Summary of emissions from oil, natural gas, coal, cement production, and flaring

Richard Heede
Climate Mitigation Services

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	1751-1759	1770s										
	Sum 1751-1769	1770	1771	1772	1773	1774	1775	1776	1777	1778	1779	1780
Oil & NGL												
Annual and cumulative Carbon Majors (MtCO2)												
Annual and cumulative Carbon Majors (MtC)												
Annual and cumulative global oil emissions (MtCO2)												
Annual and cumulative global oil emissions (MtC)	none											
Percent of annual CDIAC oil emissions identified												
Global cumulative to date oil emissions (MtCO2)												
Global cumulative to date oil emissions (percent)												
Natural Gas												
Annual and cumulative Carbon Majors (MtCO2)												
Annual and cumulative Carbon Majors (MtC)												
Annual and cumulative global nat gas emissions (MtCO2)												
Annual and cumulative global nat gas emissions (MtC)	none											
Percent of annual CDIAC gas emissions identified												
Global cumulative to date nat gas emissions (MtCO2)												
Global cumulative to date nat gas emissions (percent)												
Coal												
Annual and cumulative Carbon Majors (MtCO2)												
Annual and cumulative Carbon Majors (MtC)												
Annual and cumulative global coal emissions (MtCO2)	209	11	15	15	15	15	15	15	15	15	15	15
	sum 1751-62											
Annual and cumulative global coal emissions (MtC)	57	3	4	4	4	4	4	4	4	4	4	4
Percent Carbon Majors of global coal emissions												
Global cumulative to date coal emissions (MtCO2)		60	64	68	72	76	80	84	88	92	96	100
Global cumulative to date coal emissions (percent)		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%
Cement												
Annual and cumulative Carbon Majors (MtCO2)												
Annual and cumulative Carbon Majors (MtC)												
Annual and cumulative global cement emissions (MtCO2)												
Annual and cumulative global cement emissions (MtC)	none											
Percent Carbon Majors of global cement emissions												
Flaring												
Annual and cumulative Carbon Majors (MtCO2)												
Annual and cumulative Carbon Majors (MtC)												
Annual and cumulative global flaring (MtCO2)												
Annual and cumulative global flaring (MtC)	CDIAC estimates flaring emissions from 1950 to 2010											
Percent Carbon Majors of global flaring emissions												
Total												
Annual and cumulative Carbon Majors (MtCO2)												
Annual and cumulative Carbon Majors (MtC)												
Annual and cumulative global 1751-2010 (MtCO2)	209	11	15	15	15	15	15	15	15	15	15	15
Annual and cumulative global 1751-2010 (MtC)	57	3	4	4	4	4	4	4	4	4	4	4
Percent Carbon Majors of global CO2 1751-2010												
Cumulative												
Annual Carbon Majors 1854-210												
Total Carbon Majors 1854-2010												
Percent Carbon Majors of global CO2 1751-2010												
Annual global CO2 1751-2010	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4
Total global CO2 1751-2010	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336
Percent Carbon Majors of global CO2 1751-2010	0.0156%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.03%	0.03%	0.03%
	Sum 1751-1769	1770	1771	1772	1773	1774	1775	1776	1777	1778	1779	1780

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	1780s									1790s										1800s					
	1781	1782	1783	1784	1785	1786	1787	1788	1789	1790	1791	1792	1793	1794	1795	1796	1797	1798	1799	1800	1801	1802	1803	1804	1805
	18	18	18	18	18	18	18	18	18	18	22	22	22	22	22	22	26	26	26	29	29	37	33	33	33
	5	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	7	7	7	8	8	10	9	9	9
	105	110	115	120	125	130	135	140	145	150	156	162	168	174	180	186	193	200	207	215	223	233	242	251	260
	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
	18	18	18	18	18	18	18	18	18	18	22	22	22	22	22	22	26	26	26	29	29	37	33	33	33
	5	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	7	7	7	8	8	10	9	9	9
	0.4	**0.4**	**0.4**	**0.4**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.6**	**0.6**	**0.6**	**0.6**	**0.7**	**0.7**	**0.7**	**0.7**	**0.8**	**0.8**	**0.8**	**0.9**	**0.9**	**0.9**	**1.0**
	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336
	0.03%	0.03%	0.03%	0.03%	0.03%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.06%	0.06%	0.06%	0.06%	0.07%	0.07%	0.07%
	1781	**1782**	**1783**	**1784**	**1785**	**1786**	**1787**	**1788**	**1789**	**1790**	**1791**	**1792**	**1793**	**1794**	**1795**	**1796**	**1797**	**1798**	**1799**	**1800**	**1801**	**1802**	**1803**	**1804**	**1805**

Summary of emissions from oil, natural gas, coal, cement production, and flaring

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	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR
9	1800s				1810s										1820s										1830s					
10	1806	1807	1808	1809	1810	1811	1812	1813	1814	1815	1816	1817	1818	1819	1820	1821	1822	1823	1824	1825	1826	1827	1828	1829	1830	1831	1832	1833	1834	1835
47	37	37	37	37	37	40	40	40	40	44	48	51	51	51	51	51	55	59	59	62	62	66	66	66	88	84	84	88	88	92
49	10	10	10	10	10	11	11	11	11	12	13	14	14	14	14	14	15	16	16	17	17	18	18	18	24	23	23	24	24	25
52	270	280	290	300	310	321	332	343	354	366	379	393	407	421	435	449	464	480	496	513	530	548	566	584	608	631	654	678	702	727
53	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%
89	37	37	37	37	37	40	40	40	40	44	48	51	51	51	51	51	55	59	59	62	62	66	66	66	88	84	84	88	88	92
91	10	10	10	10	10	11	11	11	11	12	13	14	14	14	14	14	15	16	16	17	17	18	18	18	24	23	23	24	24	25
105	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.7	1.8	1.8	1.9	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.5	2.6	2.7
107	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336
109	0.07%	0.08%	0.08%	0.08%	0.09%	0.09%	0.09%	0.09%	0.10%	0.10%	0.10%	0.11%	0.11%	0.12%	0.12%	0.12%	0.13%	0.13%	0.14%	0.14%	0.15%	0.15%	0.16%	0.16%	0.17%	0.17%	0.18%	0.2%	0.2%	0.2%
111	1806	1807	1808	1809	1810	1811	1812	1813	1814	1815	1816	1817	1818	1819	1820	1821	1822	1823	1824	1825	1826	1827	1828	1829	1830	1831	1832	1833	1834	1835

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	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV
9	1830s				1840s										1850s										1860s					
10	1836	1837	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863	1864	1865
43																			0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4
45																			0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
47	106	106	110	114	121	125	132	136	143	158	158	169	172	183	198	198	209	216	253	260	278	282	286	304	333	348	352	377	410	436
49	29	29	30	31	33	34	36	37	39	43	43	46	47	50	54	54	57	59	69	71	76	77	78	83	91	95	96	103	112	119
50																		linked to Coal emissions worksheet --->												
51																			0.03%	0.04%	0.05%	0.05%	0.06%	0.06%	0.06%	0.07%	0.07%	0.07%	0.09%	0.10%
52	756	785	815	846	879	913	949	986	1,025	1,068	1,111	1,157	1,204	1,254	1,308	1,362	1,419	1,478	1,547	1,618	1,694	1,771	1,849	1,932	2,023	2,118	2,214	2,317	2,429	2,548
53	0.4%	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%	0.6%	0.6%	0.6%	0.6%	0.7%	0.7%	0.7%	0.7%	0.8%	0.8%	0.8%	0.9%	0.9%	1.0%	1.0%	1.1%	1.1%	1.2%	1.2%	1.3%	1.3%	1.4%	1.5%
85																			0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4
87																			0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
89	106	106	110	114	121	125	132	136	143	158	158	169	172	183	198	198	209	216	253	260	278	282	286	304	333	348	352	377	410	436
91	29	29	30	31	33	34	36	37	39	43	43	46	47	50	54	54	57	59	69	71	76	77	78	83	91	95	96	103	112	119
93																			0.03%	0.04%	0.05%	0.05%	0.06%	0.06%	0.06%	0.07%	0.07%	0.07%	0.09%	0.10%
99																												0.000	0.001	
101																												835	835	
103																												0.0%	0.0%	
105	2.8	2.9	3.0	3.1	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	4.6	4.8	5.0	5.2	5.4	5.7	5.9	6.2	6.5	6.8	7.1	7.4	7.8	8.1	8.5	8.9	9.3
107	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336
109	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.5%	0.5%	0.5%	0.5%	0.6%	0.6%	0.6%	0.6%	0.7%	0.7%
111	1836	1837	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863	1864	1865

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	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX
9	1860s				1870s										1880s										1890s			
10	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893
15																			0	0	0	0	0	0	0	1	1	1
17																			0	0	0	0	0	0	0	0	0	0
19					4	4	4	4	4	4	4	7	7	11	11	15	15	11	15	15	18	18	18	22	29	33	33	37
21					1	1	1	1	1	1	1	2	2	3	3	4	4	3	4	4	5	5	5	6	8	9	9	10
23																			0%	0%	1%	1%	1%	1%	1%	2%	2%	2%
24					1	2	3	4	5	6	7	9	11	14	17	21	25	28	32	36	41	46	51	57	65	74	83	93
25					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%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%
33																				4	7	11	18	11	11	7	7	7
35																				1	2	3	5	3	3	2	2	2
38																				1	3	6	11	14	17	19	21	23
39																				0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
43	0.5	0.6	0.7	0.8	1.0	1.2	1.4	1.7	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	6	6	6
45	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
47	447	476	491	520	535	572	634	671	634	685	696	704	711	758	854	876	923	986	993	1,000	1,008	1,052	1,162	1,165	1,264	1,319	1,330	1,312
49	122	130	134	142	146	156	173	183	173	187	190	192	194	207	233	239	252	269	271	273	275	287	317	318	345	360	363	358
51	0.12%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.5%
52	2,670	2,800	2,934	3,076	3,222	3,378	3,551	3,734	3,907	4,094	4,284	4,476	4,670	4,877	5,110	5,349	5,601	5,870	6,141	6,414	6,689	6,976	7,293	7,611	7,956	8,316	8,679	9,037
53	1.5%	1.6%	1.7%	1.8%	1.8%	1.9%	2.0%	2.1%	2.2%	2.3%	2.4%	2.6%	2.7%	2.8%	2.9%	3.1%	3.2%	3.3%	3.5%	3.7%	3.8%	4.0%	4.2%	4.3%	4.5%	4.7%	4.9%	5.2%
71																			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
73																			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85	0.5	0.6	0.7	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	7
87	0.1	0.2	0.2	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2
89	447	476	491	520	539	575	638	674	638	689	700	711	718	769	865	890	938	997	1,008	1,019	1,033	1,081	1,198	1,198	1,304	1,359	1,370	1,356
91	122	130	134	142	147	157	174	184	174	188	191	194	196	210	236	243	256	272	275	278	282	295	327	327	356	371	374	370
93	0.12%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.5%	0.4%	0.4%	0.5%	0.5%
99	**0.001**	**0.002**	**0.003**	**0.003**	**0.004**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.02**	**0.02**	**0.02**	**0.02**	**0.03**	**0.03**	**0.03**	**0.04**	**0.04**	**0.0**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
101	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**
103	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%	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%
105	**9.8**	**10**	**11**	**11**	**12**	**12**	**13**	**14**	**14**	**15**	**16**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**31**	**32**	**34**
107	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**
109	0.7%	0.8%	0.8%	0.8%	0.9%	0.9%	1.0%	1.0%	1.1%	1.1%	1.2%	1.2%	1.3%	1.3%	1.4%	1.5%	1.5%	1.6%	1.7%	1.8%	1.8%	1.9%	2.0%	2.1%	2.2%	2.3%	2.4%	2.5%
111	**1866**	**1867**	**1868**	**1869**	**1870**	**1871**	**1872**	**1873**	**1874**	**1875**	**1876**	**1877**	**1878**	**1879**	**1880**	**1881**	**1882**	**1883**	**1884**	**1885**	**1886**	**1887**	**1888**	**1889**	**1890**	**1891**	**1892**	**1893**

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Climate Mitigation Services

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	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY
	1890s						1900s										1910s										
	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
	1	1	2	3	2	2	2	2	2	3	3	3	5	6	6	6	8	8	14	19	13	13	24	25	21	28	38
	0	0	0	1	1	0	0	1	1	1	1	1	1	2	2	2	2	2	4	5	4	3	7	7	6	8	10
	33	40	44	48	48	51	59	66	70	73	84	84	84	103	110	117	125	132	136	150	154	165	176	198	194	224	286
	9	11	12	13	13	14	16	18	19	20	23	23	23	28	30	32	34	36	37	41	42	45	48	54	53	61	78
	4%	3%	4%	5%	5%	3%	3%	3%	3%	4%	3%	4%	6%	6%	5%	5%	6%	6%	10%	13%	9%	8%	14%	13%	11%	13%	13%
	102	113	125	138	151	165	181	199	218	238	261	284	307	335	365	397	431	467	504	545	587	632	680	734	787	848	926
	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.5%	0.5%	0.5%	0.6%	0.6%	0.7%	0.7%
						0	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3
						0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	7	7	7	7	7	11	11	15	15	15	15	18	18	18	18	22	26	26	29	29	29	33	37	40	37	37	40
	2	2	2	2	2	3	3	4	4	4	4	5	5	5	5	6	7	7	8	8	8	9	10	11	10	10	11
							4.5%	4.8%	5.4%	6.3%	6.8%	6.8%	8.2%	8.6%	8.5%	8.5%	7.7%	7.7%	7.4%	7.7%	7.8%	7.4%	8.0%	7.6%	7.6%	7.9%	7.8%
	25	27	29	31	33	36	39	43	47	51	55	60	65	70	75	81	88	95	103	111	119	128	138	149	159	169	180
	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%
	6	6	7	7	7	7	42	46	50	54	53	52	52	51	51	51	51	50	50	111	109	108	107	105	104	103	101
	2	2	2	2	2	2	12	13	14	15	14	14	14	14	14	14	14	14	14	30	30	29	29	29	28	28	28
	1,363	1,440	1,484	1,557	1,645	1,799	1,887	1,946	1,990	2,173	2,188	2,330	2,492	2,748	2,616	2,737	2,851	2,902	3,056	3,279	2,931	2,873	3,085	3,265	3,199	2,693	3,089
	372	393	405	425	449	491	515	531	543	593	597	636	680	750	714	747	778	792	834	895	800	784	842	891	873	735	843
	0.5%	0.4%	0.4%	0.4%	0.4%	0.4%	2.3%	2.4%	2.5%	2.5%	2.4%	2.3%	2.1%	1.9%	1.9%	1.9%	1.8%	1.7%	1.6%	3.4%	3.7%	3.8%	3.5%	3.2%	3.3%	3.8%	3.3%
	9,409	9,802	10,207	10,632	11,081	11,572	12,087	12,618	13,161	13,754	14,351	14,987	15,667	16,417	17,131	17,878	18,656	19,448	20,282	21,177	21,977	22,761	23,603	24,494	25,367	26,102	26,945
	5.4%	5.6%	5.8%	6.1%	6.3%	6.6%	6.9%	7.2%	7.5%	7.8%	8.2%	8.5%	8.9%	9.4%	9.8%	10.2%	10.6%	11.1%	11.6%	12.1%	12.5%	13.0%	13.5%	14.0%	14.5%	14.9%	15.4%
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.2	0.2	0.4	0.4	0	0	1
	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	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
	7	8	8	9	10	9	45	49	53	57	57	57	58	59	58	59	61	61	66	133	125	123	134	134	128	135	144
	2	2	2	3	3	2	12	13	14	16	16	16	16	16	16	16	17	17	18	36	34	34	37	37	35	37	39
	1,403	1,488	1,535	1,612	1,700	1,861	1,957	2,026	2,074	2,261	2,286	2,433	2,594	2,869	2,744	2,876	3,001	3,060	3,221	3,459	3,115	3,071	3,298	3,503	3,430	2,953	3,415
	383	406	419	440	464	508	534	553	566	617	624	664	708	783	749	785	819	835	879	944	850	838	900	956	936	806	932
	0.5%	0.5%	0.5%	0.6%	0.6%	0.5%	2.3%	2.4%	2.6%	2.5%	2.5%	2.3%	2.2%	2.1%	2.1%	2.1%	2.0%	2.0%	2.1%	3.8%	4.0%	4.0%	4.1%	3.8%	3.7%	4.6%	4.2%
	0.1	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.2**	**0.2**	**0.3**	**0.3**	**0.4**	**0.5**	**0.5**	**0.6**	**0.6**	**0.7**	**0.8**	**0.8**	**0.9**	**1.0**	**1.1**	**1.3**	**1.4**	**1.5**	**1.7**	**1.8**	**1.9**
	835	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
	35	**36**	**38**	**40**	**41**	**43**	**45**	**47**	**49**	**51**	**54**	**56**	**59**	**62**	**64**	**67**	**70**	**73**	**77**	**80**	**83**	**86**	**89**	**93**	**96**	**99**	**103**
	1,336	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**
	2.6%	2.7%	2.8%	3.0%	3.1%	3.2%	3.4%	3.5%	3.7%	3.9%	4.0%	4.2%	4.4%	4.6%	4.8%	5.0%	5.3%	5.5%	5.7%	6.0%	6.2%	6.5%	6.7%	7.0%	7.2%	7.4%	7.7%
	1894	**1895**	**1896**	**1897**	**1898**	**1899**	**1900**	**1901**	**1902**	**1903**	**1904**	**1905**	**1906**	**1907**	**1908**	**1909**	**1910**	**1911**	**1912**	**1913**	**1914**	**1915**	**1916**	**1917**	**1918**	**1919**	**1920**

Summary of emissions from oil, natural gas, coal, cement production, and flaring

Richard Heede
Climate Mitigation Services

3-Jul-13

dataset marker

	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ
	1920s									1930s										1940s							
	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947
	47	58	85	90	96	124	148	170	186	200	182	187	200	236	261	284	350	374	371	379	402	383	446	537	597	677	744
	13	16	23	25	26	34	40	46	51	55	50	51	55	64	71	78	95	102	101	103	110	105	122	147	163	185	203
	308	344	407	403	425	436	498	524	586	557	539	517	564	594	645	704	802	784	813	839	865	813	876	1,008	1,008	1,070	1,180
	84	94	111	110	116	119	136	143	160	152	147	141	154	162	176	192	219	214	222	229	236	222	239	275	275	292	322
	15%	17%	21%	22%	23%	28%	30%	32%	32%	36%	34%	36%	36%	40%	40%	40%	44%	48%	46%	45%	46%	47%	51%	53%	59%	63%	63%
	1,010	1,104	1,215	1,325	1,441	1,560	1,696	1,839	1,999	2,151	2,298	2,439	2,593	2,755	2,931	3,123	3,342	3,556	3,778	4,007	4,243	4,465	4,704	4,979	5,254	5,546	5,868
	0.8%	0.9%	0.9%	1.0%	1.1%	1.2%	1.3%	1.4%	1.6%	1.7%	1.8%	1.9%	2.0%	2.1%	2.3%	2.4%	2.6%	2.8%	2.9%	3.1%	3.3%	3.5%	3.7%	3.9%	4.1%	4.3%	4.6%
	3	3	4	5	5	10	11	12	14	18	18	19	20	22	25	29	35	31	36	42	47	49	53	58	62	70	79
	1	1	1	1	1	3	3	3	4	5	5	5	6	6	7	8	10	8	10	11	13	13	15	16	17	19	22
	37	40	51	59	62	70	77	84	103	103	92	88	92	103	110	125	139	136	139	154	154	165	183	198	216	224	246
	10	11	14	16	17	19	21	23	28	28	25	24	25	28	30	34	38	37	38	42	42	45	50	54	59	61	67
	7.1%	7.5%	7.7%	7.7%	7.5%	14.6%	14.6%	14.5%	13.9%	17.2%	19.3%	21.6%	22.1%	21.9%	22.4%	23.6%	25.3%	22.8%	25.6%	27.3%	30.4%	29.6%	29.1%	29.5%	28.6%	31.5%	32.2%
	190	201	215	231	248	267	288	311	339	367	392	416	441	469	499	533	571	608	646	688	730	775	825	879	938	999	1,066
	0.4%	0.4%	0.4%	0.5%	0.5%	0.6%	0.6%	0.6%	0.7%	0.8%	0.8%	0.9%	0.9%	1.0%	1.0%	1.1%	1.2%	1.3%	1.3%	1.4%	1.5%	1.6%	1.7%	1.8%	2.0%	2.1%	2.2%
	111	121	130	140	150	159	169	176	183	189	212	256	291	349	344	386	391	457	536	614	678	742	515	504	574	636	1,191
	30	33	36	38	41	43	46	48	50	52	58	70	80	95	94	105	107	125	146	168	185	202	141	137	157	174	325
	2,598	2,712	3,096	3,063	3,085	3,100	3,316	3,261	3,470	3,159	2,781	2,473	2,594	2,840	2,972	3,272	3,448	3,224	3,364	3,726	3,822	3,895	4,001	3,836	3,005	3,206	3,635
	709	740	845	836	842	846	905	890	947	862	759	675	708	775	811	893	941	880	918	1,017	1,043	1,063	1,092	1,047	820	875	992
	4.3%	4.5%	4.2%	4.6%	4.8%	5.1%	5.1%	5.4%	5.3%	6.0%	7.6%	10.3%	11.2%	12.3%	11.6%	11.8%	11.3%	14.2%	15.9%	16.5%	17.7%	19.0%	12.9%	13.1%	19.1%	19.8%	32.8%
	27,654	28,394	29,239	#####	30,917	31,763	32,668	33,558	34,505	35,367	36,126	36,801	37,509	38,284	39,095	39,988	40,929	41,809	42,727	43,744	44,787	45,850	46,942	47,989	48,809	49,684	50,676
	15.8%	16.2%	16.7%	17.2%	17.6%	18.1%	18.6%	19.1%	19.7%	20.2%	20.6%	21.0%	21.4%	21.8%	22.3%	22.8%	23.3%	23.8%	24.4%	24.9%	25.5%	26.1%	26.8%	27.4%	27.8%	28.3%	28.9%
								0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	0	0	0
								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
								37	37	37	29	26	26	29	33	40	40	44	48	40	44	40	37	26	26	37	44
								1928: first year CDIAC cement data																			
								10	10	10	8	7	7	8	9	11	11	12	13	11	12	11	10	7	7	10	12
	1	1	1	1	2	2	2	3	3	3	3	3	3	4	4	5	6	6	6	6	6	6	7	9	10	11	12
	0.2	0.3	0.4	0.4	0.4	0.5	0.7	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3
	161	182	221	236	251	296	331	361	386	410	414	465	516	611	634	705	782	868	949	1,042	1,134	1,181	1,022	1,108	1,242	1,394	2,026
	44	50	60	64	69	81	90	98	105	112	113	127	141	167	173	192	213	237	259	284	309	322	279	302	339	380	553
	2,942	3,096	3,554	3,525	3,573	3,606	3,891	3,906	4,195	3,855	3,441	3,104	3,276	3,565	3,759	4,141	4,430	4,188	4,364	4,760	4,884	4,914	5,097	5,068	4,254	4,536	5,104
	803	845	970	962	975	984	1,062	1,066	1,145	1,052	939	847	894	973	1,026	1,130	1,209	1,143	1,191	1,299	1,333	1,341	1,391	1,383	1,161	1,238	1,393
	5.5%	5.9%	6.2%	6.7%	7.0%	8.2%	8.5%	9.2%	9.2%	10.6%	12.0%	15.0%	15.7%	17.1%	16.9%	17.0%	17.7%	20.7%	21.7%	21.9%	23.2%	24.0%	20.1%	21.9%	29.2%	30.7%	39.7%
	2.1	**2.3**	**2.5**	**2.7**	**3.0**	**3.3**	**3.6**	**4.0**	**4.4**	**4.8**	**5.2**	**5.7**	**6.2**	**6.8**	**7.4**	**8.1**	**8.9**	**9.8**	**10.7**	**11.8**	**12.9**	**14**	**15**	**16**	**17**	**19**	**21**
	835	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**
	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.5%	0.5%	0.6%	0.6%	0.7%	0.7%	0.8%	0.9%	1.0%	1.1%	1.2%	1.3%	1.4%	1.5%	1.7%	1.8%	1.9%	2.1%	2.3%	2.5%
	106	**109**	**112**	**116**	**119**	**123**	**127**	**131**	**135**	**139**	**142**	**145**	**149**	**152**	**156**	**160**	**165**	**169**	**173**	**178**	**183**	**188**	**193**	**198**	**202**	**207**	**212**
	1,336	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**
	7.9%	8.1%	8.4%	8.7%	8.9%	9.2%	9.5%	9.8%	10.1%	10.4%	10.7%	10.9%	11.1%	11.4%	11.7%	12.0%	12.3%	12.6%	13.0%	13.3%	13.7%	14.1%	14.4%	14.8%	15.1%	15.5%	15.9%
	1921	**1922**	**1923**	**1924**	**1925**	**1926**	**1927**	**1928**	**1929**	**1930**	**1931**	**1932**	**1933**	**1934**	**1935**	**1936**	**1937**	**1938**	**1939**	**1940**	**1941**	**1942**	**1943**	**1944**	**1945**	**1946**	**1947**

Summary of emissions from oil, natural gas, coal, cement production, and flaring

Richard Heede
Climate Mitigation Services

3-Jul-13

dataset marker

	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY
9			1950s										1960s										1970s		
10	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
15	830	823	986	1,135	1,155	1,226	1,277	1,477	1,650	1,820	1,922	2,117	2,350	2,538	2,806	3,042	3,356	3,648	4,073	4,402	4,799	5,212	5,751	6,345	6,801
17	227	224	269	310	315	335	349	403	450	497	524	578	641	693	766	830	916	995	1,112	1,201	1,310	1,422	1,570	1,732	1,856
19	1,334	1,326	1,550	1,755	1,847	1,953	2,041	2,290	2,488	2,616	2,679	2,891	3,111	3,312	3,591	3,855	4,166	4,467	4,848	5,214	5,683	6,130	6,738	7,134	7,537
21	364	362	423	479	504	533	557	625	679	714	731	789	849	904	980	1,052	1,137	1,219	1,323	1,423	1,551	1,673	1,839	1,947	2,057
23	62%	62%	64%	65%	63%	63%	63%	64%	66%	70%	72%	73%	76%	77%	78%	79%	81%	82%	84%	84%	84%	85%	85%	89%	90%
24	6,232	6,594	7,017	7,496	8,000	8,533	9,090	9,715	10,394	11,108	11,839	12,628	13,477	14,381	15,361	16,413	17,550	18,769	20,092	21,515	23,066	24,739	26,578	28,525	30,582
25	4.8%	5.1%	5.4%	5.8%	6.2%	6.6%	7.1%	7.5%	8.1%	8.6%	9.2%	9.8%	10.5%	11.2%	11.9%	12.7%	13.6%	14.6%	15.6%	16.7%	17.9%	19.2%	20.6%	22.1%	23.7%
29	89	99	127	146	158	174	190	210	257	290	330	388	440	492	553	614	682	752	834	939	1,026	1,132	1,260	1,324	1,408
31	24	27	35	40	43	48	52	57	70	79	90	106	120	134	151	167	186	205	228	256	280	309	344	361	384
33	278	297	355	421	454	480	506	550	590	652	704	755	832	879	964	1,048	1,158	1,235	1,334	1,436	1,554	1,711	1,806	1,942	2,052
35	76	81	97	115	124	131	138	150	161	178	192	206	227	240	263	286	316	337	364	392	424	467	493	530	560
37	32.1%	33.4%	35.8%	34.7%	34.8%	36.3%	37.6%	38.2%	43.5%	44.5%	46.9%	51.5%	52.9%	55.9%	57.4%	58.6%	58.9%	60.9%	62.6%	65.4%	66.1%	66.1%	69.7%	68.2%	68.6%
38	1,142	1,223	1,320	1,435	1,559	1,690	1,828	1,978	2,139	2,317	2,509	2,715	2,942	3,182	3,445	3,731	4,047	4,384	4,748	5,140	5,564	6,031	6,524	7,054	7,614
39	2.4%	2.5%	2.7%	3.0%	3.2%	3.5%	3.8%	4.1%	4.5%	4.8%	5.2%	5.7%	6.1%	6.6%	7.2%	7.8%	8.4%	9.1%	9.9%	10.7%	11.6%	12.6%	13.6%	14.7%	15.8%
43	1,303	1,420	1,556	1,622	1,695	1,916	2,139	2,327	2,543	2,426	2,902	3,032	3,162	2,855	2,900	3,019	3,150	3,375	3,472	3,290	3,452	3,482	3,708	3,695	3,945
45	356	388	425	443	462	523	584	635	694	662	792	828	863	779	791	824	860	921	947	898	942	950	1,012	1,008	1,077
47	3,719	3,518	3,921	4,137	4,100	4,122	4,089	4,426	4,665	4,796	4,895	5,064	5,167	4,943	4,950	5,115	5,258	5,350	5,416	5,306	5,306	5,445	5,701	5,712	5,775
49	1,015	960	1,070	1,129	1,119	1,125	1,116	1,208	1,273	1,309	1,336	1,382	1,410	1,349	1,351	1,396	1,435	1,460	1,478	1,448	1,448	1,486	1,556	1,559	1,576
51	35.0%	40.4%	39.7%	39.2%	41.3%	46.5%	52.3%	52.6%	54.5%	50.6%	59.3%	59.9%	61.2%	57.8%	58.6%	59.0%	59.9%	63.1%	64.1%	62.0%	65.1%	64.0%	65.0%	64.7%	68.3%
52	51,691	52,651	53,721	54,850	55,969	57,094	58,210	59,418	60,691	62,000	63,336	64,718	66,128	67,477	68,828	70,224	71,659	73,119	74,597	76,045	77,493	78,979	80,535	82,094	83,670
53	29.5%	30.0%	30.6%	31.3%	31.9%	32.6%	33.2%	33.9%	34.6%	35.4%	36.1%	36.9%	37.7%	38.5%	39.3%	40.0%	40.9%	41.7%	42.5%	43.4%	44.2%	45.0%	45.9%	46.8%	47.7%
57	0	0	0	1	1	2	2	2	3	3	5	6	7	4	4	5	5	5	5	4	4	5	5	11	11
59	0	0	0	0	0	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	3	3
61	51	59	66	73	81	88	99	110	117	125	132	147	158	165	180	187	209	216	231	238	256	271	286	308	326
63	14	16	18	20	22	24	27	30	32	34	36	40	43	45	49	51	57	59	63	65	70	74	78	84	89
71	13	13	16	18	19	20	21	24	27	30	31	34	38	41	46	50	55	59	66	72	78	85	94	103	111
73	4	4	4	5	5	5	6	7	7	8	9	9	10	11	12	14	15	16	18	20	21	23	26	28	30
75			84	88	95	99	99	114	117	128	128	132	143	154	161	172	187	202	220	242	267	293	319	322	344
77			23	24	26	27	27	31	32	35	35	36	39	42	44	47	51	55	60	66	73	80	87	88	94
79			18.9%	20.9%	19.6%	20.1%	20.9%	21.1%	22.8%	23.0%	24.3%	26.1%	26.8%	26.9%	28.3%	28.8%	29.3%	29.5%	30.2%	29.7%	29.3%	29.0%	29.5%	32.1%	32.2%
85	2,236	2,355	2,685	2,922	3,028	3,338	3,630	4,040	4,479	4,570	5,190	5,579	5,997	5,930	6,308	6,729	7,247	7,839	8,451	8,707	9,360	9,916	10,817	11,479	12,276
87	610	643	733	798	826	911	991	1,103	1,222	1,247	1,416	1,522	1,637	1,618	1,722	1,836	1,978	2,139	2,306	2,376	2,554	2,706	2,952	3,133	3,350
89	5,383	5,199	5,976	6,475	6,577	6,742	6,834	7,490	7,977	8,318	8,538	8,988	9,410	9,454	9,846	10,377	10,978	11,469	12,048	12,436	13,067	13,851	14,851	15,419	16,034
91	1,469	1,419	1,631	1,767	1,795	1,840	1,865	2,044	2,177	2,270	2,330	2,453	2,568	2,580	2,687	2,832	2,996	3,130	3,288	3,394	3,566	3,780	4,053	4,208	4,376
93	41.5%	45.3%	44.9%	45.1%	46.0%	49.5%	53.1%	53.9%	56.1%	54.9%	60.8%	62.1%	63.7%	62.7%	64.1%	64.8%	66.0%	68.4%	70.1%	70.0%	71.6%	71.6%	72.8%	74.4%	76.6%
99	**23**	**25**	**28**	**31**	**34**	**37**	**41**	**45**	**50**	**54**	**59**	**65**	**71**	**77**	**83**	**90**	**97**	**105**	113	122	131	141	152	164	176
101	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	**835**	835	835	835	835	835	835	835
103	2.8%	3.0%	3.4%	3.7%	4.1%	4.5%	4.9%	5.4%	5.9%	6.5%	7.1%	7.8%	8.5%	9.2%	10.0%	10.8%	11.6%	12.6%	13.6%	14.6%	15.8%	16.9%	18.2%	19.6%	21.1%
105	**217**	**222**	**228**	**235**	**241**	**248**	**255**	**262**	**270**	**279**	**287**	**296**	**306**	**315**	**325**	**335**	**346**	**358**	370	382	395	409	424	440	456
107	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	**1,336**	1,336	1,336	1,336	1,336	1,336	1,336	1,336
109	16.3%	16.7%	17.1%	17.6%	18.1%	18.6%	19.1%	19.7%	20.2%	20.9%	21.5%	22.2%	22.9%	23.6%	24.3%	25.1%	25.9%	26.8%	27.7%	28.6%	29.6%	30.6%	31.8%	32.9%	34.1%
111	**1948**	**1949**	**1950**	**1951**	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**	**1959**	**1960**	**1961**	**1962**	**1963**	**1964**	**1965**	**1966**	**1967**	**1968**	**1969**	**1970**	**1971**	**1972**

Summary of emissions from oil, natural gas, coal, cement production, and flaring

Richard Heede
Climate Mitigation Services
3-Jul-13

dataset marker

	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV
																		[SumOil.xls]Oil Emissions'!DW122					
																		^					
	7,366	7,720	6,820	7,889	8,110	8,080	8,214	7,722	7,080	6,435	6,178	6,045	5,936	6,325	6,400	6,841	7,389	7,823	7,874	6,495	6,623	6,905	7,006
	2,010	2,107	1,861	2,153	2,213	2,205	2,242	2,108	1,932	1,756	1,686	1,650	1,620	1,726	1,747	1,867	2,016	2,135	2,149	1,772	1,808	1,884	1,912
	8,211	8,226	7,812	8,479	8,787	8,765	9,322	8,875	8,387	8,047	7,973	8,069	8,017	8,409	8,461	8,845	9,021	9,215	9,615	9,201	9,311	9,402	9,483
	2,241	2,245	2,132	2,314	2,398	2,392	2,544	2,422	2,289	2,196	2,176	2,202	2,188	2,295	2,309	2,414	2,462	2,515	2,624	2,511	2,541	2,566	2,588
	90%	94%	87%	93%	92%	92%	88%	87%	84%	80%	77%	75%	74%	75%	76%	77%	82%	85%	82%	71%	71%	73%	74%
	32,823	35,068	37,200	39,514	41,912	44,304	46,848	49,270	51,559	53,755	55,931	58,133	60,321	62,616	64,925	67,339	69,801	72,316	74,940	77,451	79,992	82,558	85,146
	25.5%	27.2%	28.9%	30.7%	32.5%	34.4%	36.4%	38.2%	40.0%	41.7%	43.4%	45.1%	46.8%	48.6%	**50.4%**	52.3%	54.2%	56.1%	58.2%	60.1%	62.1%	64.1%	66.1%
																		[SumGas.xls]Gas Emissions'!DP125					
																		^					
	1,486	1,553	1,578	1,668	1,722	1,783	1,857	1,846	1,884	1,900	1,994	2,194	2,358	2,444	2,673	2,829	2,730	2,783	2,790	2,807	2,813	2,832	2,860
	406	424	431	455	470	487	507	504	514	518	544	599	644	667	730	772	745	760	761	766	768	773	781
	2,155	2,188	2,213	2,308	2,382	2,492	2,642	2,712	2,770	2,712	2,715	2,961	3,067	3,045	3,276	3,433	3,565	3,737	3,891	4,009	4,100	4,152	4,228
	588	597	604	630	650	680	721	740	756	740	741	808	837	831	894	937	973	1,020	1,062	1,094	1,119	1,133	1,154
	69.0%	71.0%	71.3%	72.3%	72.3%	71.6%	70.3%	68.1%	68.0%	70.1%	73.4%	74.1%	76.9%	80.3%	81.6%	82.4%	76.6%	74.5%	71.7%	70.0%	68.6%	68.2%	67.6%
	8,202	8,799	9,403	10,033	10,683	11,363	12,084	12,824	13,580	14,320	15,061	15,869	16,706	17,537	18,431	19,368	20,341	21,361	22,423	23,517	24,636	25,769	26,923
	17.1%	18.3%	19.6%	20.9%	22.2%	23.6%	25.2%	26.7%	28.3%	29.8%	31.3%	33.0%	34.8%	36.5%	38.4%	40.3%	42.3%	44.5%	46.7%	48.9%	**51.3%**	53.6%	56.0%
																		[SumCoal.xls]Coal Emissions'!FA94					
																		^					
	4,087	4,176	4,333	4,410	4,485	4,618	4,845	4,959	4,928	5,180	5,244	5,418	5,835	6,027	6,222	6,461	6,606	6,703	6,404	6,268	6,083	6,185	6,355
	1,115	1,140	1,182	1,204	1,224	1,260	1,322	1,353	1,345	1,414	1,431	1,479	1,593	1,645	1,698	1,763	1,803	1,829	1,748	1,711	1,660	1,688	1,734
	5,793	5,786	6,130	6,266	6,471	6,570	6,914	7,134	7,039	7,299	7,310	7,673	8,197	8,428	8,662	8,845	9,003	8,864	8,604	8,691	8,431	8,651	8,963
	1,581	1,579	1,673	1,710	1,766	1,793	1,887	1,947	1,921	1,992	1,995	2,094	2,237	2,300	2,364	2,414	2,457	2,419	2,348	2,372	2,301	2,361	2,446
	70.5%	72.2%	70.7%	70.4%	69.3%	70.3%	70.1%	69.5%	70.0%	71.0%	71.7%	70.6%	71.2%	71.5%	71.8%	73.0%	73.4%	75.6%	74.4%	72.1%	72.1%	71.5%	70.9%
	85,251	86,830	88,503	90,213	91,979	93,772	95,659	97,606	99,527	101,519	103,514	105,608	107,845	110,145	112,509	114,923	117,380	119,799	122,147	124,519	126,820	129,181	131,627
	48.6%	49.5%	**50.5%**	51.4%	52.5%	53.5%	54.6%	55.7%	56.8%	57.9%	59.0%	60.2%	61.5%	62.8%	64.2%	65.5%	66.9%	68.3%	69.7%	71.0%	72.3%	73.7%	75.1%
																		'[SumCement.xls]Process emissions'!BQ36					
																		^					
	12	12	24	35	39	45	50	52	54	59	65	72	81	90	100	115	114	264	287	317	348	376	405
	3	3	7	9	11	12	14	14	15	16	18	20	22	25	27	31	31	72	78	86	95	103	111
	348	352	348	377	396	425	436	440	443	443	458	469	480	502	524	557	572	575	590	612	645	682	722
	95	96	95	103	108	116	119	120	121	121	125	128	131	137	143	152	156	157	161	167	176	186	197
			7.0%	9.2%	10.0%	10.7%	11.5%	11.9%	12.2%	13.2%	14.3%	15.2%	16.9%	17.9%	19.0%	20.6%	19.9%	46.0%	48.6%	51.8%	54.0%	55.2%	56.1%
																		(IH69*HR15/10^3)+(IA69*HR29/10^3)					
																		^					
	120	126	111	129	132	132	134	126	116	106	102	100	99	105	107	114	123	130	130	108	110	115	117
	33	34	30	35	36	36	37	34	32	29	28	27	27	29	29	31	33	35	36	30	30	31	32
	403	392	337	396	381	388	359	315	235	235	213	187	180	169	161	183	150	147	161	128	132	139	139
	110	107	92	108	104	106	98	86	64	64	58	51	49	46	44	50	41	40	44	35	36	38	38
	29.8%	32.1%	33.1%	32.5%	34.7%	34.0%	37.4%	40.1%	49.5%	45.2%	48.0%	53.6%	55.0%	62.3%	66.2%	62.2%	81.6%	88.4%	80.9%	84.5%	83.8%	82.6%	83.8%
																		HR57+HR43+HR15+HR29+HR71					
																		^					
	13,071	13,587	12,867	14,130	14,489	14,658	15,100	14,706	14,062	13,679	13,584	13,829	14,310	14,991	15,502	16,359	16,962	17,703	17,485	15,995	15,978	16,413	16,744
	3,567	3,708	3,511	3,856	3,954	4,000	4,121	4,013	3,838	3,733	3,707	3,774	3,905	4,091	4,231	4,465	4,629	4,831	4,772	4,365	4,361	4,479	4,570
	16,910	16,943	16,841	17,826	18,416	18,640	19,673	19,475	18,874	18,735	18,669	19,358	19,941	20,552	21,084	21,864	22,311	22,538	22,861	22,641	22,619	23,026	23,535
	4,615	4,624	4,596	4,865	5,026	5,087	5,369	5,315	5,151	5,113	5,095	5,283	5,442	5,609	5,754	5,967	6,089	6,151	6,239	6,179	6,173	6,284	6,423
	77.3%	80.2%	76.4%	79.3%	78.7%	78.6%	76.8%	75.5%	74.5%	73.0%	72.8%	71.4%	71.8%	72.9%	73.5%	74.8%	76.0%	78.5%	76.5%	70.6%	70.6%	71.3%	71.1%
																							Carbon Major
																		HQ99+HR85/1000				1994-2010	345,671
																		^					
	189	203	215	230	244	259	274	289	303	316	330	344	358	373	389	405	422	440	457	473	489	505	522
	835	835	835	835	835	835	835	835	835	835	835	835	835	835	835	835	835	835	835	835	835	835	835
	22.6%	24.3%	25.8%	27.5%	29.2%	31.0%	32.8%	34.6%	36.3%	37.9%	39.5%	41.2%	42.9%	44.7%	46.5%	48.5%	**50.5%**	52.7%	54.8%	56.7%	58.6%	60.6%	62.6%
	472	489	506	524	542	561	581	600	619	638	657	676	696	716	737	759	782	804	827	850	872	895	919
	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336
	35.4%	36.6%	37.9%	39.2%	40.6%	42.0%	43.5%	44.9%	46.4%	47.8%	49.2%	**50.6%**	52.1%	53.6%	55.2%	56.9%	58.5%	60.2%	61.9%	63.6%	65.3%	67.0%	68.8%
	1973	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**

Summary of emissions from oil, natural gas, coal, cement production, and flaring

Richard Heede
Climate Mitigation Services

3-Jul-13

dataset marker

	1990s				2000s											Sum 1751 to 2010	
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Million tonnes CO2 & C	
Oil & NGL																	
	7,366	7,590	7,813	7,689	7,939	7,950	7,764	8,229	8,595	8,913	8,606	8,631	8,726	8,478	8,550	Y 365,729	Annual and cumulative Carbon Majors (MtCO2)
	2,010	2,071	2,132	2,098	2,167	2,170	2,119	2,246	2,346	2,433	2,349	2,356	2,382	2,314	2,333	Y 99,812	Annual and cumulative Carbon Majors (MtC)
	9,626	9,904	10,095	9,904	10,326	10,359	10,296	10,754	11,092	11,253	11,286	11,264	11,341	11,091	11,430	Y 472,012	Annual and cumulative global oil emissions (MtCO2)
	2,627	2,703	2,755	2,703	2,818	2,827	2,810	2,935	3,027	3,071	3,080	3,074	3,095	3,027	3,119	Y 128,817	Annual and cumulative global oil emissions (MtC)
	77%	77%	77%	78%	77%	77%	75%	77%	77%	79%	76%	77%	77%	76%	75%	Y 77.48%	Percent of annual CDIAC oil emissions identified
	87,773	90,476	93,231	95,934	98,752	101,579	104,389	107,324	110,351	113,422	116,502	119,576	122,671	125,698	128,817		Global cumulative to date oil emissions (MtCO2)
	68.1%	70.2%	72.4%	74.5%	76.7%	78.9%	81.0%	83.3%	85.7%	88.0%	90.4%	92.8%	95.2%	97.6%	100.0%		Global cumulative to date oil emissions (percent)
Natural Gas																	
	3,051	3,169	3,244	3,331	3,239	3,349	3,469	3,582	3,625	3,769	3,876	3,926	4,108	3,982	4,274	Y 120,113	Annual and cumulative Carbon Majors (MtCO2)
	833	865	885	909	884	914	947	977	989	1,029	1,058	1,071	1,121	1,087	1,166	Y 32,780	Annual and cumulative Carbon Majors (MtC)
	4,426	4,434	4,555	4,654	4,719	4,804	4,932	5,097	5,243	5,397	5,566	5,683	5,921	5,772	6,200	Y 176,055	Annual and cumulative global nat gas emissions (MtCO2)
	1,208	1,210	1,243	1,270	1,288	1,311	1,346	1,391	1,431	1,473	1,519	1,551	1,616	1,575	1,692	Y 48,047	Annual and cumulative global nat gas emissions (MtC)
	68.9%	71.5%	71.2%	71.6%	68.6%	69.7%	70.3%	70.3%	69.1%	69.8%	69.6%	69.1%	69.4%	69.0%	68.9%	Y 68.22%	Percent of annual CDIAC gas emissions identified
	28,131	29,341	30,584	31,854	33,142	34,453	35,799	37,190	38,621	40,094	41,613	43,164	44,780	46,355	48,047		Global cumulative to date nat gas emissions (MtCO2)
	58.5%	61.1%	63.7%	66.3%	69.0%	71.7%	74.5%	77.4%	80.4%	83.4%	86.6%	89.8%	93.2%	96.5%	100.0%		Global cumulative to date nat gas emissions (percent)
Coal																	
	6,388	6,345	6,418	6,515	6,509	6,899	7,206	7,864	8,632	9,134	9,370	9,783	10,463	10,751	11,278	Y 329,604	Annual and cumulative Carbon Majors (MtCO2)
	1,743	1,732	1,751	1,778	1,776	1,883	1,967	2,146	2,356	2,493	2,557	2,670	2,855	2,934	3,078	Y 89,953	Annual and cumulative Carbon Majors (MtC)
	9,062	9,160	8,776	8,633	8,684	9,138	9,252	10,066	10,886	11,586	12,213	12,707	13,110	12,969	13,950	Y 642,500	Annual and cumulative global coal emissions (MtCO2)
	2,473	2,500	2,395	2,356	2,370	2,494	2,525	2,747	2,971	3,162	3,333	3,468	3,578	3,539	3,807	Y 175,346	Annual and cumulative global coal emissions (MtC)
	70.5%	69.3%	73.1%	75.5%	74.9%	75.5%	77.9%	78.1%	79.3%	78.8%	76.7%	77.0%	79.8%	82.9%	80.8%	Y 51.30%	Percent Carbon Majors of global coal emissions
	134,100	136,600	138,995	141,351	143,721	146,215	148,740	151,487	154,458	157,620	160,953	164,421	167,999	171,538	175,346		Global cumulative to date coal emissions (MtCO2)
	76.5%	77.9%	79.3%	80.6%	82.0%	83.4%	84.8%	86.4%	88.1%	89.9%	91.8%	93.8%	95.8%	97.8%	100.0%		Global cumulative to date coal emissions (percent)
Cement																	
	415	426	438	457	470	504	537	613	678	735	838	914	930	1,017	1,106	Y 13,205	Annual and cumulative Carbon Majors (MtCO2)
	113	116	120	125	128	138	147	167	185	201	229	249	254	278	302	Y 3,604	Annual and cumulative Carbon Majors (MtC)
	744	766	766	795	828	868	923	1,011	1,092	1,173	1,301	1,400	1,414	1,509	1,638	Y 32,519	Annual and cumulative global cement emissions (MtCO2)
	203	209	209	217	226	237	252	276	298	320	355	382	386	412	447	Y 8,875	Annual and cumulative global cement emissions (MtC)
	55.8%	55.6%	57.2%	57.5%	56.8%	58.0%	58.2%	60.6%	62.1%	62.7%	64.4%	65.3%	65.7%	67.4%	67.5%	Y 40.61%	Percent Carbon Majors of global cement emissions

Natural gas flaring rate: 1.736 kg CO2 per tCO2

Crude oil flaring rate: 15.94 kg CO2 per tCO2

Flaring

	123	127	130	128	132	133	130	137	143	149	144	144	146	142	144	6,040	Annual and cumulative Carbon Majors (MtCO2)
	33	35	36	35	36	36	35	38	39	41	39	39	40	39	39	1,648	Annual and cumulative Carbon Majors (MtC)
	143	150	136	136	176	169	176	172	202	224	227	249	267	267	267	12,601	Annual and cumulative global flaring (MtCO2)
	39	41	37	37	48	46	48	47	55	61	62	68	73	73	73	3,439	Annual and cumulative global flaring (MtC)
	85.9%	84.2%	96.0%	94.7%	75.2%	78.7%	73.8%	79.8%	71.1%	66.5%	63.4%	58.0%	54.7%	53.1%	53.7%	47.93%	Percent Carbon Majors of global flaring emissions

CDIAC includes vented CO2 in natural gas estimates.

This project estimates vented CO2 from gas operations separately, total: 4 MtCO2

Total including vented CO2: 834,695

Total

	17,342	17,656	18,043	18,120	18,289	18,834	19,107	20,424	21,673	22,700	22,834	23,399	24,374	24,370	25,351	Y 834,691	Annual and cumulative Carbon Majors (MtCO2)
	4,733	4,818	4,924	4,945	4,991	5,140	5,214	5,574	5,915	6,195	6,232	6,386	6,652	6,651	6,919	Y 227,797	Annual and cumulative Carbon Majors (MtC)
	24,000	24,415	24,327	24,121	24,733	25,338	25,580	27,100	28,515	29,632	30,592	31,303	32,054	31,609	33,486	Y 1,335,686	Annual and cumulative global 1751-2010 (MtCO2)
	6,550	6,663	6,639	6,583	6,750	6,915	6,981	7,396	7,782	8,087	8,349	8,543	8,748	8,626	9,139	Y 364,524	Annual and cumulative global 1751-2010 (MtC)
	72.3%	72.3%	74.2%	75.1%	73.9%	74.3%	74.7%	75.4%	76.0%	76.6%	74.6%	74.7%	76.0%	77.1%	75.7%	Y 62.49%	Percent Carbon Majors of global CO2 1751-2010

Global: 463,367 | 74.6%

Billion tonnes CO2

Cumulative

	540	557	575	593	612	630	650	670	692	714	737	761	785	809	835	Y 834.7	Annual Carbon Majors 1854-210
	835	835	835	835	835	835	835	835	835	835	835	835	835	835	835	Y 834.7	Total Carbon Majors 1854-2010
	64.6%	66.8%	68.9%	71.1%	73.3%	75.5%	77.8%	80.3%	82.9%	85.6%	88.3%	91.1%	94.0%	97.0%	100.0%		Percent Carbon Majors of global CO2 1751-2010
	943	967	992	1,016	1,040	1,066	1,091	1,118	1,147	1,177	1,207	1,239	1,271	1,302	1,336	Y 1,335.7	Annual global CO2 1751-2010
	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	Y 1,335.7	Total global CO2 1751-2010
	70.6%	72.4%	74.2%	76.0%	77.9%	79.8%	81.7%	83.7%	85.9%	88.1%	90.4%	92.7%	95.1%	97.5%	100.0%	62.49%	Percent Carbon Majors of global CO2 1751-2010
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010		

Cell: IO19
Comment: Rick Heede:
CDIAC data in million tonnes of carbon converted to CO2, which is 3.664191 times Carbon if carbon and oxygen isotopes are accounted for, per Kevin Baumert May05, then at World resources Institute: CO2 conversion is, precisely: C=12.0107 + O=15.9994 x 2 = 44.0095/12.0107 = 3.664191.

Cell: IO21
Comment: Rick Heede:
From the associated "Methods" paper: CDIAC's emissions are estimated for each fuel using the following formula: CO2 = (P) (FO) (C).

From crude oil and natural gas liquids production in the global-total accounts2
CO2l = CO2 emissions in 106 metric tons of carbon
Pl = annual production or consumption in 106 tons
FOl = 0.918 ± 3%
Cl = carbon content in tons C per ton fuel = 0.85 ± 1%

From primary and secondary liquid fuel production and trade in the national accounts when non-energy liquid products are specifically subtracted3
CO2l = CO2 emissions in 106 metric tons of carbon
Pl = annual production or consumption in 106 tons
FOl = 0.985 ± 3%
Cl = carbon content in tons C per ton fuel = 0.85 + 1%
± 2%.

Boden, T.A., G. Marland, and R.J. Andres. 2009. Global, Regional, and National Fossil-Fuel CO2 Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi 10.3334/CDIAC/00001.

Jan10: CMS added CDIAC extrapolations for gas emissions from their dataset "Preliminary 2007-08 Global & National Estimates by Extrapolation" (undated) to the main file cited above.vede:

Cell: IO33
Comment: Rick Heede:
CDIAC data in million tonnes of carbon converted to CO2, which is 3.664191 times Carbon if carbon and oxygen isotopes are accounted for, per Kevin Baumert May05, then at World resources Institute: CO2 conversion is, precisely: C=12.0107 + O=15.9994 x 2 = 44.0095/12.0107 = 3.664191.

Cell: IO35
Comment: Rick Heede:
From the associated "Methods" paper: CDIAC's emissions are estimated for each fuel using the following formula: CO2 = (P) (FO) (C).

From primary and secondary gas fuel production and trade:
CO2 = CO2 emissions in 10^6 metric tonnes of carbon;
P = annual production or consumption in thousands of 10^12 joules;
FO = 0.98 ± 1%;
C = carbon content in 10^6 tonnes per thousand 10^12 joules = 0.0137 ± 2%.

Boden, T.A., G. Marland, and R.J. Andres. 2009. Global, Regional, and National Fossil-Fuel CO2 Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi 10.3334/CDIAC/00001.

Jan10: CMS added CDIAC extrapolations for gas emissions from their dataset "Preliminary 2007-08 Global & National Estimates by Extrapolation" (undated) to the main file cited above.

Cell: IO47
Comment: Rick Heede:
CDIAC data in million tonnes of carbon converted to CO2, which is 3.664191 times Carbon if carbon and oxygen isotopes are accounted for, per Kevin Baumert May05, then at World resources Institute: CO2 conversion is, precisely: C=12.0107 + O=15.9994 x 2 = 44.0095/12.0107 = 3.664191.

Cell: IO49
Comment: Rick Heede:
From the associated "Methods" paper: CDIAC's emissions are estimated for each fuel using the following formula: CO2 = (P) (FO) (C).

From primary and secondary solid fuel production and trade5
CO2s = CO2 emissions in 106 metric tons of carbon
Ps = annual production or consumption in 106 tons coal equivalent6
FOs = 0.982 ± 2%
Cs = carbon content in tons C per ton coal equivalent = 0.746 ± 2%.

While there is, as Marland et al point out, a strong correlation between heat rate and carbon content and the "C content is quite constant when production is in units of tonnes coal equivalent where 1 tonne coal equivalent is defined as 29.31 10^9 joules." CMS factor of 21 million Btu per short on = 23.15 million Btu/tonne, and the CDIAC datum (29.31 10^9 joules/tonne) = 27.78 million Btu/tonne.

CDIAC uses average carbon content of 74.6 percent per tonne of coal equivalent, whereas CMS uses an average factor of 60.1 percent for utility coal per tonne (albeit not the same eqiuv tonne used by CDIAC; the average utility coal factor CMS applies to coal production when coal rank is not specified).

If we "upgrade" CMS's "average utility coal" to CDIAC's coal equivalent, the CMS carbon factor per tonne of coal becomes 27.78/23.15 = 1.20; 1.20 times the CMS carbon content per tonne of average utililty coal = 601.4 tonne carbon per tonne of coal times 1.2 = 721.7 kgC/tonne, or 0.7217. Compare CDIAC's carbon factor of 0.746 ± 2%, which is 3.4 percent higher than the adjusted CMS factor. In practice, however, for the companies and countries listed in the coal production sheet, and applying the coal ranks when known (and thus a higher proportion of lignite than higher-grade coals on a tonnage basis), the AVERAGE coal contains 0.5733 tonne carbon per tonne produced (20July06: 72,724 million tonnes C / 126,862 million tonnes coal produced = 0.5733). (Note: this is prior to any application of oxidation rate and non-fuel uses.) In sum, CMS may be underestimating the emissions of carbon dioxide by (0.746 - 0.573)/0.573 = 0.302, or 30.2 percent relative to the CDIAC data.

Now, let's compare the annual CDIAC carbon data with EIA's global coal production data as follows:

1990: CDIAC estimates 2,378 million tonnes carbon (MtC) vs EIA coal production of 4,851 million tonnes of coal: 0.4902 tC/tonne coal;

2000: CDIAC estimates 2,214 million tonnes carbon (MtC) vs EIA coal production of 4,473 million tonnes of coal: 0.4950 tC/tonne coal.

In other words, curious results compared to the CDIAC factors discussed above, even though the FO (fuel oxidation rate) factor is not applied to 1990 and 2000; the FO would reduce the carbon emitted from a tonne of coal by 1.8 percent.

Applying CDIAC's formula of CO2 = (P) (FO) (C) without making any adjustment for CDIAC's coal equivalent or fuel oxidation rate for 2000 coal production: CO2 = (4,473 million tonnes of coal produced) * 0.982 * 0.746 = 3,277 million tonnes of carbon; in contrast, CDIAC's estimated emissions = 2,214 MtC. The EIA data includes lignite, sub-bituminous, bituminous, and anthracite coal.

CMS has not resolved this apparent discrepancy between CDIAC emissions estimates from combustion of solid fuels and the EIA coal production data.

Source: Marland, Gregg, Tom Boden, & R. J. Andres (~2005) "Global, Regional, and National Fossil Fuel CO2 Emissions," Carbon Dioxide Information Analysis Center (CDIAC), Oak Ridge National Laboratory, US DOE, http://cdiac.esd.ornl.gov/trends/emis/em_cont.htm

Boden, T.A., G. Marland, and R.J. Andres. 2009. Global, Regional, and National Fossil-Fuel CO2 Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi 10.3334/CDIAC/00001.

Jan10: CMS added CDIAC extrapolations for coal emissions from their dataset "Preliminary 2007-08 Global & National Estimates by Extrapolation" (undated) to the main file cited above.

Cell: IO51
Comment: Rick Heede:
Of CDIAC estimated emissions of carbon dioxide from combustion of coal worldwide 1751-2004, CMS has identified (at this writing, 26Nov06) 47.5 percent from the production of coal by identified producers from 1990 to 2004. Note that CMS has differentiated emissions by rank of coal produced, when company or country production data makes this possible to do.

Cell: IO61

Comment: Rick Heede:
CDIAC data in million tonnes of carbon converted to CO2, which is 3.664191 times Carbon if carbon and oxygen isotopes are accounted for, per Kevin Baumert May05, then at World Resources Institute: CO2 conversion is, precisely: C=12.0107 + O=15.9994 x 2 = 44.0095/12.0107 = 3.664191.

Cell: IO63
Comment: Rick Heede:
From the associated "Methods" paper: CDIAC's emissions methodology is not described.

Boden, T.A., G. Marland, and R.J. Andres. 2009. Global, Regional, and National Fossil-Fuel CO2 Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi 10.3334/CDIAC/00001.

Jan10: CMS added CDIAC extrapolations for gas emissions from their dataset "Preliminary 2007-08 Global & National Estimates by Extrapolation" (undated) to the main file cited above.

Cell: HZ69
Comment: Rick Heede:
CMS reviews numerous estimates of flaring emissions in the oil and gas industries in the worksheets in "AncillaryCH4&CO2.xls".
See "Flaring and Venting" worksheet in the "AncillaryCH4&CO2.xls" workbook for details.

Cell: IG69
Comment: Rick Heede:
Flaring rates are calculated in the worksheet "AncillaryCH4&CO2.xls".
See the "Flaring and Venting" worksheet in the AncillaryCO2CH4.xls workbook.

Cell: IO75
Comment: Rick Heede:
CDIAC data in million tonnes of carbon converted to CO2, which is 3.664191 times Carbon if carbon and oxygen isotopes are accounted for, per Kevin Baumert May05, then at World Resources Institute: CO2 conversion is, precisely: C=12.0107 + O=15.9994 x 2 = 44.0095/12.0107 = 3.664191.

Cell: IO77
Comment: Rick Heede:
Marland, Gregg, & Ralph Rotty (1984) "Carbon dioxide emissions from fossil fuels: a procedure for estimation and results for 1950-1982," Tellus, vol. 36b:232-261.
Fossil fuel, cement, and flaring emissions are estimated in the dataset available at: http://cdiac.ornl.gov/by_new/bysubjec.html#trace
Boden, T.A., G. Marland, and R.J. Andres. 2011. Global, Regional, and National Fossil-Fuel CO2 Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi 10.3334/CDIAC/00001.