

	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		
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2	ve methane										Entity emissions from combustion, venting, flaring, and fugitive methane																														
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7	RWE Energy, Germany										RWE Energy, Germany																														
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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		
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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%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
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

RWE Energy, Germany

	DR	DS	DT	DU	DV	DW	DX	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	EZ	FA	FB	FC	FD			
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10	1960s					1970s					1980s										1990s					1990s																
11	1965	1966	1967	1968	1969	1970	1971	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	1999	2000	2001	2002	2003			
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16																																										
17	96	101	100	108	112	113	109	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	112	113	116	118	118			
18	96	101	100	108	112	113	109	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	112	113	116	118	118			
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22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
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29	96	101	100	108	112	113	109	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	112	113	116	118	118			
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34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
36	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
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40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	11	11	11	12	13	13	12	13	14	15	15	15	15	15	16	16	16	16	16	16	16	15	14	14	14	14	14	15	14	14	14	14	13	13	13	13	13	13	13	13		
42	11	11	11	12	13	13	12	13	14	15	15	15	15	15	16	16	16	16	16	16	16	15	14	14	14	14	14	15	14	14	14	14	13	13	13	13	13	13	13	13		
43																																										
44																																										
45	107	112	111	121	124	126	122	126	139	147	145	147	147	145	157	157	159	155	155	161	154	150	142	138	139	138	142	146	135	134	134	137	131	126	125	126	129	131	131			
46																																										
47																																										
48	11,282	11,807	12,184	12,849	13,705	14,840	15,440	16,158	17,016	16,943	16,921	17,819	18,308	18,979	19,485	19,392	18,865	18,725	18,903	19,453	20,146	20,433	21,095	21,902	22,232	22,547	23,032	22,313	22,580	22,742	23,232	23,963	24,103	24,018	24,326	25,025	25,235	25,788	27,034			
49	3,079	3,222	3,325	3,507	3,740	4,050	4,214	4,410	4,644	4,624	4,618	4,863	4,996	5,180	5,318	5,292	5,149	5,110	5,159	5,309	5,498	5,576	5,757	5,977	6,067	6,153	6,286	6,089	6,162	6,207	6,340	6,540	6,578	6,555	6,639	6,830	6,887	7,038	7,378			
50	0.85%	0.86%	0.82%	0.84%	0.82%	0.76%	0.71%	0.70%	0.74%	0.78%	0.77%	0.74%	0.72%	0.68%	0.72%	0.73%	0.76%	0.75%	0.74%	0.74%	0.69%	0.66%	0.60%	0.57%	0.56%	0.55%	0.55%	0.59%	0.54%	0.53%	0.52%	0.51%	0.49%	0.47%	0.46%	0.45%	0.46%	0.46%	0.44%			
51																																										
52	51.3	53.4	54.7	57.2	60.6	86.8	92.3	99.4	112.6	112.5	105.2	117.3	114.8	122.9	119.4	110.5	93.4	92.8	89.4	86.3	87.0	86.8	84.9	92.0	93.2	90.0	89.1	89.9	89.7	90.1	89.9	91.9	89.3	84.0	82.0	82.6	83.0	82.8	88.0			
53																																										
54	0.75%	0.76%	0.74%	0.76%	0.74%	0.53%	0.48%	0.46%	0.45%	0.47%	0.50%	0.46%	0.47%	0.43%	0.48%	0.51%	0.62%	0.61%	0.63%	0.67%	0.64%	0.63%	0.61%	0.54%	0.54%	0.56%	0.58%	0.59%	0.55%	0.54%	0.54%	0.54%	0.53%	0.54%	0.55%	0.55%	0.56%	0.57%	0.54%			
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	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	Entity emissions from combustion, venting, flaring, and fugitive methane																																					
2	Richard Heede Climate Accountability Institute 18-Oct-20																																					
3	RWE Energy, Germany																																					
4																					to 2015				to 2016				to 2017				to 2018					
5																					Cumulative				Cumulative				Cumulative				Cumulative					
6																					MtCO2e				MtCO2e				MtCO2e				MtCO2e					
7																					(except where noted)				(except where noted)				(except where noted)				(except where noted)					
8																					V (V = verified)																	
9																					Entity CO2 emissions				kg CO2/tCO2													
10																					Oil & NGLs				MtCO2				linked									
11																					Natural Gas				MtCO2				linked									
12																					Coal				MtCO2				linked									
13																					Combustion total				MtCO2				sum									
14																					Oil & NGLs: Venting				MtCO2				calculated				3.83 linked					
15																					Oil & NGLs: Flaring				MtCO2				calculated				15.94 linked					
16																					Own fuel use				MtCO2				calculated				57.26 linked					
17																					Natural Gas: Venting				MtCO2				calculated				28.53 linked					
18																					Natural Gas: Flaring				MtCO2				calculated				1.74 linked					
19																					Venting & Flaring total				MtCO2				sum									
20																					Cement				MtCO2				linked									
21																					Total CO2 emissions				MtCO2				sum				row 18+24+26					
22																					Entity methane emissions				kg CH4/tCO2													
23																					Methane: Oil & NGLs				MtCH4				calculated				1.92 linked					
24																					Methane: Natural Gas				MtCH4				calculated				9.88 linked					
25																					Methane: Coal				MtCH4				calculated				4.03 linked					
26																					Total methane emissions				MtCH4				sum									
27																					Entity methane emissions				GWP													
28																					Methane: Oil & NGLs				MtCO2e				calculated				28					
29																					Methane: Natural Gas				MtCO2e				calculated				28					
30																					Methane: Coal				MtCO2e				calculated				28					
31																					Total methane emissions				MtCO2e				sum				(per IPCC SAR)					
32																					Total attributed emissions				MtCO2e				sum									
33																					CDIAC CO2 emissions				MtCO2													
34																					Oil, Natural Gas, Coal, Flaring, & Cement				Mt Carbon													
35																					Entity percent of total CO2 emissions				Percent													
36																					CDIAC sums December 2019																	
37																					Entity percent of total CH4 emissions				Percent													
38																					CDIAC/EDGAR methane				Tg CH4													
39																					Entity percent of total CH4 emissions				Percent													
40	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	0.43%	0.41%	0.39%	0.39%	0.36%	0.35%	0.33%	0.33%	0.35%	0.33%	0.32%	0.32%	0.32%	0.32%	0.29%								
41	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	0.53%	0.51%	0.48%	0.49%	0.46%	0.45%	0.42%	0.42%	0.43%	0.40%	0.38%	0.39%	0.39%	0.38%	0.35%								
42	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
43	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
44	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
45	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
46	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
47	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
48	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
49	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
50	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
51	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
52	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
53	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
54	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
55	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
56	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
57	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
58	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
59	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
60	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							
61	120	119	118	120	115	111	109	114	121	116	113	113	114	114	105																							

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 Quéré, 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, Sönke Zaehele. 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 ~695% 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