

Summary of emissions from identified coal production												
Richard Heede Climate Accountability Institute 16-Oct-20												
Copyright Climate Accountability Institute												
Coal												
Emission factor tCO2/tonne												
thermal coal – average utility coal (USA) lignite, brown, or soft coal sub-bituminous coal bituminous coal anthracite metallurgical												
thermal coal – average utility coal lignite, brown, or soft coal sub-bituminous coal bituminous coal anthracite metallurgical												
Row #												
11 2,129 12 1,203 13 1,814 14 2,439 15 2,622 16 2,665												
Thermal Lignite Sub-bituminous Bituminous Anthracite Metallurgical Total												
Percent Percent Percent Percent Percent Percent Percent												
linked? verified												
Alliance Resource Partners, USA	1			100%			100%	Yes	V	Jan-20		
Anglo American, UK	2	85.7%				14.3%	100%	Yes	V	Jul-19		
Arch Coal Company, USA	3	6.8%	82.2%				11.0%	Yes	V	Jul-19		
British Coal Corporation	4			100.0%			100%	Yes	V	Jul-19		
BP Coal, UK	5	100.0%					100%	Yes	V	Jul-19		
BHP Billiton, Australia	6	65.3%				34.7%	100%	Yes	V	Jul-19		
Chevron Mining	27	100.0%					100%	Yes	V	Jul-19		
China, Peoples Republic	7		5.5%	65.9%	11.8%	16.7%	100%	Yes	V	Jul-19		
Cloud Peak, USA	8		100.0%				100%	Yes	V	Jul-19		
Coal India, India	9	7.4%	88.5%	2.9%		1.2%	100%	Yes	V	Jul-19		
CONSOL Energy / CNX, USA	10			84.1%		15.9%	100%	Yes	V	Jul-19		
Contura Energy / ANR, USA	11			79.2%		20.8%	100%	Yes	V	Jul-19		
Cyprus Amax, USA	12	100.0%					100%	Yes	V	Jul-19		
Czechoslovakia	13		2.8%	89.5%		7.7%	100%	Yes	V	Jul-19		
Czech Republic + Slovakia	14		83.4%	7.8%		8.8%	100%	Yes	V	Jul-19		
Exxon Mobil	15	100.0%					100%	Yes	V	Jul-19		
Exaro, South Africa	16	88.8%				11.2%	100%	Yes	V	Jul-19		
FSU (Former Soviet Union)	17		19.8%	61.8%	8.6%	9.8%	100%	Yes	V	Jul-19		
Glencore, Switzerland	18			89.8%		10.2%	100%	Yes	V	Jul-19		
Kazakhstan	19		5.6%	6.2%	76.7%	11.5%	100%	Yes	V	Jul-19		
Kerr-McGee Coal (Anadarko), USA	20	100.0%					100%	Yes	V	Jul-19		
Kiewit Mining Group, USA	21		10.3%	89.7%			100%	Yes	V	Jul-19		
Murray Coal Corporation, USA	22			100.0%			100%	Yes	V	Jul-19		
North American Coal Corp., USA	23		100.0%				100%	Yes	V	Jul-19		
North Korea	24			11.1%	32.3%	56.6%	100%	Yes	V	Jul-19		
Occidental, USA	25				69.0%		31.0%	Yes	V	Jul-19		
Peabody Energy, USA	26	92.9%				7.1%	100%	Yes	V	Jul-19		
Poland	28		46.3%		45.1%	8.6%	100%	Yes	V	Jul-19		
Rio Tinto, Australia	29			58.7%	34.7%	6.6%	100%	Yes	V	Jul-19		
Ruhrkohle AG (RAG), Germany	30		68.5%			31.5%	100%	Yes	V	Jul-19		
Russian Federation (not including FSU)	31		22.1%		51.3%	4.0%	22.6%	Yes	V	Jul-19		
RWE, Germany	32		100.0%				100%	Yes	V	Jul-19		
Sasol, South Africa	33			100.0%			100%	Yes	V	Jul-19		
Shell Coal (1979-1999)	34	100.0%					100%	Yes	V	Jul-19		
Singareni Collieries Company, India	35		7.4%	88.5%	2.9%	1.2%	100%	Yes	V	Jul-19		
Teck Resources, Canada	36					100.0%	100%	Yes	V	Jun-20		
UK Coal, UK	37			100.0%			100%	Yes	V	Jul-19		
Ukraine	38			0.4%	45.9%	23.4%	30.4%	Yes	V	Jul-19		
Vale, Brazil	39	40.3%				59.7%	100%	Yes	V	Jun-20		
Vistra Energy, USA	40		100.0%				100%	Yes	V	Jul-19		
Westmoreland Coal, USA	41		22.0%	67.1%	10.8%		100%	Yes	V	Jul-19		
Whitehaven Coal, Australia	42	75.0%				25.0%	100%	Yes	V	Jan-20		
Emissions from identified coal prod'n (MtCO2/yr)												
Emissions from identified coal prod'n (MtC/yr)												
CDIAC coal emissions (MtCO2/yr) 1751-2008												
CDIAC coal emissions (MtC/yr) 1751-2008												
Percent of total CDIAC coal emissions identified												
Converted to CO2: 4,595												
CDIAC sum 1751-1849: 1,254												
Converted to CO2: 17,870												
CDIAC sum 1751-1878: 4,877												

	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK
1	Summary of emissions from identified coal production																						
2	Richard Heede																						
3	Climate Accountability Institute																						
4	16-Oct-20																						
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7																							
8	1850s											1860s											
9	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863	1864	1865	1866	1867	1868	1869	1870	1871	
10	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	
11	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	
12	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	
13	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	
14	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	
15	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	
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111	198	198	209	216	253	260	278	282	286	304	333	348	352	377	410	436	447	476	491	520	535	572	
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113	54	54	57	59	69	71	76	77	78	83	91	95	96	103	112	119	122	130	134	142	146	156	
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1	Summary of emissions from identified coal production																									
2	Richard Heerde																									
3	Climate Mitigation Services																									
4	16-Oct-20																									
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8	1870s								1880s										1890s							
9	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	
10	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	
11	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	
12	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	
13	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	
14	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	
15	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	
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107	1	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
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109	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
110	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	1,363	1,440	1,484	
111	173	183	173	187	190	192	194	207	233	239	252	269	271	273	275	287	317	318	345	360	363	358	372	393	405	
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	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	
1	Summary of emissions from identified coal production																									
2																										
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4	Richard Heede Climate Accountability Institute 16-Oct-20																									
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8	1900s													1910s												
9	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	
10	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	2.129	
11	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	1.203	
12	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	1.814	
13	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	2.439	
14	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	2.622	
15	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	2.665	
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107	7	7	8	43	47	50	53	53	52	52	51	50	51	50	50	49	105	103	102	101	99	98	97	95	105	
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109	2	2	2	12	13	14	15	14	14	14	14	14	14	14	14	13	29	28	28	27	27	27	26	26	29	
110																										
111	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	2,598	
112																										
113	425	449	491	515	531	543	593	597	636	680	750	714	747	778	792	834	895	800	784	842	891	873	735	843	709	
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	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	
1	Summary of emissions from identified coal production																									
2	Richard Heede Climate Accountability Institute 16-Oct-20																									
3																										
4																										
5																										
6																										
7																										
8	1920s								1930s										1940s							
9	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	
10	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	
11	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	
12	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	
13	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	
14	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	
15	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	
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22	3	3	4	5	5	6	7	7	7	7	8	8	9	10	10	11	11	12	13	14	15	17	18	19	21	
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55	29	36	44	51	59	66	74	82	89	113	158	194	249	243	282	283	297	368	440	496	551	310	283	327	359	
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102																										
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106																										
107	114	124	134	143	153	163	170	177	184	207	252	288	347	342	384	389	466	545	624	688	751	518	505	578	644	
108																										
109	31	34	36	39	42	44	46	48	50	56	69	79	95	93	105	106	127	149	170	188	205	141	138	158	176	
110	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	
111	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	
112																										
113	4.2%	4.0%	4.4%	4.6%	4.9%	4.9%	5.2%	5.1%	5.8%	7.4%	10.2%	11.1%	12.2%	11.5%	11.7%	11.3%	14.5%	16.2%	16.7%	18.0%	19.3%	13.0%	13.2%	19.2%	20.1%	
114																										
115																										
116																										
117																										
118																										
119																										

	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	
1	Summary of emissions from identified coal production																									
2																										
3																										
4	Richard Heede Climate Accountability Institute [16-Oct-20]																									
5	Copyright Climate Accountability Institute																									
6																										
7																										
8	1940s							1950s							1960s											
9	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	
10	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	
11	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	
12	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	
13	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	
14	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	
15	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	
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22	22	23	25	24	24	25	27	26	27	28	28	31	30	32	32	32	32	33	41	40	38	32	27	29	32	
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25																										
26																										
27	488	504	520	536	538	541	544	546	549	535	521	507	494	480	474	469	464	458	453	433	413	393	373	353	344	
28																										
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34																										
35	57	78	98	119	140	160	267	374	481	587	318	801	907	1,014	606	606	661	705	728	794	551	727	877	1,132	1,139	
36																										
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41	38	40	42	44	46	48	52	56	60	77	82	87	92	96	101	106	111	115	120	125	130	134	137	144	123	
42																										
43	<--- bituminous bituminous & metallurgical --->																									
44																										
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47	41	39	38	41	52	64	76	87	99	111	123	134	146	158	170	180	189	193	188	188	181	187	198	205	210	
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54																										
55	391	458	527	612	627	670	788	899	963	1,056	1,140	1,220	1,246	1,264	1,257	1,274	1,309	1,364	1,423	1,442	1,466	1,465	1,317	1,305	1,346	
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71	9	11	13	15	18	13	13	16	19	22	25	28	31	34	37	41	44	47	50	53	56	59	69	68	52	
72																										
73	7	10	13	16	27	21	16	18	23	43	45	44	51	56	58	64	77	91	96	106	110	114	117	133	110	
74																										
75	130	137	144	152	158	164	171	177	183	189	196	202	208	215	221	228	242	260	267	276	279	293	313	326	339	
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89	4	4	5	5	5	5	5	5	6	6	6	7	7	8	8	9	10	9	10	10	10	10	11	11	10	
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101	8	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	13	13	13	13	19	13	
102																										
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104																										
105																										
106																										
107	1,202	1,319	1,440	1,582	1,654	1,732	1,979	2,227	2,438	2,686	2,519	3,095	3,248	3,401	3,014	3,104	3,234	3,373	3,587	3,696	3,466	3,664	3,722	4,001	3,992	
108																										
109	328	360	393	432	451	473	540	608	665	733	687	845	886	928	823	847	882	920	979	1,009	946	1,000	1,016	1,092	1,089	
110																										
111	3,635	3,719	3,518	3,921	4,137	4,100	4,122	4,089	4,426	4,665	4,796	4,895	4,952	5,141	4,926	4,913	5,113	5,207	5,293	5,341	5,257	5,315	5,516	5,695	5,697	
112																										
113	992	1,015	960	1,070	1,129	1,119	1,125	1,116	1,208	1,273	1,309	1,336	1,352	1,403	1,344	1,341	1,396	1,421	1,445	1,458	1,435	1,451	1,505	1,554	1,555	
114																										
115	33.1%	35.5%	40.9%	40.3%	40.0%	42.3%	48.0%	54.5%	55.1%	57.6%	52.5%	63.2%	65.6%	66.2%	61.2%	63.2%	63.2%	64.8%	67.8%	69.2%	65.9%	68.9%	67.5%	70.3%	70.1%	
116																										
117																										
118																										
119																										

	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	
1	Summary of emissions from identified coal production																											
2																												
3																												
4	Richard Heede Climate Accountability Institute 16-Oct-20																											
5	Copyright Climate Accountability Institute																											
6																												
7																												
8	1970s							1980s										1990s							1990s			
9	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1998
10	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	
11	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	
12	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	
13	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	
14	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	
15	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	
16																												
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22																												
23	34	37	41	45	51	59	73	75	79	79	75	75	81	81	90	94	100	95	96	93	92	100	101	102	107	116	142	
24																												
25	22	24	24	24	22	23	22	47	50	56	55	69	75	70	79	89	102	108	105	105	110	107	123	125	127	186		
26																												
27	334	325	316	307	295	295	292	301	309	303	295	257	104	255	252	243	253	230	223	222	187	137	78					
28																												
29	22	22	18	18	19	19	15	59	44	44	45	44	57	56	59	58	56	55										
30																												
31	17	16	17	15	19	21	23	20	17	21	25	29	41	81	92	91	85	92	89	100	110	125	130	144	112	119	129	
32																												
33	14	16	15	14	15	16	17	18	19	31	27	24	26	26	25	24	25	29	29	29	32	38	38	33	31	30	43	
34																												
35	1,158	1,147	1,209	1,256	1,292	1,337	1,502	1,539	1,507	1,511	1,619	1,736	1,918	2,120	2,173	2,255	2,381	2,562	2,624	2,643	2,713	2,796	3,013	3,307	3,394	3,372	3,237	
36																												
37																												
38	130	138	160	165	159	160	164	172	193	202	212	229	238	256	282	298	317	324	372	391	389	398	416	449	464	467		
39																												
40																												
41	146	136	116	123	125	108	94	113	110	94	105	95	105	96	93	118	123	120	123	124	126	102	158	155	157	163	164	
42																												
43																												
44																												
45	32	32	39	42	47	54	58	67	78	68	75	77	80	74	68	95	97	102	116	119	115							
46																												
47	201	203	206	214	219	226	230	232	251	247	251	258	264	258	257	258	253	242	216	200	186							
48																												
49																												
50																												
51	9	12	15	18	21	24	27	30	33	36	39	44	49	58	62	69	74	84	92	91	71	70	70	31	29	29	30	
52																												
53																												
54	1,495	1,490	1,528	1,565	1,588	1,613	1,615	1,604	1,599	1,565	1,591	1,577	1,590	1,622	1,677	1,696	1,724	1,653	1,786	1,421								
55																												
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61																												
62	11	11	11	11	12	12	12	12	13	13	13	14	14	14	15	15	29	25	27	32	24	24	23	24	25	24		
63																												
64																												
65																												
66																												
67	13	12	11	11	12	10	9	13	14	13	15	16	21	24	26	23	25	25	24	25	27	29	30	29	29	31	35	
68																												
69	52	56	60	64	69	73	77	81	75	78	82	83	85	67	67	66	80	62	82	77	72	67	63	59	52	51	46	
70																												
71	51	52	47	44	40	38	31	45	46	45	48	32	28	32	37	42	46	45	43	40	37							
72																												
73	141	137	134	144	139	129	103	127	116	102	113	105	127	122	131	164	168	180	194	217	240	263	285	305	316	336	350	
74																												
75	369	369	381	399	412	428	441	451	434	375	428	441	456	470	489	502	502	470	406	395	374	374	377	377	379	378	336	
76																												
77	6	6	6	27	30	30	29	38	39	47	38	37	40	50	73	80	82	89	108	113	86	97	137	141	145	175	237	
78																												
79																												
80																												
81																												
82																												
83	113	125	132	130	132	132	130	141	141	143	140	140	144	138	135	128	124	125	124	128	131	122	120	120	123	118	113	
84																												
85	11	11	11	11	12	14	17	20	32	41	68	81	85	86	86	84	86	89	90	91	95	98	99	106	108	118	118	
86																												
87																												
88	19	25	32	38	43	49	49	60	57	64	70	66	62	57	53	49	38	39	41	44	46	46						
89	11	12	13	13	14	15	15	16	17	18	19	20	22	23	25	27	29	30	31	35	36	38	39	41	44	46	46	
90																												
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101	14	14	12	13	12	12	12	12	12	12	13	13	13	13	13	14	14	16	17	16	19	18	19	10	7	11	10	
102																												
103																												
104																												
105																												
106																												
107	4,254	4,394	4,500	4,669	4,763	4,853	5,023	5,255	5,279	5,248	5,518	5,608	5,814	6,245	6,446	6,664	6,914	7,102	7,241	6,942	6,868	6,554	6,700	6,941	6,998	6,986	7,108	
108	1,161	1,199	1,228	1,274	1,300	1,325	1,371	1,434	1,441	1,432	1,506	1,531	1,587	1,704	1,759	1,819	1,887	1,938	1,976	1,895	1,874	1,789	1,829	1,894	1,910	1,907	1,940	
109	5,692	5,854	5,866	5,994	6,262	6,395	6,589	6,837	7,040	6,998	7,125	7,339	7,650	8,206	8,300	8,600	8,893	8,919	8,754	8,676	8,455	8,565	8,613	8,865	9,079	9,037	8,802	
110	1,553	1,598	1,601	1,636	1,709	1,745	1,798	1,866	1,921	1,910	1,944	2,003	2,088	2,240	2,265	2,347	2,427	2,434	2,389	2,368	2,307	2,337	2,351	2,419	2,478	2,466	2,402	
111	74.7%	75.1%	76.7%	77.9%	76.1%	75.9%	76.2%	76.9%	75.0%	75.0%	77.5%	76.4%	76.0%	76.1%	77.7%	77.5%	77.7%	79.6%	82.7%	80.0%	81.2%	76.5%	77.8%	78.3%	77.1%	77.3%	80.8%	
112																												
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119																												

	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH				
1	Summary of emissions from identified coal production																								Carbon coefficient		2.129		Million tonnes CO2 / million tonnes of coal	
2																									(average utility coal, USA)		2.129		Million tonnes CO2 / million tonnes of coal	
3																									CMEs summed to 2018					
4																									sums verified, linked to columns D-J and rows 11-16.					
5																														
6																														
7																														
8	2000s												2010s										Cumulative		Coal					
9	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Million tonnes CO2								
10	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129	2,129									
11	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203	1,203									
12	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814									
13	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439									
14	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622									
15	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665									
16	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665	2,665									
17																														
18																														
19																														
20																														
21	31	30	35	40	42	45	51	52	54	58	57	64	68	77	86	90	91	81	84	89										
22	146	161	171	177	191	198	201	203	205	218	215	218	210	219	218	221	209	158	108	111										
23	232	248	279	268	261	215	245	236	236	244	221	285	255	231	235	235	223	169	172	169										
24																														
25																														
26																														
27																														
28																														
29																														
30																														
31	209	288	293	267	273	287	289	281	290	269	238	240	237	242	256	187	194	178	161	166										
32	29	25	31	27	24	20	20	24	23	21	19	15	8	4																
33	3,315	3,364	3,576	3,768	4,459	5,158	5,748	6,245	6,707	7,056	7,571	8,332	9,148	9,587	9,658	9,414	9,105	8,288	8,563	8,987										
34																														
35																														
36																														
37																														
38																														
39	468	482	503	523	551	582	617	649	682	726	775	775	784	813	831	889	969	996	1,020	1,091										
40	157	156	165	149	136	152	155	151	145	146	129	141	72	62	66	73	66	55	59	15										
41	221	235	249	259	295	274	291	306	306	302	274	269	275	245	196	181	159	28	24	40										
42																														
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48	90	98	99	95	96	96	92	93	92	89	84	82	86	83	74	70	69	68	67	62										
49	33	32	24	6																										
50	33	36	37	40	42	43	44	92	91	99	101	97	88	91	89	91	97	96	101	105										
51	100	102	101	174	148	148	152	189	204	210	209	197	210	325	340	360	324	307	297	319										
52	137	176	180	167	190	196	195	228	231	233	238	261	274	284	282	269	253	243	265	278										
53	25	24	24	24	21	48	46	36	60	56	53	53	48	36	32	28	26	19	31	29										
54	33	36	35	44	43	48	44	45	61	58	56	55	59	65	144	139	123	102	101	103										
55	34	34	34	37	39	38	38	39	37	37	37	37	30	31	33	32	33	35	41	42										
56	52	56	57	54	55	56	60	61	60	62	63	80	75	75	74	76	68	77	54	54										
57	364	347	381	389	399	446	472	488	464	502	479	483	450	450	437	451	420	353	372	358										
58	321	305	307	304	307	305	299	293	273	270	254	250	261	271	268	257	255	246	239	231										
59	290	274	311	311	310	329	321	339	325	335	292	152	66	67	73	68	63	62	49	14										
60	65	63	61	59	57																									
61	523	534	552	528	571	576	629	633	643	678	614	664	657	732	778	794	826	853	907	981										
62	112	113	116	118	118	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105										
63	124	125	126	125	127	116	113	106	104	95	95	104	94	98	98	97	100	103	92	91										
64	36																													
65	47	54	55	60	61	63	65	68	73	80	91	92	94	96	91	94	109	110	111	116										
66	10	15	21	18	27	29	28	26	28	36	50	62	61	66	68	71	67	74	71	70										
67	55	51	54	53	46	35	25	24	20	19	17	18	18	15	12	10	5													
68	160	159	157	157	164	152	154	157	164	164	152	147	160	167	164	117	88	91	87	88										
69																														
70																														
71	31	28	25	26	27	26	27	25	24	25	25	30	35	34	32	32	32	26	27	15										
72	9	42	32	41	44	46	48	47	48	46	38	47	35	34	66	71	84	87	63	53										
73																														
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107	7,493	7,696	8,093	8,319	9,136	9,846	10,586	11,256	11,783	12,267	12,729	13,539	14,158	14,798	14,995	14,715	14,339	13,178	13,441	13,932										
108																														
109	2,045	2,100	2,209	2,270	2,493	2,687	2,889	3,072	3,216	3,348	3,474	3,695	3,864	4,039	4,092	4,016	3,913	3,596	3,668	3,802										
110	8,738	9,060	9,108	9,499	10,274	10,947	11,615	12,274	12,864	13,360	13,201	14,005	14,884	15,044	14,932	14,938	14,642	14,442	14,484	14,681										
111	2,385	2,473	2,486	2,593	2,804	2,988	3,170	3,350	3,511	3,646	3,603	3,822	4,062	4,106	4,075	4,077	3,996	3,941	3,953	4,007										
112																														
113	85.7%	84.9%	88.9%	87.6%	88.9%	89.9%	91.1%	91.7%	91.6%	91.8%	96.4%	96.7%	95.1%	98.4%	100.4%	98.5%	97.9%	91.3%	92.8%	94.9%										
114																														
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Cell: F22

Comment: Rick Heede:
We have calculated carbon coefficients for various coal ranks in the attached worksheet ("Coal C Coefficients") and here apply the coefficient for "average utility coal," which comprises the bulk of the coal mined by the identified coal operators. Where information on coal types and ranks is available in company annual reports, each coal rank and amounts produced are listed in separate columns, permitting more precise estimation of the amount of carbon dioxide emitted by the coal's combustion.
EPA (2011) "Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2010," Annex B, Table B2 and Annex 4 (PCC Reference Approach for Estimating CO2 Emissions from Fossil Fuel Combustion: Tables 4-2 and 4-4. Also see citations and calculations at "Coal Carbon Coefficients" worksheet.

Cell: L18

Comment: Rick Heede:
Are the coal-type percentages linked to each entity's worksheet? And verified?

Cell: E23

Comment: Rick Heede:
Since Anglo apparently started mining metallurgical coal in 1974, CMS applies the average metallurgical to thermal coal factor to 1974-2004 only; prior years are applied the thermal coal factor.

Cell: G35

Comment: Rick Heede:
CAI updated China's coal production from subbituminous to bituminous, per EIA coal production data (for China, specifically), April 2019, based on revised production by coal rank; production of lignite, anthracite, and metallurgical coal are unchanged. See notes in China / Coal production worksheet.
This revision increased China's coal emissions by 20.4%.

Cell: GG35

Comment: Rick Heede:
CAI updated China's coal production from subbituminous to bituminous, April 2019, based on revised production by coal rank. See notes in China / Coal production worksheet.
This revision increased China's coal emissions by 20.4%, from 159.4 GtCO2 through 2016 data to 191.8 GtCO2.

Cell: GG57

Comment: Rick Heede:
Note: CAI does not add emissions from crude oil production (de minimus, at 5-11 Mb/yr).

Cell: GG111

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: $C=12.0107 + O=15.9994 \times 2 = 44.0095/12.0107 = 3.664191$.

Cell: GB113

Comment: Rick Heede:
January 2020: Linked to data in GCP / CDIAC Global CO2 1751-2018.xls. Note revisions of previous years for China from 1990-, flaring revisions, and cement corrections to 1930 (previously entered). Sums 1751-2018 verified. Linked to CDIAC global 1751-2018.xls (last updated Jan20).

Cell: GG113

Comment: Rick Heede:
From the associated "Methods" paper: CDIAC's emissions are estimated for each fuel using the following formula: $CO_2 = (P) (FO) (C)$.
From primary and secondary solid fuel production and trade5
 $CO_2s = CO_2$ emissions in 106 metric tons of carbon
 $Ps =$ annual production or consumption in 106 tons coal equivalent6
 $FOs = 0.982 \pm 2\%$
 $Cs =$ carbon content in tons C per ton coal equivalent = $0.746 \pm 2\%$.
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 equiv 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 utility 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 $0.746 \pm 2\%$, 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 2,14 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 $CO_2 = (P) (FO) (C)$ without making any adjustment for CDIAC's coal equivalent or fuel oxidation rate for 2000 coal production: $CO_2 = (4,473 \text{ million tonnes of coal produced}) \times 0.982 \times 0.746 = 3,277$ 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.
June 2018: replaced the CDIAC data with revised data set (CDIAC and Global Carbon Project and le Quere et al. 2017) with dsata through 2016.
Sources: Cite as: Boden, T. A., Marland, G., and Andres, R. J.: Global, Regional, and National Fossil-Fuel CO2 Emissions, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A., doi 10.3334/CDIAC/00001_V2017, 2017; available at: http://cdiac.ess-dive.lbl.gov/trends/emis/overview_2014.html
Also see globalcarbonproject.org, 2017 Carbon Budget.

Cell: GG115

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: GH117

Comment: Rick Heede:

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Cell: GG118

Comment: Rick Heede:

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