	1.23	0.07	19.73	1.38	2.08	2.99	0.20	20.23	4.05	4.08	10.76	5.24	100	121	245	2,313	5.24%	10.60%
1998	0.15	27.93	4.19	10.75	4.61	0.11	19.73	2.17	3.26	4.69	0.23	20.23	4.65	4.69	12.37	5.45	105	131	253	2,358	5.56%	10.75%
1999	0.22	27.93	6.14	15.77	6.76	0.15	19.73	2.96	4.45	6.40	0.22	20.23	4.45	4.49	11.83	5.68	110	139	264	2,417	5.75%	10.90%
2000	0.10	27.93	2.79	7.17	3.07	0.10	19.73	1.97	2.97	4.27	0.22	20.23	4.45	4.49	11.83	5.32	102	125	249	2,461	5.08%	10.13%
2001	0.17	27.93	4.75	12.19	5.22	0.08	19.73	1.58	2.37	3.41	0.23	20.23	4.65	4.69	12.37	5.02	97	119	237	2,473	4.83%	9.57%
2002	0.15	27.93	4.19	10.75	4.61	0.10	19.73	1.97	2.97	4.27	0.22	20.23	4.45	4.49	11.83	5.09	98	121	239	2,472	4.88%	9.68%
2003	0.12	27.93	3.35	8.60	3.69	0.08	19.73	1.58	2.37	3.41	0.21	20.23	4.25	4.28	11.29	5.02	97	117	237	2,518	4.65%	9.42%
2004	0.22	27.93	6.14	15.77	6.76	0.05	19.73	0.99	1.48	2.13	0.20	20.23	4.05	4.08	10.76	5.41	105	130	255	2,609	4.97%	9.78%
2005	0.19	27.93	5.31	13.62	5.84	0.06	19.73	1.18	1.78	2.56	0.20	20.23	4.05	4.08	10.76	5.19	101	122	247	2,628	4.65%	9.40%
2006	0.21	27.93	5.86	15.05	6.45	0.07	19.73	1.38	2.08	2.99	0.24	20.23	4.86	4.90	12.91	5.14	100	120	245	2,603	4.63%	9.42%
2007	0.20	27.93	5.59	14.34	6.14	0.08	19.73	1.58	2.37	3.41	0.24	20.23	4.86	4.90	12.91	5.06	98	122	237	2,603	4.69%	9.12%
2008	0.23	27.93	6.42	16.49	7.07	0.08	19.73	1.58	2.37	3.41	0.24	20.23	4.86	4.90	12.91	4.59	89	115	212	2,444	4.71%	8.67%
2009	0.13	27.93	3.72	9.55	4.09	0.04	19.73	0.87	1.31	1.89	0.24	20.23	4.86	4.90	12.91	4.12	79	101	189	2,320	4.34%	8.16%
2010	0.07	27.93	1.95	5.02	2.15	0.03	19.73	0.59	0.89	1.28	0.25	20.23	5.06	5.10	13.45	4.33	82	104	197	2,351	4.43%	8.40%
average	0.13		3.72	9.56	4.10	0.10		2.04	3.07	4.41	0.23		4.70	4.74	12.49	4.57	88.47	109.36	215.05			
% of total	2.9%		4.2%	8.7%	1.9%	2.3%		2.3%	2.8%	2.1%	5.1%		5.3%	4.3%	5.8%	100.0%	100.0%	100.0%	100.0%	2,298	4.75%	

Average storage rate 1980-2010 for non-energy uses of petroleum (USA) 9.335%

Carbon storage rate in CDIAC's global emissions database 1751-2010 6.700%

Average of CDIAC & US liquids average 1980-2010 carbon storage rate; applied to Carbon Major Entities' production 8.018%

linked to Oil Emissions Factor Calc

BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB
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Table A-256: 2010 Non-Energy Carbon Stored in Products

Fuel Type	Consumption for Non-Energy Use (Tbtu)	Carbon Coefficients (Tg Carbon/QBtu)	Carbon Content (Tg Carbon)	Fraction Sequestered	Carbon Stored (Tg CO ₂ Eq.)
Coal	64.9	25.61	1.66	0.10	0.6
Natural Gas	221.9	14.46	3.21	0.59	7.0
Asphalt & Road Oil	877.8	20.55	18.04	1.00	65.9
LPG	1,545.8	17.06	26.37	0.59	57.4
Lubricants	291.7	20.20	5.89	0.09	2.0
Pentanes Plus	103.6	19.10	1.98	0.59	4.3
Petrochemical Feedstocks	[a]	[a]	[a]	[a]	43.1
Petroleum Coke	3.0	27.85	0.08	0.30	0.1
Special Naphtha	25.5	19.74	0.50	0.59	1.1
Waxes/Misc.	[a]	[a]	[a]	[a]	1.3
Misc. U.S. Territories Petroleum	[a]	[a]	[a]	[a]	0.4
Total					183.1

[a] Values for Misc. U.S. Territories Petroleum, Petrochemical Feedstocks and Waxes/Misc. are not shown because these categories are aggregates of numerous smaller components.
Note: Totals may not sum due to independent rounding.

Table A-257: 2010 Reference Approach CO₂ Emissions from Fossil Fuel Consumption (Tg CO₂ Eq. unless otherwise noted)

Fuel Category	Potential Emissions	Carbon Sequestered	Net Emissions	Fraction Oxidized	Total Emissions
Coal	1,898.9	0.6	1,898.3	100.0%	1,898.3
Petroleum	2,367.2	175.5	2,191.7	100.0%	2,191.7
Natural Gas	1,297.1	7.0	1,290.1	100.0%	1,290.1
Total	5,563.2	183.1	5,380.1	-	5,380.1

Note: Totals may not sum due to independent rounding.

U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010, (Draft)

Annex 4 IPCC Reference Approach for Estimating CO₂ Emissions from Fossil Fuel Combustion, Table A-256

(see EPA final April 2012, on page 7 at right)

Table A-58: Fuel Types and Percent of C Stored for Non-Energy Uses

Sector/Fuel Type	Storage Factor (%)
Industry	-
Industrial Coking Coal ^a	10
Industrial Other Coal ^b	59
Natural Gas to Chemical Plants ^b	59
Asphalt & Road Oil	100
LPG ^b	59
Lubricants	9
Pentanes Plus ^b	59
Naphtha (<401 deg. F) ^b	59
Other Oil (>401 deg. F) ^b	59
Still Gas ^b	59
Petroleum Coke ^c	30
Special Naphtha ^b	59
Distillate Fuel Oil	50
Waxes	58
Miscellaneous Products	0
Transportation	-
Lubricants	9
U.S. Territories	-
Lubricants	9
Other Petroleum (Misc. Prod.)	10
- Not applicable	

U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010, (Draft)

Annex 2.3: Methodology for Estimating Carbon Emitted from Non-Energy Uses of Fossil Fuels,

Table A-58: Fuel Types and Percent of C Stored for Non-Energy Uses

Table 3-5: CO₂ Emissions from Fossil Fuel Combustion by Fuel Type and Sector (Tg CO₂ Eq.)

Fuel/Sector	1990	2000	2005	2006	2007	2008	2009
Coal	1,718.4	2,065.5	2,112.3	2,076.5	2,106.0	2,072.5	1,841.0
Residential	3.0	1.1	0.8	0.6	0.7	0.7	0.6
Commercial	12.0	8.8	9.3	6.2	6.7	6.5	5.8
Industrial	155.3	127.3	115.3	112.6	107.0	102.6	83.4
Transportation	NE	NE	NE	NE	NE	NE	NE
Electricity Generation	1,547.6	1,927.4	1,983.8	1,953.7	1,987.3	1,959.4	1,747.6
U.S. Territories	0.6	0.9	3.0	3.4	4.3	3.3	3.5
Natural Gas	1,000.6	1,217.4	1,159.0	1,141.3	1,218.0	1,226.0	1,209.9

⁵⁴ This decrease also represents the largest absolute and percentage decrease since the beginning of EIA's record of annual energy consumption data, beginning in 1949 (EIA 2010a).

⁵⁵ An additional discussion of fossil fuel emission trends is presented in the Trends in U.S. Greenhouse Gas Emissions Chapter.

Energy 3-3

Residential	238.0	270.7	262.2	237.3	257.0	264.4	257.2
Commercial	142.1	172.5	162.9	153.8	164.0	170.2	167.9
Industrial	409.1	457.2	380.8	377.7	389.0	391.0	365.0
Transportation	36.0	35.6	33.1	33.1	35.3	36.8	36.3
Electricity Generation	175.3	280.8	318.8	338.0	371.3	361.9	373.1
U.S. Territories	NO	0.7	1.3	1.4	1.4	1.6	1.5
Petroleum	2,019.0	2,311.6	2,481.5	2,434.9	2,432.4	2,267.1	2,166.7
Residential	97.4	98.8	94.9	83.6	84.6	83.1	81.4
Commercial	64.9	49.6	51.3	48.5	48.7	47.4	50.3
Industrial	282.1	266.6	326.9	357.9	346.0	309.3	282.0
Transportation	1,449.9	1,773.9	1,863.5	1,845.0	1,858.7	1,753.1	1,683.4
Electricity Generation	97.5	88.4	99.2	54.4	53.9	39.2	36.9
U.S. Territories	27.2	34.2	45.7	45.5	40.4	35.0	36.7
Geothermal*	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Total	4,738.4	5,594.8	5,753.2	5,653.1	5,756.7	5,565.9	5,209.0

NE (Not estimated)

NO (Not occurring)

* Although not technically a fossil fuel, geothermal energy-related CO₂ emissions are included for reporting purposes.

Note: Totals may not sum due to independent rounding.

U.S. Environmental Protection Agency (2011) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2009,

Table 3-5: CO₂ Emissions from Fossil Fuel Combustion by Fuel Type and Sector (Tg CO₂ Eq.), page 3-3, data for 1990, 2000, 2005-2009.

Table 3-19: CO₂ Emissions from Non-Energy Use Fossil Fuel Consumption (Tg CO₂ Eq.)

Year	1990	2000	2005	2006	2007	2008	2009	2010
Potential Emissions	307.2	380.1	375.9	367.1	355.6	333.1	297.3	302.5
C Stored	191.3	237.7	236.3	229.1	225.2	198.0	179.0	183.1
Emissions as a % of Potential	38%	37%	37%	38%	37%	41%	40%	39%
Emissions	115.8	142.5	139.6	138.0	130.4	135.0	118.2	119.4

U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010 (DRAFT).

DS DT DU DV DW DX DY DZ EA EB EC ED EE EF EG EH EI EJ EK EL

Table 3-20: Adjusted Consumption of Fossil Fuels for Non-Energy Uses (TBtu)

Year	1990	2000	2005	2006	2007	2008	2009	2010
Industry	4,138.4	5,192.2	5,124.0	4,945.4	4,826.0	4,483.0	4,118.8	4,217.7
Industrial Coking Coal	+	53.6	80.5	62.9	2.3	29.1	6.4	64.9
Industrial Other Coal	8.2	12.4	11.9	11.9	11.9	11.9	11.9	11.9
Natural Gas to Chemical Plants	263.2	418.6	389.4	228.0	222.4	227.0	219.5	221.9
Asphalt & Road Oil	1,170.2	1,275.7	1,323.2	1,261.2	1,197.0	1,012.0	873.1	877.8
LPG	1,118.7	1,606.9	1,443.9	1,489.8	1,479.4	1,416.9	1,467.2	1,545.8
Lubricants	186.3	189.9	160.2	156.1	161.2	149.6	134.5	149.5
Pentanes Plus	77.5	229.3	146.3	105.4	132.4	114.7	93.2	103.6
Naphtha (<401 ° F)	325.8	593.7	679.6	617.5	541.4	466.7	449.7	471.3
Other Oil (>401 ° F)	661.2	533.8	499.5	572.7	667.7	598.5	391.7	403.7
Still Gas	21.3	12.6	67.7	57.2	44.2	47.3	133.9	147.2
Petroleum Coke	27.2	7.5	105.2	134.2	117.8	147.4	112.1	3.0
Special Naphtha	100.7	94.4	60.9	68.9	75.3	83.1	44.1	25.5
Distillate Fuel Oil	7.0	11.7	11.7	17.5	17.5	17.5	17.5	17.5
Waxes	33.3	33.1	31.4	26.1	21.9	19.1	12.2	15.4
Miscellaneous Products	137.8	119.2	112.8	136.0	133.5	142.0	151.8	158.8
Transportation	176.0	179.4	151.3	147.4	152.2	141.3	127.1	141.2
Lubricants	176.0	179.4	151.3	147.4	152.2	141.3	127.1	141.2
U.S. Territories	86.7	152.2	121.9	133.4	108.4	126.7	56.3	56.3
Lubricants	0.7	3.1	4.6	6.2	5.9	2.7	1.0	1.0
Other Petroleum (Misc. Prod.)	86.0	149.1	117.3	127.2	102.5	124.1	55.2	55.2
Total	4,401.1	5,523.7	5,397.2	5,226.2	5,086.6	4,751.0	4,302.1	4,415.2

+ Does not exceed 0.05 TBtu

Note: To avoid double-counting, coal coke, petroleum coke, natural gas consumption, and other oils are adjusted for industrial process consumption reported in the Industrial Processes sector. Natural gas, LPG, Pentanes Plus, Naphthas, Special Naphtha, and Other Oils are adjusted to account for exports of chemical intermediates derived from these fuels. For residual oil (not shown in the table), all non-energy use is assumed to be consumed in C black production, which is also reported in the Industrial Processes chapter.

U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 - 2010 (DRAFT).

Table 3-21: 2010 Adjusted Non-Energy Use Fossil Fuel Consumption, Storage, and Emissions

Sector/Fuel Type	Adjusted Non-Energy Use ^a (TBtu)	Carbon Content Coefficient (Tg C/QBtu)	Potential Carbon (Tg C)	Storage Factor	Carbon Stored (Tg C)	Carbon Emissions (Tg C)	Carbon Emissions (Tg CO ₂ Eq.)
Industry	4,217.7	-	78.5	-	49.6	28.9	106.1
Industrial Coking Coal	64.9	25.61	1.7	0.10	0.2	1.5	5.5
Industrial Other Coal	11.9	25.82	0.3	0.59	0.2	0.1	0.5
Natural Gas to Chemical Plants	221.9	14.47	3.2	0.59	1.9	1.3	4.8
Asphalt & Road Oil	877.8	20.55	18.0	1.00	18.0	0.1	0.3
LPG	1,545.8	17.06	26.4	0.59	15.7	10.7	39.3
Lubricants	149.5	20.20	3.0	0.09	0.3	2.7	10.1
Pentanes Plus	103.6	19.10	2.0	0.59	1.2	0.8	2.9
Naphtha (<401° F)	471.3	18.55	8.7	0.59	5.2	3.5	13.0
Other Oil (>401° F)	403.7	20.17	8.1	0.59	4.8	3.3	12.1
Still Gas	147.2	17.51	2.6	0.59	1.5	1.0	3.8
Petroleum Coke	3.0	27.85	0.1	0.30	+	0.1	0.2
Special Naphtha	25.5	19.74	0.5	0.59	0.3	0.2	0.7
Distillate Fuel Oil	17.5	20.17	0.4	0.50	0.2	0.2	0.6
Waxes	15.4	19.80	0.3	0.58	0.2	0.1	0.5
Miscellaneous Products	158.8	20.31	3.2	+	+	3.2	11.8
Transportation	141.2	-	2.9	-	0.3	2.6	9.5
Lubricants	141.2	20.20	2.9	0.09	0.3	2.6	9.5
U.S. Territories	56.3	-	1.1	-	0.1	1.0	3.7
Lubricants	1.0	20.20	+	0.09	+	+	0.1
Other Petroleum (Misc. Prod.)	55.2	20.00	1.1	0.10	0.1	1.0	3.6
Total	4,415.2	-	82.5	-	49.9	32.6	119.4

+ Does not exceed 0.05 Tg

- Not applicable.

^aTo avoid double counting, net exports have been deducted.

Note: Totals may not sum due to independent rounding.

U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 - 2010 (DRAFT).

Table 3-22: Tier 2 Quantitative Uncertainty Estimates for CO₂ Emissions from Non-Energy Uses of Fossil Fuels (Tg CO₂ Eq. and Percent)

Source	Gas	2010 Emission Estimate (Tg CO ₂ Eq.)	Uncertainty Range Relative to Emission Estimate ^a (%)			
			Lower Bound	Upper Bound	Lower Bound	Upper Bound
Feedstocks	CO ₂	79.3	63.4	96.1	-20%	21%
Asphalt	CO ₂	0.3	0.1	0.6	-58%	119%
Lubricants	CO ₂	17.7	14.6	20.5	-17%	16%
Waxes	CO ₂	0.4	0.3	0.7	-29%	74%
Other	CO ₂	25.7	10.3	27.0	-60%	5%
Total	CO₂	123.4	97.6	135.3	-21%	10%

^aRange of emission estimates predicted by Monte Carlo Stochastic Simulation for a 95 percent confidence interval. NA (Not Applicable)

Table 3-23: Tier 2 Quantitative Uncertainty Estimates for Storage Factors of Non-Energy Uses of Fossil Fuels (Percent)

Source	Gas	2010 Storage Factor (%)	Uncertainty Range Relative to Emission Estimate ^a (%)			
			Lower Bound	Upper Bound	Lower Bound	Upper Bound
Feedstocks	CO ₂	58%	56%	60%	-3%	4%
Asphalt	CO ₂	99.6%	99.1%	99.8%	-0.5%	0.3%
Lubricants	CO ₂	9%	4%	17%	-57%	91%
Waxes	CO ₂	58%	49%	71%	-15%	22%
Other	CO ₂	17%	16%	66%	-3%	292%

^aRange of emission estimates predicted by Monte Carlo Stochastic Simulation for a 95 percent confidence interval, as a percentage of the inventory value (also expressed in percent terms)

U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 - 2010 (DRAFT).

(subject to revision)

Note, 2 October: the data in these tables are used in the worksheet on non-energy uses and sequestration. Some of these values were revised in the final report, shown on the following page.

U.S. EPA (2012) *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010*, (final), April. Chapter 3. Note revisions since draft rpt Feb12.

Table 3-20: Adjusted Consumption of Fossil Fuels for Non-Energy Uses (TBtu)

Year	1990	2005	2006	2007	2008	2009	2010
Industry	4,197.8	5,309.5	5,181.3	5,012.3	4,626.9	4,335.1	4,453.5
Industrial Coking Coal	+	80.5	62.9	2.3	29.2	6.4	64.9
Industrial Other Coal	8.2	11.9	11.9	11.9	11.9	11.9	10.3
Natural Gas to Chemical Plants	263.7	390.1	228.3	223.0	227.3	220.5	222.8
Asphalt & Road Oil	1,170.2	1,323.2	1,261.2	1,197.0	1,012.0	873.1	877.8
LPG	1,168.7	1,667.9	1,754.8	1,703.3	1,609.2	1,702.6	1,817.3
Lubricants	186.3	160.2	156.1	161.2	149.6	134.5	149.5
Pentanes Plus	84.9	105.2	74.3	91.6	64.9	70.1	67.8
Naphtha (<401 ° F)	326.2	680.5	618.3	542.5	467.2	451.3	472.7
Other Oil (>401 ° F)	662.1	500.4	573.6	669.1	599.1	393.0	404.9
Still Gas	21.3	67.7	57.2	44.2	47.3	133.9	147.2
Petroleum Coke	27.2	105.2	134.2	117.8	147.4	112.1	1.1
Special Naphtha	100.9	61.0	68.9	75.4	83.2	44.3	25.6
Distillate Fuel Oil	7.0	11.7	17.5	17.5	17.5	17.5	17.5
Waxes	33.3	31.4	26.1	21.9	19.1	12.2	15.4
Miscellaneous Products	137.8	112.8	136.0	133.5	142.0	151.8	158.8
Transportation	176.0	151.3	147.4	152.2	141.3	127.1	141.2
Lubricants	176.0	151.3	147.4	152.2	141.3	127.1	141.2
U.S. Territories	86.7	121.9	133.4	108.4	126.7	56.3	56.3
Lubricants	0.7	4.6	6.2	5.9	2.7	1.0	1.0
Other Petroleum (Misc. Prod.)	86.0	117.3	127.2	102.5	124.1	55.2	55.2
Total	4,460.5	5,582.8	5,462.1	5,272.9	4,895.0	4,518.4	4,651.0

U.S. EPA (2012) *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010*, (final), April. Chapter 3: Energy, page 3-32.

Table 3-21: 2010 Adjusted Non-Energy Use Fossil Fuel Consumption, Storage, and Emissions

Sector/Fuel Type	Adjusted Non-Energy Use ^a (TBtu)	Carbon Content Coefficient (Tg C/QBtu)	Potential Carbon (Tg C)	Storage Factor	Carbon Stored (Tg C)	Carbon Emissions (Tg C)	Carbon Emissions (Tg CO ₂ Eq.)
Industry	4,453.5	-	82.4	-	51.9	30.5	111.9
Industrial Coking Coal	64.9	25.61	1.7	0.10	0.2	1.5	5.5
Industrial Other Coal	10.3	25.82	0.3	0.59	0.2	0.1	0.4
Natural Gas to Chemical Plants	222.8	14.47	3.2	0.59	1.9	1.3	4.8
Asphalt & Road Oil	877.8	20.55	18.0	1.00	18.0	0.1	0.3
LPG	1,817.3	17.06	31.0	0.59	18.4	12.6	46.1
Lubricants	149.5	20.20	3.0	0.09	0.3	2.7	10.1
Pentanes Plus	67.8	19.10	1.3	0.59	0.8	0.5	1.9
Naphtha (<401 ° F)	472.7	18.55	8.8	0.59	5.2	3.6	13.1
Other Oil (>401 ° F)	404.9	20.17	8.2	0.59	4.9	3.3	12.2
Still Gas	147.2	17.51	2.6	0.59	1.5	1.0	3.8
Petroleum Coke	1.1	27.85	+	0.30	+	+	0.1
Special Naphtha	25.6	19.74	0.5	0.59	0.3	0.2	0.8
Distillate Fuel Oil	17.5	20.17	0.4	0.50	0.2	0.2	0.6
Waxes	15.4	19.80	0.3	0.58	0.2	0.1	0.5
Miscellaneous Products	158.8	20.31	3.2	+	+	3.2	11.8
Transportation	141.2	-	2.9	-	0.3	2.6	9.5
Lubricants	141.2	20.20	2.9	0.09	0.3	2.6	9.5
U.S. Territories	56.3	-	1.1	-	0.1	1.0	3.7
Lubricants	1.0	20.20	+	0.09	+	+	0.1
Other Petroleum (Misc. Prod.)	55.2	20.00	1.1	0.10	0.1	1.0	3.6
Total	4,651.0	-	86.4	-	52.3	34.1	125.1

+ Does not exceed 0.05 Tg

- Not applicable.

^a To avoid double counting, net exports have been deducted.

Note: Totals may not sum due to independent rounding.

U.S. EPA (2012) *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010*, (final), April. Chapter 3: Energy, page 3-32.

Table 3-22: Tier 2 Quantitative Uncertainty Estimates for CO₂ Emissions from Non-Energy Uses of Fossil Fuels (Tg CO₂ Eq. and Percent)

Source	Gas	2010 Emission Estimate (Tg CO ₂ Eq.)	Uncertainty Range Relative to Emission Estimate ^a (%)			
			Lower Bound	Upper Bound	Lower Bound	Upper Bound
Feedstocks	CO ₂	83.1	65.2	114.0	-22%	37%
Asphalt	CO ₂	0.3	0.1	0.6	-58%	117%
Lubricants	CO ₂	19.6	16.2	22.8	-18%	16%
Waxes	CO ₂	0.5	0.3	0.8	-28%	63%
Other	CO ₂	21.7	13.9	24.5	-36%	13%
Total	CO₂	125.1	103.8	154.0	-17%	23%

^a Range of emission estimates predicted by Monte Carlo Stochastic Simulation for a 95 percent confidence interval.

NA (Not Applicable)

Table 3-23: Tier 2 Quantitative Uncertainty Estimates for Storage Factors of Non-Energy Uses of Fossil Fuels (Percent)

Source	Gas	2010 Storage Factor (%)	Uncertainty Range Relative to Emission Estimate ^a (%)			
			Lower Bound	Upper Bound	Lower Bound	Upper Bound
Feedstocks	CO ₂	59%	54%	61%	-10%	3%
Asphalt	CO ₂	99.6%	99%	100%	-1%	0%
Lubricants	CO ₂	9%	4%	17%	-59%	90%
Waxes	CO ₂	58%	49%	71%	-15%	23%
Other	CO ₂	16%	10%	44%	-39%	179%

^a Range of emission estimates predicted by Monte Carlo Stochastic Simulation for a 95 percent confidence interval, as a percentage of the inventory value (also expressed in percent terms).

U.S. EPA (2012) *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010*, (final), April. Chapter 3: Energy, page 3-33.

Table A-256: 2010 Non-Energy Carbon Stored in Products

Fuel Type	Consumption for Non-Energy Use (TBtu)	Carbon Coefficients (Tg Carbon/QBtu)	Carbon Content (Tg Carbon)	Fraction Sequestered	Carbon Stored (Tg CO ₂ Eq.)
Coal	64.9	25.61	1.66	0.10	0.6
Natural Gas	222.8	14.46	3.22	0.59	7.0
Asphalt & Road Oil	877.8	20.55	18.04	1.00	65.9
LPG	1,817.3	17.06	31.00	0.59	67.5
Lubricants	291.7	20.20	5.89	0.09	2.0
Pentanes Plus	67.8	19.10	1.29	0.59	2.8
Petrochemical Feedstocks	[a]	[a]	[a]	[a]	43.1
Petroleum Coke	1.1	27.85	0.03	0.30	0.0
Special Naphtha	25.6	19.74	0.51	0.59	1.1
Waxes/Misc.	[a]	[a]	[a]	[a]	1.3
Misc. U.S. Territories Petroleum	[a]	[a]	[a]	[a]	0.4
Total					191.7

[a] Values for Misc. U.S. Territories Petroleum, Petrochemical Feedstocks and Waxes/Misc. are not shown because these categories are aggregates of numerous smaller components.

Note: Totals may not sum due to independent rounding.

Table A-257: 2010 Reference Approach CO₂ Emissions from Fossil Fuel Consumption (Tg CO₂ Eq. unless otherwise noted)

Fuel Category	Potential Emissions	Carbon Sequestered	Net Emissions	Fraction Oxidized	Total Emissions
Coal	1,899.0	0.6	1,898.4	100.0%	1,898.4
Petroleum	2,363.9	184.1	2,179.8	100.0%	2,179.8
Natural Gas	1,297.1	7.0	1,290.1	100.0%	1,290.1
Total	5,560.0	191.7	5,368.3		5,368.3

Note: Totals may not sum due to independent rounding.

U.S. Environmental Protection Agency (2012) *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010*, 481 pp., 15April12, + annexes. epa.gov/climatechange/emissions/usinventoryreport.html
Annex 4: IPCC reference approach, table A-256 and A-257.

Non-Energy Uses Oil

Cell: H11

Comment: Rick Heede:

100 percent of asphalt and road oil is considered sequestered.

U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010, (Draft), Annex 4 IPCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A-256: 2010 Non-Energy Carbon Stored in Products. Table 256 is reproduced at right.

Cell: M11

Comment: Rick Heede:

EPA: 59 percent of Liquefied Petroleum Gases are sequestered in the U.S. (58% in 2009). U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010, (Draft) Annex 2.3: Methodology for Estimating Carbon Emitted from Non-Energy Uses of Fossil Fuels, Table A-58: Fuel Types and Percent of C Stored for Non-Energy Uses. Table A-58 is reproduced at right. EIA(2004) Documentation for Emissions of Greenhouse Gases in the United States 2002, p. 15-18: LPGs such as ethane, propane, butane are used by the petrochemical industry as feedstocks for intermediate materials (ethylene, propylene, and butadiene) in the manufacture of plastics. EIA estimates that 80 percent of LPG is sequestered in plastics, synthetic rubber, and related compounds; thus 20 percent is emitted. CMS note: the fraction stored has decreased over time.

Cell: R11

Comment: Rick Heede:

EPA: 59 percent of Pentanes Plus is sequestered in the U.S. in 2010; in 2009 the EPA factor was 58 percent.

U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010, (Draft) Annex 2.3: Methodology for Estimating Carbon Emitted from Non-Energy Uses of Fossil Fuels, Table A-58: Fuel Types and Percent of C Stored for Non-Energy Uses. Table A-58 is reproduced at right.

Cell: W11

Comment: Rick Heede:

EPA uses a carbon storage factor of 9 percent and an overall combustion / volatilization / emission factor of 91 percent. U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010, (Draft) Annex 4 IPCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A-256.

Following the IPCC Guidelines, EIA (EI, 2004, Documentation for Emissions of Greenhouse Gases in the United States 2002, p. 20) assumed that 50 percent of lubricants are emitted to the atmosphere through in-use oxidation or post-use “recycling” in boilers.

Cell: AB11

Comment: Rick Heede:

U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010, (Draft), Annex 4 IPCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A-256, and A-58: Fuel Types and Percent of C Stored for Non-Energy Uses. EIA(2004) Documentation for Emissions of Greenhouse Gases in the United States 2002, p. 23-24: EIA recognizes two product categories referred to as petrochemical feedstocks: naphtha (synthetic) and gas oils. These products are “presumably destined for ethylene crackers, and probably some mix of aromatic hydrocarbons (benzene, toluene, and xylene), and feedstocks used to make aromatic hydrocarbons. These naphthas and gas oils have carbon factors of 18.14 and 19.95 kgC/million Btu, respectively.

Following IPCC Guidelines, EIA assumes that 75 percent of the carbon in naphthas and 50 percent of carbon in gas oil feedstock is sequestered in plastics. Since the production of naphtha and gas oil are roughly equal (109 and 111 million bbl in 2002), we average the combination to 62.5 sequestered, which means that 37.5 percent is emitted to the atmosphere.

Cell: AK11

Comment: Rick Heede:

EPA uses a storage factor of 30 percent for Petroleum Coke in the U.S. in 2010 (same as 2009). U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010, (Draft) Annex 4 IPCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A-256. EIA(2004) Documentation for Emissions of Greenhouse Gases in the United States 2002, p. 25: Petroleum coke is the high-carbon (~90 percent C) “coal-like solid created after intensive extraction of lighter hydrocarbons from petroleum feedstocks by oil refiners. Most petroleum coke is used in the refineries as fuel or as a catalyst.” EIA “assumes that 50 percent of the carbon in petroleum coke for nonfuel use is sequestered” but notes that it has been “difficult to identify significant sequestering nonfuel uses of petroleum coke in the United States” and is “currently under evaluation and it may yield a downward estimation in the sequestering amounts ...” EIA also notes non-sequestering uses as sacrificial anodes in primary aluminum smelting and metallurgical uses.

Cell: AP11

Comment: Rick Heede:

EPA uses a carbon storage factor of 59 percent for Special Naphthas in 2010 (58 percent in 2009).

U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010, (Draft) Annex 4 IPCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A-256. EIA(2004) Documentation for Emissions of Greenhouse Gases in the United States 2002, p. 26: Special naphthas is an “array of hydrocarbon-based solvents such as hexane and the volatile oils used in petroleum-based paints. In general, solvents evaporate into the atmosphere as nonmethane volatile organic compounds (NMVOCs) after use and swiftly weather into atmospheric carbon dioxide.” EIA assumed that 100 percent of the carbon in special naphtha is emitted.

Cell: AU11

Comment: Rick Heede:

U.S. EPA (2012) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010, (Draft), Annex 4 IPCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A-256, nor Table A-58 (in Annex 2.3: Methodology for Estimating Carbon Emitted from Non-Energy Uses of Fossil Fuels) sheds much light on “other” products such as waxes and miscellaneous. EIA(2004) Documentation for Emissions of Greenhouse Gases in the United States 2002, p. 28-29: EIA includes distillate fuel oil, residual fuel oil, waxes, and miscellaneous products in this “other” category.

Distillate and residual fuel: EIA assumes that 50 percent of each fuel is sequestered and 50 percent emitted. Non-fuel uses of distillate is listed as 2 million bbl and 9 million bbl of residual fuel in 2002. Carbon content factor of 19.95 and 21.49 kgC/million Btu, respectively.

Waxes: Includes waxes and polishes in such uses as food packaging materials and water proofing and various polishes. EIA uses a carbon factor of 19.81 kgC/million Btu. Consumption has varied between 5.81 and 7.7 million bbl in recent years. “Following the IPCC, EIA assumes that 100 percent of the carbon in waxes and polishes is sequestered.” (p. 29). Neither IPCC nor EIA account for incineration of waxes used on ubiquitous food packaging materials, nor carbon entering the atmosphere via weathering of VOCs.

Miscellaneous products: Includes non-fuel uses of petroleum not classified elsewhere, such as petrolatum, lube refining byproducts, aromatic extracts, tars, absorption oils, petroleum rocket fuels, synthetic natural gas feedstocks, and specialty oils. EIA assumes. This category consumed 23.15 million bbl in 2002, i.e., 58 percent of total “other” nonfuel petroleum uses in 2002. EIA uses a carbon factor of 20.23 kgC/million Btu. Significantly, EIA “assumes a 100 percent sequestration for this category” that includes rocket fuel. Granted, NASA has experienced mission problems, but rocket fuel combustion is not zero.

CMS concludes that the emission rate of the nonfuel uses above average 11 million bbl of total “other” in 2002 of 40 million bbl = 27.5 percent (and thus a sequestration rate of 72.5 percent).

Cell: J13

Comment: Rick Heede:

LPG varies in carbon content. Data from U.S. Environmental Protection Agency (2011) INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990 – 2009, ANNEX 2 Methodology and Data for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A- 34: Annually Variable C Content Coefficients by Year (Tg C/QBtu), 1990 & 1995-2009. CMS assumes 1980-1989 equal to 1990, and 2010 equal to 2009.

Cell: D18

Comment: Rick Heede:

Non-Energy Uses Oil

U. S. Energy Information Administration (2011) Annual Energy Review 2010 Table 1.15 Fossil Fuel Consumption for Nonfuel Use Estimates, 1980-2010, www.eia.gov/totalenergy/data/annual

Cell: E18

Comment: Rick Heede:
CMS uses the latest EPA data (Nov2011): Climate leaders Emission Factor Hub at www.epa.gov/climateleaders/guidance/ghg-emissions.html

Cell: I18

Comment: Rick Heede:
U. S. Energy Information Administration (2011) Annual Energy Review 2010 Table 1.15 Fossil Fuel Consumption for Nonfuel Use Estimates, 1980-2010, www.eia.gov/totalenergy/data/annual

Cell: J18

Comment: Rick Heede:
CMS uses the latest EPA data (Nov2011): Climate leaders Emission Factor Hub at www.epa.gov/climateleaders/guidance/ghg-emissions.html

Cell: N18

Comment: Rick Heede:
U. S. Energy Information Administration (2011) Annual Energy Review 2010 Table 1.15 Fossil Fuel Consumption for Nonfuel Use Estimates, 1980-2010, www.eia.gov/totalenergy/data/annual

Cell: O18

Comment: Rick Heede:
CMS uses the latest EPA data (Nov2011): Climate leaders Emission Factor Hub at www.epa.gov/climateleaders/guidance/ghg-emissions.html

Cell: S18

Comment: Rick Heede:
U. S. Energy Information Administration (2011) Annual Energy Review 2010 Table 1.15 Fossil Fuel Consumption for Nonfuel Use Estimates, 1980-2010, www.eia.gov/totalenergy/data/annual

Cell: T18

Comment: Rick Heede:
CMS uses the latest EPA data (Nov2011): Climate leaders Emission Factor Hub at www.epa.gov/climateleaders/guidance/ghg-emissions.html

Cell: X18

Comment: Rick Heede:
U. S. Energy Information Administration (2011) Annual Energy Review 2010 Table 1.15 Fossil Fuel Consumption for Nonfuel Use Estimates, 1980-2010, www.eia.gov/totalenergy/data/annual

Cell: Y18

Comment: Rick Heede:
CMS uses the latest EPA data (Nov2011): Climate leaders Emission Factor Hub at www.epa.gov/climateleaders/guidance/ghg-emissions.html

Cell: AG18

Comment: Rick Heede:
U. S. Energy Information Administration (2011) Annual Energy Review 2010 Table 1.15 Fossil Fuel Consumption for Nonfuel Use Estimates, 1980-2010, www.eia.gov/totalenergy/data/annual

Cell: AH18

Comment: Rick Heede:
CMS uses the latest EPA data (Nov2011): Climate leaders Emission Factor Hub at www.epa.gov/climateleaders/guidance/ghg-emissions.html

Cell: AL18

Comment: Rick Heede:
U. S. Energy Information Administration (2011) Annual Energy Review 2010 Table 1.15 Fossil Fuel Consumption for Nonfuel Use Estimates, 1980-2010, www.eia.gov/totalenergy/data/annual

Cell: AM18

Comment: Rick Heede:
CMS uses the latest EPA data (Nov2011): Climate leaders Emission Factor Hub at www.epa.gov/climateleaders/guidance/ghg-emissions.html

Cell: AQ18

Comment: Rick Heede:
U. S. Energy Information Administration (2011) Annual Energy Review 2010 Table 1.15 Fossil Fuel Consumption for Nonfuel Use Estimates, 1980-2010, www.eia.gov/totalenergy/data/annual

Cell: AR18

Comment: Rick Heede:
CMS uses the latest EPA data (Nov2011): Climate leaders Emission Factor Hub at www.epa.gov/climateleaders/guidance/ghg-emissions.html

Cell: AV18

Comment: Rick Heede:
U. S. Energy Information Administration (2011) Annual Energy Review 2010 Table 1.15 Fossil Fuel Consumption for Nonfuel Use Estimates, 1980-2010, www.eia.gov/totalenergy/data/annual

Non-Energy Uses Oil

Cell: AZ18

Comment: Rick Heede:

U. S. Energy Information Administration (2011) Annual Energy Review 2010, page 317: Table 11.2 Carbon Dioxide Emissions From Energy Consumption by Source, Selected Years, 1949-2010 (Million Metric Tons of Carbon Dioxide). Note: "Data are estimates for carbon dioxide emissions from energy consumption, including the nonfuel use of fossil fuels."
This being the case, CMS does not add the emissions from non-fuel uses to total emissions in order to estimate the sequestration rate in column "AY", which divides total CO2 of sequestered petroleum by total petroleum emissions.

Cell: N20

Comment: Rick Heede:

Pentanes Plus are included in LPG for 1980-1983.

Cell: AZ30

Comment: Rick Heede:

U.S. Environmental Protection Agency (2011) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2009, Table 3-5: CO2 Emissions from Fossil Fuel Combustion by Fuel Type and Sector (Tg CO2 Eq.), page 3-3, data for 1990 (2,019 MtCO2), 2000 (2,312 MtCO2); 2005 (2,482 MtCO2); 2006 (2,435 MtCO2); 2007 (2,432 MtCO2); 2008 (2,267 MtCO2); and 2009 (2,167 MtCO2). The EPA data is 92 to 94 percent of the EIA value.

Cell: BR45

Comment: Rick Heede:

U.S. Environmental Protection Agency (2011) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2009, Table 3-5: CO2 Emissions from Fossil Fuel Combustion by Fuel Type and Sector (Tg CO2 Eq.), page 3-3, data for 1990, 2000, 2005-2009.

Cell: D49

Comment: Rick Heede:

CMS uses the EPA data from U.S. Environmental Protection Agency (2011) Inventory of U.S. Greenhouse Gas Emissions and Sinks, ANNEX 4 IPCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A-252: 2009 Non-Energy Carbon Stored in Products. (Note: this table is reproduced at right.)
The EIA estimate for 2009 is 0.87 QBtu.

Cell: I49

Comment: Rick Heede:

CMS uses the EPA data from U.S. Environmental Protection Agency (2011) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2009, ANNEX 4 IPCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A-252: 2009 Non-Energy Carbon Stored in Products. (Note: this table is reproduced at right.)
The EIA estimate for 2009 is 1.54 QBtu.

Cell: N49

Comment: Rick Heede:

CMS uses the EPA data from U.S. Environmental Protection Agency (2011) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2009, ANNEX 4 IPCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A-252: 2009 Non-Energy Carbon Stored in Products. (Note: this table is reproduced at right.)
The EIA estimate for 2009 is 0.10 QBtu.

Cell: S49

Comment: Rick Heede:

CMS uses the EPA data from U.S. Environmental Protection Agency (2011) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2009, ANNEX 4 IPCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A-252: 2009 Non-Energy Carbon Stored in Products. (Note: this table is reproduced at right.)
The EIA estimate for 2009 is 0.26 QBtu.

Cell: AG49

Comment: Rick Heede:

CMS uses the EPA data from U.S. Environmental Protection Agency (2011) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2009, ANNEX 4 IPCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A-252: 2009 Non-Energy Carbon Stored in Products. (Note: this table is reproduced at right.)
The EIA estimate for 2009 is 0.18 QBtu.

Cell: AL49

Comment: Rick Heede:

CMS uses the EPA data from U.S. Environmental Protection Agency (2011) INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990 – 2009, ANNEX 4 IPCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion, Table A-252: 2009 Non-Energy Carbon Stored in Products. (Note: this table is reproduced at right.)
The EIA estimate for 2009 is 0.05 QBtu.

Cell: CY56

Comment: Rick Heede:

Gritsevich, Inna (2000) Carbon Stored in Materials and Products in Case of Non-Energy Use of Fossil Fuels (in Russia): Problems and Approaches to Assessment of Related CO2 Emissions. Proceedings of the GHGT-5, Cairns, Australia, 13-16 August 2000, Center for Energy Efficiency, Moscow, cenef@glas.apc.org, nws.chem.uu.nl/energy/ghg5-papnew.pdf