

	CE	CF	CG	CH	CI	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	DI	DJ	DK	DL	DM	DN	DO	DP	DQ
1																																							
2	ve methane										Entity emissions from combustion, venting, flaring, and fugitive methane																												
3																																							
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5																																							
6																																							
7	BHP Billiton, Australia										BHP Billiton, Australia																												
8																																							
9																																							
10						1930s					1930s					1940s					1950s					1960s													
11	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
12																																							
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48	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	5,383	5,199	5,976	6,475	6,577	6,742	6,834	7,490	7,977	8,318	8,538	8,857	9,345	9,366	9,699	10,248	10,781
49	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	1,469	1,419	1,631	1,767	1,795	1,840	1,865	2,044	2,177	2,270	2,330	2,417	2,550	2,556	2,647	2,797	2,942
50																																							
51	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.07%	0.09%	0.09%	0.09%	0.09%	0.09%	0.10%	0.10%	0.10%
52																																							
53																																							
54	21.2	23.0	22.8	24.4	22.3	19.9	17.9	18.8	20.4	21.0	23.3	24.8	23.4	24.8	26.2	27.0	27.0	27.4	26.9	23.5	24.7	27.6	29.2	28.1	30.4	32.2	32.7	33.1	33.1	35.9	38.4	39.7	40.9	42.7	44.6	44.3	45.1	47.1	49.4
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Entity emissions from combustion, venting, flaring, and fugitive methane

Richard Heede
Climate Accountability Institute
18-Oct-20

BHP Billiton, Australia

	FE	FF	FG	FH	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	GI	GJ	GK	GL					
1																																							
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9																																							
10	2000s										2010s										Cumulative																		
11	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	MtCO2e		Entity emissions											Cumulative		Cumulative		Cumulative		Cumulative		
12	(except where noted)																		(V = verified)													(except where noted)		(except where noted)		(except where noted)		(except where noted)	
13																																							
14																																							
15	19	23	21	21	26	29	36	34	32	33	39	46	43	36	32	to 2018		Entity CO2 emissions		kg CO2/tCO2		to 2015		to 2016		to 2017		to 2018											
16	17	19	19	19	20	19	20	22	44	47	48	42	40	36	34	V	1,526	Oil & NGLs		MtCO2	linked	1,415		1,458		1,494		1,526											
17	287	289	281	290	269	238	240	237	242	256	187	194	178	161	166	V	6,807	Natural Gas		MtCO2	linked	583		623		659		693											
18	324	330	322	331	314	286	295	292	317	336	274	282	261	233	232	V	9,026	Coal		MtCO2	linked	6,301		6,480		6,641		6,807											
19																			V		9,026		Combustion total		MtCO2	sum	8,300		8,561		8,794		9,026						
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	Oil & NGLs: Venting		MtCO2	calculated	3.83	linked	5		6		6		6										
21	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	24	Oil & NGLs: Flaring		MtCO2	calculated	15.94	linked	23		23		24		24										
22	1	1	1	1	1	1	1	1	3	3	3	2	2	2	2	40	Own fuel use		MtCO2	calculated	57.26	linked	33		36		38		40										
23	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20	Natural Gas: Venting		MtCO2	calculated	28.53	linked	17		18		19		20										
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Natural Gas: Flaring		MtCO2	calculated	1.74	linked	1		1		1		1										
25	2	2	2	2	2	2	2	3	4	5	5	5	4	4	4	91	Venting & Flaring total		MtCO2	sum	79		83		87		91												
26																																							
27																																							
28																																							
29	326	332	324	333	316	288	298	295	322	341	279	287	266	236	236	-	Cement		MtCO2	linked																			
30																			V		9,117		Total CO2 emissions		MtCO2	sum	row 18+24+26		8,379		8,644		8,881		9,117				
31																																							
32																																							
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	Entity methane emissions		kg CH4/tCO2		to 2015		to 2016		to 2017		to 2018												
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	Methane: Oil & NGLs		MtCH4	calculated	1.92	linked	3		3		3		3										
35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	27	Methane: Natural Gas		MtCH4	calculated	9.88	linked	6		6		7		7										
36	1.4	1.4	1.4	1.4	1.3	1.2	1.2	1.2	1.5	1.6	1.3	1.3	1.2	1.1	1.1	V	37	Methane: Coal		MtCH4	calculated	4.03	linked	25		26		27		27									
37																			V		37		Total methane emissions		MtCH4	sum	34		35		36		37						
38																																							
39	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	82	Entity methane emissions		GWP		to 2015		to 2016		to 2017		to 2018												
40	5	5	5	5	5	5	5	6	12	13	13	12	11	10	9	192	Methane: Oil & NGLs		MtCO2e	calculated	28	linked	76		79		80		82										
41	32	33	32	33	30	27	27	27	27	29	21	22	20	18	19	769	Methane: Natural Gas		MtCO2e	calculated	28	linked	161		172		182		192										
42	38	39	38	39	37	34	34	35	41	44	36	36	33	30	30	V	1,043	Methane: Coal		MtCO2e	calculated	28	linked	712		732		750		769									
43																			V		1,043		Total methane emissions		MtCO2e	sum	per IPCC SAR)		949		983		1,013		1,043				
44																																							
45	364	371	362	372	353	322	332	329	363	384	315	323	299	266	266	V	10,159	Total attributed emissions		MtCO2e	sum	9,328		9,627		9,894		10,159											
46																																							
47	28,308	29,264	30,231	31,135	31,854	31,414	33,018	34,136	34,660	34,825	35,089	35,106	35,251	35,681	36,443	V	1,612,851	CDIAC CO2 emissions		MtCO2	1,505,476		1,540,727		1,576,408		1,612,851												
48	7,726	7,986	8,250	8,497	8,693	8,573	9,011	9,316	9,459	9,504	9,576	9,581	9,620	9,738	9,946	V	440,166	Oil, Natural Gas, Coal, Flaring, & Cement		Mt Carbon																			
49																			CDIAC sums December 2019		0.57%		Entity percent of total CO2 emissions		Percent	0.56%		0.56%		0.56%		0.57%							
50																																							
51	1.15%	1.13%	1.07%	1.07%	0.99%	0.92%	0.90%	0.86%	0.93%	0.98%	0.79%	0.82%	0.75%	0.66%	0.65%	V	6,971	CDIAC/EDGAR methane		Tg CH4	6,610		6,728		6,848		6,971												
52																																							
53	91.7	94.7	98.4	99.5	101.2	99.9	105.1	109.5	113.4	115.2	118.2	117.8	118.4	120.0	122.7	V	0.53%	Entity percent of total CH4 emissions		Percent	0.51%		0.52%		0.53%		0.53%												
54	1.49%	1.47%	1.39%	1.41%	1.31%	1.21%	1.17%	1.13%	1.30%	1.35%	1.10%	1.09%	1.01%	0.89%	0.87%																								
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Cell: FY48**Comment:** Rick Heede:

CAI compares entity emissions to the CDIAC / Global Carbon Project (www.globalcarbonproject.org) annual estimate of carbon dioxide emissions from fossil fuels and cement production. The CAI Carbon Majors methodology is based on the CDIAC methodology; see: Heede, Richard (2019) Carbon Majors: Accounting for carbon and methane emissions 1854-2010 Methods & Results Report, ISBN 978-3-659-57841-0, OmniScriptum, Riga, 148 pp.

Reference of the full global carbon budget 2019: Pierre Friedlingstein, Matthew W. Jones, Michael O'Sullivan, Robbie M. Andrew, Judith Hauck, Glen P. Peters, Wouter Peters, Julia Pongratz, Stephen Sitch, Corinne Le Quééré, Dorothee C. E. Bakker, Josep G. Canadell, Philippe Ciais, Rob Jackson, Peter Anthoni, Leticia Barbero, Ana Bastos, Vladislav Bastrikov, Meike Becker, Laurent Bopp, Erik Buitenhuis, Naveen Chandra, Frédéric Chevallier, Louise P. Chini, Kim I. Currie, Richard A. Feely, Marion Gehlen, Dennis Gillilan, Thanos Gkritzalis, Daniel S. Goll, Nicolas Gruber, Sören Gutekunst, Ian Harris, Vanessa Haverd, Richard A. Houghton, George Hurtt, Tatiana Ilyina, Atul K. Jain, Emilie Joetzjer, Jed O. Kaplan, Etsushi Kato, Kees Klein Goldewijk, Jan Ivar Korsbakken, Peter Landschützer, Siv K. Lauvset, Nathalie Lefèvre, Andrew Lenton, Sebastian Lienert, Danica Lombardozzi, Gregg Marland, Patrick C. McGuire, Joe R. Melton, Nicolas Metz, David R. Munro, Julia E. M. S. Nabel, Shin-Ichiro Nakaoka, Craig Neill, Abdirahman M. Omar, Tsunee Ono, Anna Peregon, Denis Pierrot, Benjamin Poulter, Gregor Rehder, Laure Resplandy, Eddy Robertson, Christian Rödenbeck, Roland Séférian, Jörg Schwinger, Naomi Smith, Pieter P. Tans, Hanqin Tian, Bronte Tilbrook, Francesco N Tubiello, Guido R. van der Werf, Andrew J. Wiltshire, Sonke Zaehle. Global Carbon Budget 2019, Earth Syst. Sci. Data, 2019. <https://doi.org/10.5194/essd-11-1783-2019>

See also: Gillilan, D., Marland, G., Boden, T. and Andres, R.: Global, Regional, and National Fossil-Fuel CO2 Emissions.

Cell: FY54**Comment:** Rick Heede:

This study's total fugitive and vented methane from oil and natural gas systems and coal mining are summed here and compared to CDIAC's estimate for 1860 to 1969 (Stern & Kaufmann, 1998). CAI uses revised data from EDGAR for 1970-2015, with extrapolation by CAI for 2016-2018 (based on growth of emissions from oil, gas, and coal production). There is a non-linearity at 1969/1970 btw datasets.

Methane emissions may be revised if a more comprehensive and integrated dataset becomes available.

Furthermore, the Stern & Kaufman does not estimate methane emissions from oil (only gas-related CH4). The most recent EDGAR Nov19 datasets aggregate methane emissions from the Oil & Gas sector. CAI disaggregates methane from oil and methane from gas on the basis of an earlier EDGAR dataset 1970-2008 that reports CH4 from oil and gas separately. CAI uses this average allocation of ~69.5% from gas and ~30.5% from oil to estimate methane emissions from both sectors. This, given the fluctuations of methane emissions --the proportion from natural gas increases over time (from 50% in 1970 to 76% in 2008) -- this disaggregation is only approximate.

Stern, David I., & Robert K. Kaufmann (1998) "Annual Estimates of Global Anthropogenic Methane Emissions: 1860-1994," in Trends Online: A Compendium of Data on Global Change, Carbon Dioxide Information Analysis Center, Oak Ridge National Lab., U.S. DOE, Oak Ridge, Tenn., U.S.A. <http://cdiac.esd.ornl.gov/trends/meth/ch4.htm#flaring>

Crippa, M., G. Oreggioni, D. Guizzardi, M. Muntean, E. Schaaf, E. Lo Vullo, E. Solazzo, F. Monforti-Ferrario, J.G.J. Olivier, & E. Vignati (2019) Fossil CO2 and GHG emissions of all world countries - 2019 Report, Publications Office of the European Union, Luxembourg. ISBN 978-92-76-11100-9. https://edgar.jrc.ec.europa.eu/overview.php?VP_GHG