

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1		Emissions		Summary of emissions from identified gas production																			
2				Richard Heede Climate Accountability Institute 15-Oct-20																			
3				Copyright Climate Accountability Institute																			
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							
13																							
14																							
15																							
16																							
17																							
18																							
19																							
20																							
21																							
22																							
23																							
24																							
25																							
26																							
27																							
28																							
29																							
30																							
31																							
32																							
33																							
34																							
35																							
36																							
37																							
38																							
39																							
40																							
41																							
42																							
43																							
44																							
45																							
46																							
47																							
48																							
49																							
50																							
51																							
52																							
53																							
54																							
55																							
56																							
57																							
58																							
59																							
60																							
61																							
62																							
63																							
64																							
65																							
66																							
67																							
68																							
69																							
70																							
71																							
72																							
73																							
74																							
75																							
76																							
77																							
78																							
79																							
80																							
81																							
82																							
83																							
84																							
85																							
86																							
87																							
88																							
89																							
90																							
91																							
92																							
93																							
94																							
95																							
96																							
97																							
98																							
99																							
100																							
101																							
102																							
103																							
104																							
105																							
106																							
107																							
108																							
109																							
110																							
111																							
112																							
113																							
114																							
115																							
116																							
117																							
118																							
119																							
120																							
121																							
122																							
123																							
124																							
125																							
126																							
127																							
128																							
129																							
130																							
131																							
132																							
133																							
134																							
135																							
136																							
137																							
138																							
139																							
140																							
141																							
142																							
143																							
144																							
145																							
146																							
147																							
148																							
149																							
150																							
151																							
152																							
153																							
154																							
155																							
156																							
157																							
158																							
159																							
160																							
161																							
162																							
163																							
164																							
165																							
166																							
167																							
168																							
169																							
170																							
171																							
172																							
173																							
174																							
175																							
176																							
177																							

	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1	Summary of emissions from identified gas production																							
2																								
3																								
4	Richard Heede Climate Mitigation Services 16-Oct-20																							
5																								
6																								
7																								
8	1890s					1900s										1910s								
9	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918
11	0.0534	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343
12																								
14																								
16																								
18																								
20																								
22																								
24																								
26																								
28																								
30																								
32																								
34																								
36																								
38																								
40																								
42																								
44																								
46																								
48																								
50																								
52																								
54																								
56																								
58		0.5	0.7	0.8	0.9	1.0	1.2	1.5	1.6	1.6	1.9	2	2	2	2	2	2	2	2	2	3	3	3	
60																								
62																								
64																								
66																								
68																								
70																								
72																								
74																								
76																								
78																								
80																								
82																								
84																								
86																								
88																								
90																								
92																								
94																								
96																								
98																								
100																								
102																								
104																								
106																								
108																								
110																								
112																								
114																								
116																								
118																								
120																								
122																								
124																								
126																								
128																								
130																								
132																								
134																								
136																								
138																								
140																								
142																								
144																								
146																								
148																								
150																								
152																								
154																								
156																								
158																								
160																								
162																								
164	0.5	0.7	0.8	0.9	1.0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3		
165																								
167	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
169	7	7	7	7	11	11	15	15	15	15	18	18	18	18	22	26	26	29	29	29	33	37	40	37
170																								
171	2	2	2	2	3	3	4	4	4	4	5	5	5	5	6	7	7	8	8	8	9	10	11	10
173	0.0%	0.0%	0.0%	0.0%	0.0%	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%
174																								
176																								
177																								

	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT
1	Summary of emissions from identified gas production																								
2																									
3																									
4																									
5																									
6																									
7																									
8	1920s												1930s						1940s						
9	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943
10	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343
11																									
12																									
13																									
14																									
15																									
16																									
17																									
18																									
19																									
20																									
21																									
22																									
23																									
24																									
25																									
26																									
27																									
28																									
29																									
30																									
31																									
32																									
33																									
34																									
35																									
36																									
37																									
38																									
39																									
40																									
41																									
42																									
43																									
44																									
45																									
46																									
47																									
48																									
49																									
50																									
51																									
52																									
53																									
54																									
55																									
56																									
57																									
58	3	3	3	3	4	5	5	5	6	6	8	8	7	6	6	7	8	9	12	8	11	12	13	14	16
59																									
60																									
61																									
62																									
63																									
64																									
65																									
66																									
67																									
68																									
69																									
70																									
71																									
72																									
73																									
74																									
75																									
76																									
77																									
78																									
79																									
80																									
81																									
82																									
83																									
84																									
85																									
86																									
87																									
88																									
89																									
90																									
91																									
92																									
93																									
94																									
95																									
96																									
97																									
98																									
99																									
100																									
101																									
102																									
103																									
104																									
105																									
106																									
107																									
108																									
109																									
110																									
111																									
112																									
113																									
114																									
115																									
116																									
117																									
118																									
119																									
120																									
121																									
122																									
123																									
124																									
125																									
126																									
127																									
128																									
129																									
130																									
131																									
132																									
133																									
134																									
135																									
136																									
137																									
138																									
139																									
140																									
141																									
142																									
143																									
144																									
145																									
146																									
147																									
148																									
149																									
150																									
151																									
152																									
153																									
154																									
155																									
156																									
157																									
158																									
159																									
160																									
161																									
162																									
163																									
164	3	3	3	3	4	5	5	10	11	12	14	18	18	19	20	22	25	29	35	31	36	42	47	49	53
165																									
166	1	1	1	1	1	1	1	3	3	3	4	5	5	5	6	6	7	8	10	8	10	11	13	13	15
167																									
168	37	40	37	40	51	59	62	70	77	84	103	103	92	88	92	103	110	125	139	136	139	154	154	165	183
169																									
170	10	11	10	11	14	16	17	19	21	23	28	28	25	24	25	28	30	34	38	37	38	42	42	45	50
171																									
172	7.9%	7.8%	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%	23.0%	23.6%	25.3%	22.8%	25.6%	27.3%	30.4%	29.6%	29.1%
173																									
174																									
175																									
176																									
177																									

	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
1	Summary of emissions from identified gas production																											
2																												
3																												
4	Richard Heede Climate Accountability Institute 15-Oct-20																											
5	Copyright Climate Accountability Institute																											
6																												
7																												
8	1940s							1950s							1960s													
9	1944	1945	1946	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	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343	0.05343
11																												
12																												
13																												
14																												
15																												
16																												
17																												
18																												
19																												
20																												
21																												
22																												
23																												
24																												
25																												
26																												
27																												
28	4	4	5	5	7	9	10	13	15	18	19	21	26	29	30	33	42	45	49	53	61	66	71	76	82	94	99	102
29																												
30																												
31																												
32																												
33																												
34	13	14	14	16	20	21	26	29	31	38	45	55	59	67	73	81	93	102	113	122	134	145	167	186	205	225	245	251
35																												
36																												
37																												
38	17	18	24	25	27	28	43	51	52	52	54	56	62	66	67	74	75	76	78	79	82	81	81	79	80	82	85	86
39																												
40																												
41																												
42																												
43																												
44																												
45																												
46																												
47																												
48																												
49																												
50																												
51	0.6	1.4	2.2	3.8	5.1	6.3	7.8	8.8	9.1	11	12	13	13	13	14	14	16	17	18	21	23	23						
52																												
53																												
54																												
55																												
56																												
57																												
58	17	18	19	23	25	28	33	36	40	44	46	50	53	57	58	62	66	69	78	82	93	107	122	133	155	181	209	234
59																												
60																												
61																												
62																												
63																												
64																												
65																												
66																												
67																												
68																												
69																												
70																												
71																												
72																												
73																												
74																												
75																												
76																												
77																												
78																												
79																												
80																												
81																												
82																												
83																												
84																												
85																												
86																												
87																												
88																												
89																												
90																												
91																												
92																												
93																												
94																												
95																												
96																												
97																												
98																												
99																												
100																												
101																												
102																												
103																												
104																												
105																												
106																												
107																												
108																												
109																												
110																												
111																												
112																												
113																												
114																												
115																												
116																												
117																												
118																												
119																												
120																												
121																												
122																												
123																												
124																												
125																												
126																												
127																												
128																												
129																												
130	8	8	9	10	10	11	12	13	14	15	16	17	18	19	19	21	24	26	31	35	39	42	48	56	68	82	97	104
131																												
132																												
133																												
134																												
135																												
136																												
137																												
138																												
139																												
140																												
141																												
142																												
143																												
144																												
145																												
146																												
147																												
148																												
149																												
150																												
151																												
152																												
153																												
154																												
155																												
156																												
157																												
158																												
159																												
160																												
161																												
162																												
163																												
164	58	62	70	79	89	99	127	146	158	174	190	210	257	290	330	388	440	492	553	614	682	752	835	939	1,027	1,132	1,260	1,324
165																												
166	16	17	19	22	24	27	35	40	43	48	52	57	70	79	90	106	120	134	151	167	186	205	228	256	280	309	344	361
167																												
168	198	216	224	246	278	297	355	421	454	480	506	550	590	652	704	759	835	882	968	1,049	1,155	1,233	1,342	1,436	1,562	1,712	1,794	1,936
169																												
170	54	59	61	67	76	81	97	115	124	131	138	150	161	178	192	207	228	241	264	286	315	337	366	392	426	467	490	528
171																												
172	29.5%	28.6%	31.5%	32.2%	32.1%	33.4%	35.8%	34.7%	34.8%	36.3%	37.6%	38.2%	43.5%	44.5%	46.9%	51.2%	52.7%	55.7%	57.1%	58.5%	59.0%	61.0%	62.2%	65.4%	65.7%	66.1%	70.2%	68.4%
173																												
174																												
175																												
176																												
177																												

Summary of emissions from identified gas production. CO2 Coefficient: 0.053434. Million tonnes CO2/Billion cubic feet (MtCO2/Bcf). Includes columns for years 1999-2018 and cumulative totals. Lists companies like Abu Dhabi National Oil (ADNOC), Anadarko, and others.

Cell: EP2

Comment: Rick Heede:
See the "Gas Emissions Factor Calc" worksheet for details, which accounts for carbon content, heating values, and final emission factor per billion cubic feet (Bcf) of gas production, including deducting for non-energy uses of natural gas (see "non-energy uses" worksheet). Ancillary emissions of fugitive methane, vented CO2, and CO2 from flaring are estimated and applied in the summary entity worksheet.

Cell: C14

Comment: Rick Heede:
ADNOC details both gas production and utilization rates from 1974 through 1994 in its annual reports; see ADNOC gas production worksheet for details.

Cell: C20

Comment: Rick Heede:
CMS estimated the CO2-equivalent of Apache Corporation's 1981-1983 gas blow-out (assuming all of the gas was vented and none of it was flared). The company reported a blow rate of 35 million cf per day, which we use as the average over the sixteen month event: 35 million cf/d = 0.0168 Tcf over 30d*16months = 0.01858 Qbtu (at 1,106 Btu per cf for wet gas), which, at 14.92 Mtc/Qbtu, equals 0.2772 MTC (1.01581 MtCO2) and thus (at CH4 at 23xCO2) = 6.3762 MTC-eq (23.3636 MtCO2-eq). This represents a significant additional impact of Apache's total estimated emissions from natural gas and oil production. See cell comment at Apache Corporation worksheet for details.

This amount is added to Apache's estimated emissions in 1982.

Cell: EV20

Comment: Rick Heede:
26Jan06 estimate of the CO2-equiv of the Apache's blow-out (assuming none of it was flared, and using only 50 percent of the 35 million cf per day): 17.5 Mcf = 0.0084 Tcf over 30d*16 months = 0.00929 Qbtu (at 1,106 Btu per cf for wet gas), which, at 14.92 Mtc/Qbtu, equals 0.139 MTC (0.508 MtCO2) and thus (at CH4 at 23xCO2) = 3.19 MTC-eq (11.7 MtCO2-eq). These emissions are NOT included in this summary.

Cell: EV22

Comment: Rick Heede (Jan10):
Bahrain: Banagas annual emissions of CO2-equivalent if the reported 3 million SCM per of natural gas vented to the atmosphere (prior to 1979 only) is estimated by CMS to total 56.3 million tonnes of CO2e per year (MtCO2e/yr). If the natural gas (assumed to be all methane, since CMS does not have data on entrained CO2 and other entrained gases) is assumed to be flared rather than vented, then emissions would total 2.25 MtCO2/yr.

Cell: EV169

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: EQ171

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: EV171

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.
Updated emissions data for 2011-2013 from Global Carbon Project/CDIAC Global emissions 1959-2013, on 22Sep14.

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: EV176

Comment: Rick Heede:

Intentionally left blank

Page Intentionall Left Blank.

Cell: EW176

Comment: Rick Heede:

Intentionally left blank

Page Intentionall Left Blank.