

ExxonMobil Corporation: Emissions Inventory 1882-2002

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Climate Mitigation Services
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Data in italics = inferred or proxy-based data

Sum of Greenhouse Gas Emissions

Year	Kerosene, jet fuels	Gasoline, naphthas	Diesel and heating oil	Heavy oils, residuals	Specialty products	Aggregated products	Natural Gas	Venting & Flaring	Coal	Company energy use	Total CO2 emissions	Methane emissions
	Carbon emitted per year <i>Million tonnes carbon</i>	Carbon emitted per year <i>Million tonnes carbon</i>	Carbon emitted per year <i>Million tonnes carbon</i>	Carbon emitted per year <i>Million tonnes carbon</i>	Carbon emitted per year <i>Million tonnes carbon</i>	Carbon emitted per year <i>Million tonnes carbon</i>	Carbon emitted per year <i>Million tonnes carbon</i>	Carbon emitted per year <i>Million tonnes carbon</i>	Carbon emitted per year <i>Million tonnes carbon</i>	Carbon emitted per year <i>Million tonnes carbon</i>	Carbon emitted per year <i>Million tonnes carbon</i>	Carbon emitted per year <i>Million tonnes CO2e</i>
1882						0.97		0.02			0.99	0.01
1883						0.95					0.96	0.01
1884						0.99		0.02			1.00	0.01
1885						1.03		0.02			1.05	0.01
1886						1.13		0.02			1.14	0.01
1887						1.20		0.02			1.22	0.01
1888						1.29		0.02			1.31	0.02
1889						1.59		0.03			1.62	0.02
1890						1.75		0.03			1.78	0.02
1891						2.11		0.04			2.15	0.02
1892						2.27		0.04			2.31	0.03
1893						2.41		0.04			2.45	0.03
1894						2.49		0.04			2.53	0.03
1895						2.39		0.04			2.43	0.03
1896						2.54		0.04			2.59	0.03
1897						2.82		0.05			2.87	0.03
1898						2.85		0.05			2.90	0.03
1899						2.69		0.05			2.73	0.03
1900						2.61	0.13	0.10		0.03	2.88	0.03
1901						2.85	0.19	0.12		0.05	3.28	0.04
1902						3.04	0.21	0.13		0.05	3.45	0.04
1903						3.07	0.25	0.15		0.06	3.53	0.04
1904						3.28	0.27	0.16		0.07	3.77	0.04
1905						3.52	0.33	0.18		0.09	4.12	0.05
1906						3.81	0.40	0.21		0.11	4.53	0.05
1907						4.25	0.42	0.22		0.11	4.97	0.05
1908						4.39	0.42	0.22		0.11	5.15	0.06
1909						4.75	0.50	0.26		0.13	5.64	0.06
1910						5.53	0.53	0.28		0.14	6.48	0.07
1911						5.84	0.53	0.28		0.14	6.80	0.07
1912						5.81	0.58	0.30		0.17	7.40	0.07
1913						5.28	0.61	0.29		0.17	6.98	0.07
1914						5.38	0.62	0.29		0.17	6.98	0.07
1915						6.26	0.65	0.32		0.17	8.00	0.08
1916						6.61	0.78	0.36		0.23	8.59	0.08
1917						7.44	0.83	0.39		0.29	9.59	0.09
1918						8.66	0.75	0.38		0.32	10.81	0.11
1919						10.24	0.78	0.41		0.38	12.81	0.12
1920						11.61	0.84	0.46		0.41	14.25	0.14
1921						11.56	0.70	0.41		0.39	13.97	0.13
1922						12.50	0.81	0.45		0.41	15.17	0.15
1923						16.20	1.07	0.59		0.59	19.69	0.19
1924						20.61	1.21	0.70		0.70	24.82	0.24
1925						20.94	1.29	0.70		0.70	24.99	0.25
1926						22.51	1.39	0.77		0.77	26.21	0.25
1927	1.90	6.49	1.87	5.96	1.06	4.82	1.53	0.80		2.57	27.00	0.25
1928	1.84	6.86	1.95	7.14	1.10	5.30	1.66	0.86		2.80	29.51	0.28
1929	1.86	8.20	2.30	7.91	1.24	6.14	2.03	1.01		3.25	33.94	0.32
1930	1.77	8.33	2.45	7.73	1.14	6.19	2.05	1.02		3.25	33.92	0.32
1931	1.79	7.85	2.15	6.73	1.14	5.80	1.79	0.87		2.99	31.11	0.29
1932	1.73	8.03	2.18	7.97	1.01	6.18	1.66	0.83		3.09	33.07	0.30
1933	2.26	8.57	2.63	10.58	1.08	7.42	1.66	0.91		3.60	38.72	0.36
1934	2.28	8.37	3.05	11.31	1.11	7.78	1.89	0.99		3.79	40.57	0.37
1935	2.28	8.76	3.44	11.51	1.25	8.25	2.05	1.07		4.00	42.60	0.39
1936	2.44	9.47	4.36	12.13	1.37	9.15	2.52	1.28		4.46	47.18	0.43
1937	2.60	10.34	5.42	13.45	1.49	10.35	3.28	1.46		5.12	53.52	0.49
1938	2.49	10.62	5.90	12.51	1.43	10.42	3.22	1.48		5.18	51.81	0.47
1939	2.76	11.11	6.43	12.89	1.63	11.18	3.08	1.57		5.34	55.99	0.50
1940	2.53	9.87	5.98	13.00	1.27	10.50	3.32	1.40		5.09	52.97	0.48
1941	2.53	11.47	7.03	14.86	1.45	12.17	3.51	1.61		5.77	60.41	0.54
1942	2.49	9.94	6.59	13.67	1.17	11.11	3.82	1.48		5.39	55.65	0.50
1943	1.93	11.35	7.03	17.70	1.13	12.86	4.27	1.56		6.17	63.99	0.58
1944	1.96	12.44	7.94	22.61	1.30	16.04	4.63	1.60		7.47	78.10	0.67
1945	1.95	14.54	8.58	23.78	1.50	16.88	4.91	1.65		7.82	81.61	0.74
1946	2.64	14.12	9.30	22.34	1.86	17.17	5.04	1.85		7.92	82.23	0.75
1947	4.89	16.30	10.64	26.48	2.29	23.08	6.05	2.29		9.76	101.80	0.90
1948	5.01	18.14	12.45	26.40	2.31	22.71	6.73	2.46		10.30	106.50	0.94
1949	4.72	19.61	12.06	25.39	2.32	22.36	7.51	2.65		10.48	107.10	0.95
1950	5.53	21.32	13.98	28.90	2.70	24.82	8.54	2.82		11.79	120.15	0.93
1951	0.00	24.42	22.27	30.94	2.92	28.07	9.95	3.23		13.32	135.13	0.98
1952	0.00	26.70	24.16	30.69	2.87	30.87	10.15	3.40		13.81	142.66	1.03
1953	0.00	28.10	24.46	30.35	2.84	33.55	10.58	3.57		14.78	148.24	1.08
1954	0.00	29.35	25.93	30.45	3.20	33.92	11.07	3.80		15.14	152.86	1.15
1955	0.00	31.49	28.28	37.14	3.83	36.76	12.00	4.23		16.94	170.67	1.27
1956	0.00	32.88	31.18	39.88	4.28	39.15	12.87	4.52		18.17	182.87	1.36
1957	0.00	32.99	30.34	41.64	4.14	39.19	13.23	4.82		19.21	185.26	1.37
1958	0.00	35.46	33.11	42.32	4.25	40.59	13.44	4.65		20.40	194.22	1.40
1959	0.00	38.25	35.30	45.55	4.94	44.21	14.64	5.03		22.23	210.15	1.52
1960	6.83	30.49	35.42	50.63	5.27	46.47	15.29	5.20		23.70	219.32	1.57
1961	7.56	30.75	36.01	53.66	6.15	48.90	16.09	5.39		24.49	229.00	1.63
1962	8.61	32.44	39.33	57.62	7.45	51.29	17.83	5.86		26.18	242.61	1.78
1963	8.81	33.69	42.48	59.23	8.08	54.68	18.89	6.20		27.87	259.77	1.85
1964	9.66	35.79	42.53	65.83	9.16	57.79	21.45	6.74		29.00	277.95	2.06
1965	10.19	37.78	44.79	72.57	9.99	61.87	25.22	7.44		31.26	301.12	2.29
1966	11.52	39.21	47.65	73.40	11.09	65.00	29.33	8.13		32.97	318.30	2.52
1967	13.38	42.60	50.26	75.70	11.39	70.84	32.20	8.63		34.73	339.73	2.69
1968	14.80	68.97	76.65	98.28	20.73	88.59	38.49	9.63		37.05	362.60	3.03
1969	15.53	72.21	81.52	109.33	20.53	107.73	45.52	10.73		39.76	395.11	3.41
1970	14.43	77.17	88.16	120.52	22.35	104.18	54.18	12.17	0.89	40.67	430.54	3.92
1971	14.31	77.94	88.54	117.73	22.40	104.00	60.70	12.97	1.77	41.14	437.51	4.22
1972	14.47	81.33	94.59	116.85	24.09	104.00	65.26	13.76	2.66	41.73	454.74	4.50
1973	14.47	88.65	98.79	125.01	26.27	104.00	72.01	15.15	3.54	44.55	488.44	4.97
1974	12.17	82.73	87.45	108.69	24.20	104.00	72.81	14.57	4.43	41.43	448.47	4.84
1975	11.81	80.45	84.98	90.22	23.62	104.00	70.76	13.76	5.31	39.18	419.97	4.61
1976	12.78	82.17	92.91	96.72	28.78	104.00	70.06	14.37	6.20	42.07	446.05	4.79
1977	13.02	82.40	92.53	91.93	29.05	104.00	69.07	14.55	7.08	41.83	441.45	4.84
1978	13.87	85.63	97.24	89.78	25.99	104.00	68.81	14.83	7.97	42.19	446.29	4.92
1979	14.15	85.71	96.69	84.45	26.82	104.00	67.94	14.36	8.85	40.90	439.86	4.80
1980	13.67	81.99	90.39	77.80	20.24	104.00	53.69	11.99	9.74	36.69	396.19	4.01
1981	13.06	76.47	85.26	69.84	18.68	104.00	50.30	11.14	10.62	34.32	369.70	3.76
1982	13.34	76.58	83.87	57.13	18.80	104.00	43.94	10.11	11.53	32.59	347.90	3.42
1983	12.78	78.13	83.24	48.24	21.88	104.00	42.20	9.93	13.15	31.61	341.15	3.39
1984	12.61	81.02	87.82	47.58	21.82	104.00	48.19	10.57	14.76	33.32	357.69	3.65
1985	13.18	83.31	89.25	39.49	21.99	104.00	47.74	10.37	17.21	33.13	355.67	3.65
1986	12.82	86.88	90.89	36.21	22.51	104.00	45.88	10.41	18.39	33.30	357.30	3.65
1987	13.67	89.68	91.35	33.43	23.62							

Cell: L3

Comment: Rick Heede:

Friends of the Earth Trust Ltd commissioned this report from Climate Mitigation Services. CMS prepared this report for information purposes. CMS exercised due care in compiling the information contained herein and the attached spreadsheet. CMS makes no warranty as to the accuracy, completeness, or usefulness of this information.

This work was done in May through October 2003 under contract with Friends of the Earth Trust Limited, with offices in London, 44-20-7490-1555, www.foe.co.uk. The project was conceived, funding secured, and administered through the good guidance of Peter Roderick, Esq, co-leader of Climate Justice Programme, London, www.climatelaw.org.

Richard Heede is Principal of Climate Mitigation Services, 1626 Gateway Road, Snowmass, Colorado, USA 81654; tel 970-927-9511; email: heede@rmi.org. He was assisted by Eliza Eubank. Assistance was also provided by staff of the Environmental Law Alliance Worldwide-US office, Oregon, www.elaw.org, and Peter Roderick of the Climate Justice Programme, London www.climatelaw.org.

Cell: D9

Comment: Rick Heede:

This worksheet summarizes emissions from all estimated combusted products marketed (or produced, in the case of coal) by Standard Oil Company starting in 1882 through ExxonMobil in 2002, and is thus a sum of the individual emissions sources detailed in the following worksheets. Emissions of carbon dioxide and methane from non-marketed hydrocarbons are also included: each company's own use of energy, venting of CO₂ from production and processing facilities, flaring of natural gas throughout the production to combustion cycle, and leakage of methane from oil, gas, and coal all results in significant emissions.

The gases included in this inventory are carbon dioxide and methane (we exclude nitrous oxide and the "other gases" -- hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride -- due to paucity of published information from ExxonMobil and the difficulty of developing pertinent and reasonably accurate proxy data sets). Interested readers should refer to the "Gases and Boundary Definition" section of the appended report.

Units are million metric tonnes of carbon, not carbon dioxide, per year, except for methane emissions, which are in units of million metric tonnes of methane gas. Note: we use "tonnes" to mean metric tonnes; we never use US tons, except to quote original data.

For the years from 1882 to 1911 -- when Standard Oil Company was dissolved into Standard Oil Company (New Jersey) (which we typically shorten to SONJ, and which later evolved into Exxon) and Standard Oil Company of New York (Socony, later Mobil) -- we only count emissions from product sales representing the fraction equivalent to each company's inheritance of Standard Oil Company's net asset value upon its dissolution, or 43 percent for SONJ and 9 percent for Socony. The remaining 48 percent of net assets were distributed among 32 other companies spun off from Standard: Standard Oil of California became Chevron; Standard Oil of Ohio became Sohio, then BP-America; Standard Oil of Indiana became Amoco [and now it's become BP-Amoco]; Continental Oil became Conoco; and Atlantic became part of ARCO then Sun, etc.

We have calculated emissions from individual petroleum products marketed by each company when available. Data on sales by product type became available in 1927, hence the large data-less area through 1926. The "Aggregated products" column shows, for 1882-1926, emissions from total marketed sales of petroleum (but only the SONJ and Socony fractions, as explained above). Aggregated products column from 1927 through 1967 shows Socony emissions only, as Socony-Mobil public reporting did not detail sales by product type until 1968. This does not affect the accuracy of Mobil's emissions, however, inasmuch as appropriate combustion and sequestration factors are applied to aggregated sales, too.

Although Standard Oil Company first entered the natural gas business in 1883, sales were relatively small until 1900, and a minor part of SONJ's and Socony-Mobil's business until mid-century. Coal production started in 1970 but never exceeded 6 percent of total carbon emissions, and ExxonMobil's coal interests are now being divested.

"Company energy use" needs some explanation. 1. A comprehensive assessment would include not only the company energy use data but also flaring and venting and fugitive methane emissions. 2. Our company energy use column estimates emissions from energy used in facilities, buildings, refineries, and transportation. 3. Methane emissions should be multiplied by 23/3.667 (methane multiplier/carbon in CO2 factor) to convert methane into carbon equivalent, or a factor of 6.27. (Note: not, in this case, CO2 equivalent). 4. Data for company energy use commences in 1900 with the advent of electricity purchased from the electric grid; Note: company use of oil products in refineries and elsewhere is already included in the aggregated sales data for 1882-1899, since the basic data is total input to refineries, not the preferred but unavailable data for total sales. 5. Some emissions sources are not estimable, such as oil spills -- which were ubiquitous and relatively large in the early days of the petroleum age -- and the subsequent conversion to carbon dioxide through oxidation of the spilled fuel's carbon. 6. We have not included emissions of nitrous oxide from either company facilities -- typically from the manufacture of adipic acid (because ExxonMobil's published reports do not specify adipic acid sales) -- nor from the use of ExxonMobil's marketed products in stationary or mobile sources.

Readers should refer to individual worksheets for additional details, definitions, methodologies, data sources, and calculations.

Carbon emissions co-efficients used in this report:

Kerosene = 19.72 kg carbon per million Btu (21.537 lbs CO2 per gallon; 135 kBtu per gallon; 159.535 lbs CO2 per million Btu);

Jet fuel = 19.33 kg carbon per million Btu (21.095 lbs CO2 per gallon; 156.258 lbs CO2 per million Btu);

Gasoline = 19.38 kg carbon per million Btu (19.564 lbs CO2 per gallon; 125.1 kBtu per gallon, 156.425 lbs CO2 million Btu);

Naphtha = 19.86 kg carbon per million Btu (160.553 lbs CO2 per million Btu);

Middle distillates (home heating oils, diesel fuels) = 19.95 kg carbon per million Btu (22.384 lbs CO2 per gallon; 138.7 kBtu per gallon; 161.386 lbs CO2 per million Btu);

Heavy fuels, residuals = 21.49 kg carbon per million Btu (26.033 lbs CO2 per gallon; 138.7 kBtu per gallon; 173.906 lbs CO2 per million Btu);

Crude oil = 20.25 kg carbon per million Btu (163.71 lbs CO2 per million Btu) (we use this factor for figuring emissions for aggregated oil sales).

Natural gas (pipeline): 14.48 kg carbon per million Btu (1,027 Btu per cubic foot; 120.593 per 1000 cubic feet; 117.080 lbs CO2 per million Btu).

Coal ("average US utility coal"): 25.98 kg carbon per million Btu (4,276.9 lbs CO2 per short ton; 210.0 lbs CO2 per million Btu).

See the Methods & Results paper for derivatiom of carbon emissions per kWh of electricity consumed.

Sources: Energy information Administration (1998?) Voluntary Reporting of Greenhouse Gases, 1997, Appendix (oil products); www.eia.doe.gov/oiaf/1605/frntvrgg.html, US DOE.

Calculated from EIA (2003) Annual Energy Review 2001, pp. 337 and 349 (natural gas and coal).

Cell: D10

Comment: Rick Heede:

This column shows estimated carbon emissions from combustion of Standard Oil Company (New Jersey) through ExxonMobil Corporation sale of kerosene and related fuels from 1927 to 2002; kerosene sales and emissions for 1882-1926 are reported in the "aggregated products" worksheet. (Only 52 percent of Standard Oil's marketed products and emissions are counted for

1882 through 1911; this allocation fraction represents the net asset value inherited by SONJ and Socony upon Standard Oil's dissolution in 1911.) A few years (1991-1995) of Mobil data is also included (the remainder of Mobil's product sales and resulting emissions are included either in other products or in aggregate products, depending on the year).

Kerosene is a middle distillate and dominated Standard Oil Company's business until surpassed by gasoline demand in 1911. The early product was sold and used as "illuminating oil" in the early decades to replace coal oil and even whale oil also used in oil lamps. Jet fuel (much of which is kerosene based) is also included in the column after the advent of turbine aircraft engines in the late 1940s (commercial jets entered the market in the 1950s).

Consult the comments embedded in each worksheet for data sources, definitions, methodologies, assumptions, limitations, caveats, calculations, and results.

Cell: F10

Comment: Rick Heede:

This column shows estimated carbon emissions from combustion of Standard Oil Company (New Jersey) through ExxonMobil Corporation sale of motor gasolines and related fuels (eg, aviation gasoline) from 1927 to 2002; gasoline sales and emissions for 1882-1926 are reported in the "aggregated products" worksheet. (Only 52 percent of Standard Oil's marketed products and emissions are counted for 1882 through 1911; this allocation fraction represents the net asset value inherited by SONJ and Socony upon Standard Oil's dissolution in 1911.) A few years (1991-1995) of Mobil data is also included (the remainder of Mobil's product sales and resulting emissions are included either in other products or in aggregate products, depending on the year).

Gasoline is a light distillate and has dominated Standard Oil Company's oil sales since 1911 (when it surpassed kerosene demand). Gasoline sales comprise approximately 33 to 38 percent of total combusted products sold by ExxonMobil in recent years.

Consult the comments embedded in each worksheet for data sources, definitions, methodologies, assumptions, limitations, caveats, calculations, and results.

Cell: H10

Comment: Rick Heede:

This column shows estimated carbon emissions from combustion of Standard Oil Company through ExxonMobil Corporation sale of middle distillates (eg, diesel fuels, home heating oils, and kerosene used for lighting and similar end-uses [kerosene-based jet fuel is typically included in "aviation fuels"]) from 1927 to 2002; diesel and middle distillates sales and emissions for 1882-1926 are reported in the "aggregated products" worksheet. (Only 52 percent of Standard Oil's marketed products and emissions are counted for 1882 through 1911; this allocation fraction represents the net asset value inherited by SONJ and Socony upon Standard Oil's dissolution in 1911.) A few years (1991-1995) of Mobil data is also included (the remainder of Mobil's product sales and resulting emissions are included either in other products or in aggregate products, depending on the year).

Consult the comments embedded in each worksheet for data sources, definitions, methodologies, assumptions, limitations, caveats, calculations, and results.

Cell: J10

Comment: Rick Heede:

This column shows estimated carbon emissions from combustion of Standard Oil Company through ExxonMobil Corporation sale of heavy oils and related fuels (eg, bunker fuels used in shipping, utility fuels) from 1927 to 2002; heavy oil sales and emissions for 1882-1926 are reported in the "aggregated products" worksheet. (Only 52 percent of Standard Oil's marketed products and emissions are counted for 1882 through 1911; this allocation fraction represents the net asset value inherited by SONJ and Socony upon Standard Oil Company's dissolution in

1911.) A few years (1991-1995) of Mobil data is also included (the remainder of Mobil's product sales and resulting emissions are included either in other products or in aggregate products, depending on the year).

Consult the comments embedded in each worksheet for data sources, definitions, methodologies, assumptions, limitations, caveats, calculations, and results.

Cell: L10

Comment: Rick Heede:

This column shows estimated carbon emissions from combustion of Standard Oil Company through ExxonMobil Corporation sale of specialty or other products (see below) from 1927 to 2002; specialty products and emissions for 1882-1926 are reported in the "aggregated products" worksheet. (Only 52 percent of Standard Oil's marketed products and emissions are counted for 1882 through 1911; this allocation fraction represents the net asset value inherited by SONJ and Socony upon Standard Oil's dissolution in 1911.) A few years (1991-1995) of Mobil data is also included (the remainder of Mobil's product sales and resulting emissions are included either in other products or in aggregate products, depending on the year).

We estimate the combusted and/or oxidized fractions of specialty products reported in Annual Reports and SEC Form 10-Ks starting in about 1950; for 1927-1949, we used Larsen et al (1971) New Horizons: History of Standard Oil Company (NJ), 1927-1950, Appendix 2, Table 7, p. 820.

We only report here the estimated fraction of such sales that are either combusted or are oxidized over a relatively short time horizon and enters the atmosphere as carbon dioxide.

In general, "specialty products" includes: lubricants and lube stocks; waxes (candles, polishes, etc); greases; solvents (specialty naphthas) for paint thinner, cleaning solvents, inks etc; pitch; asphalts and road oils; and miscellaneous products, which include aromatic extracts, tars (also pitch), absorption oils, syn gas feedstocks, specialty oils, and petroleum-based rocket fuels).

A fraction of these products are combusted -- such as waxes and rocket fuel and a fraction of engine lubricating oil -- or oxidized to the atmosphere -- such as solvents and lubricating oil spilled into driveways, backyards, and waterways by do-it-yourself mechanics.

The US Energy Information Administration, taking the lead from the IPCC, suggest sequestration fractions of zero to 100 percent for these individual products. Lacking a detailed breakdown of the composition of these products, and noting that petrochemical feedstocks are typically NOT included in specialty products, we use an estimated sequestration rate of 35 percent for the product category (meaning an oxidation and/or combustion factor of 0.65). This factor will be adjusted if warranted by further research.

Energy Information Administration (2003) Emissions of Greenhouse Gases in the United States 2001, US DOE, Appendix A6, p. 104-107.

Consult the comments embedded in each worksheet for data sources, definitions, methodologies, assumptions, limitations, caveats, calculations, and results.

Cell: N10

Comment: Rick Heede:

This column shows total oil sales -- or more precisely, the carbon emissions thereof -- for years and/or company entities for which detailed product sales are unavailable. A sum of all product sales is shown in the column titled "total oil products" on the far right of this summary sheet (this column AB is for illustrative purposes only as a sum of both companies' oil-related total emissions, and is not added into the rest of the worksheet. It is also used as a basis for estimating emissions from each company's use of oil products, which we consider a derivative of

its sales volume [e.g., pipeline energy, and trucking gasoline to service stations]).

As explained in the comments to the "aggregated products" worksheet, data included therein rather than in the separate worksheets for individual product types vary by years. Standard Oil Company (1882-1911) did not report product sales by category, and hence we report aggregated product sales in this column and not in the product worksheet. The same is the case for for both SONJ and Socony from 1912 through 1926. From 1927 through 2002, however, SONJ/Exxon emissions are reported in the separate product worksheets (and summed in the respective columns on this worksheet). However, Socony-Mobil did not report sales by product type until 1968, and this worksheet shows aggregated product sales for Socony-Mobil only from 1927 through 1967. Thereafter, both companies' oil sales are reported in the separate worksheets and shown on this worksheets' columns D through L.

Note: The summary row "Total 1882-2002" in this aggregated products column is the sum of the data shown in this column only, and not total oil sales (this latter is shown in the "total oil products" column).

Cell: P10

Comment: Rick Heede:

This column shows carbon emissions from Standard Oil Company through ExxonMobil Corporation's sale of natural gas from 1900 to 2002.

Note: carbon emissions from venting and flaring at oil and gas production facilities, refineries, and other company-owned sources are estimated separately.

Consult the comments embedded in each worksheet for data sources, definitions, methodologies, assumptions, limitations, caveats, calculations, and results.

Cell: R10

Comment: Rick Heede:

This column estimates carbon emissions from vented carbon dioxide (principally from production platforms) and flared natural gas (mostly from oil and gas production platforms but also from refineries, storage tanks, and other facilities).

Note: It is extremely difficult to get data on which to base estimates of flaring and venting, and we rely on numerous sources and methods in order to build up a reasonable estimate. ExxonMobil did not estimate either contribution to emissions of greenhouse gases until 2000, and has not published its results. We fully document our estimates in the worksheet.

Consult the comments embedded in each worksheet for data sources, definitions, methodologies, assumptions, limitations, caveats, calculations, and results.

Note: we show this data in italic to highlight that this is a calculated result using proxy data and (we think) well-supported inferences, but not based on company data or actual measurements.

Cell: T10

Comment: Rick Heede:

Emissions from combustion of coal produced in Exxon and Mobil-owned or shared equity mines are shown here. No coal production was reported by either company prior to 1970, and ExxonMobil appears to be selling its coal interests.

Cell: V10

Comment: Rick Heede:

This column is the sum of Standard Oil Company through ExxonMobil Corporation emissions from company use of oil, gas, and electricity in its own facilities, buildings, ships, trucks, service stations, pipelines, and other equipment. This includes estimates of its combustion of energy

commodities produced but not marketed as well as electricity purchased from electric utilities.

Note: this data does not include other sources normally considered "internal" or facility-related emissions such as flared or vented gas or fugitive methane.

Consult the comments embedded in each worksheet for data sources, methodologies, assumptions, limitations, caveats, and calculations.

Note: we show this data in italic to highlight that this is a calculated result using proxy data and (we think) well-supported inferences, but not based on company data or actual measurements.

Cell: X10

Comment: Rick Heede:

This column is the sum all Standard Oil Company through ExxonMobil emissions of carbon dioxide (in units of million tonnes of carbon per year). It thus includes emissions from the combustion of marketed petroleum, natural gas, and coal for ExxonMobil and its predecessors, covering a period from 1882-2002. This sum includes all emissions of carbon dioxide: from the combustion of marketed oil products, natural gas, and coal, as well as emissions from each company's consumption of electricity and fuels (including emissions at utilities from estimated purchased electricity), direct venting of CO₂, and flaring of natural gas from company facilities and equipment. These are all complicated estimations, and readers are referred to the discussions in comments to data sets and columns for details on assumptions, data sources, methodologies, formulas, and proxy data used.

Note: as explained elsewhere, we only count the proportion of Standard Oil Company emissions for 1882-1911 that represents the net asset value of SONJ-Exxon and Socony-Mobil as of the dissolution date (year-end 1911), or 43 and 9 percent, respectively.

Cell: Z10

Comment: Rick Heede:

This column shows the sum of Standard Oil Company through ExxonMobil Corporation fugitive emissions of methane from oil, natural gas, and coal operations. In units of million tonnes of methane gas. Methane leakage occurred exclusively from oil production prior to the gradually growing market for natural gas. Coal production did not commence for either company until Exxon opened a mine on its coal properties in 1970. See the methane worksheet for details.

To convert from methane gas to carbon-equivalent, multiply methane emissions by 23 (the GWP factor CH₄:CO₂) divided by 3.667 (CO₂:carbon), or x 6.272. Methane is thus converted to carbon-equivalent when added to carbon emissions in columns Af and AH (Total internal and total everything).

Note: the global warming potential of methane has been revised from 21xCO₂ to 23xCO₂ by the IPCC. Source: Houghton, J. T. et al (2001) Climate Change 2001: The Scientific Basis, Working Group One, Third Assessment, IPCC, Cambridge University Press, p. 388.

Consult the comments embedded in each worksheet for data sources, methodologies, assumptions, limitations, caveats, and calculations.

Note: we show this data in italic to highlight that this is a calculated result using proxy data and (we think) well-supported inferences, but not based on company data or actual measurements.

Cell: P33

Comment: Rick Heede:

These data (1900-1935 and 1940-1946) are inferred. See the natural gas worksheet for details.

Cell: N60

Comment: Rick Heede:

No product sales data are available prior to 1927 for Standard Oil Company (except for a few sample years, eg, 1890 and 1897) or for its post-dissolution daughter companies, Standard Oil Company (New Jersey) and Standard Oil Company of New York (Socony). We therefore list in this "aggregated product sales" column 52 percent of emissions from total sales for Standard Oil 1882-1911, both SONJ and Socony 1912-1926, and for Socony-Mobil only from 1927-1967.

See "Total ExxonMobil" on the "Aggregated Products" worksheet for a running total of both companies.

Cell: T103**Comment:** Rick Heede:

Exxon coal production data are inferred: production started in 1970, but lacking quantitative data from 1970 through 1983 we infer a rate of growth that coincides with reported production in 1984 forward. See coal worksheet for details.