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CO₂ emissions from fuel combustion

HIGHLIGHTS

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International
Energy Agency
Secure
Sustainable
Together

2018

World

Key indicators

	1990	1995	2000	2005	2010	2015	2016	%change 90-16
CO ₂ fuel combustion (MtCO ₂)	20518.2	21 379.6	23 223.4	27 069.7	30 489.9	32 276.0	32 314.2	57%
Share of World CO ₂ from fuel combustion	100%	100%	100%	100%	100%	100%	100%	
TPES (PJ)	367338	386 256	420 172	481 264	539 103	572 432	576 164	57%
GDP (billion 2010 USD)	37943.2	42 185.9	49 978.2	58 084.4	65 943.9	75 596.7	77 362.4	104%
GDP PPP (billion 2010 USD)	46097.2	51 473.8	61 738.5	74 363.9	89 110.1	105 887.0	109 230.7	137%
Population (millions)	5280.1	5 705.1	6 111.0	6 509.0	6 921.3	7 343.3	7 429.3	41%
CO ₂ / TPES (tCO ₂ per TJ)	55.9	55.4	55.3	56.2	56.6	56.4	56.1	0%
CO ₂ / GDP (kgCO ₂ per 2010 USD)	0.54	0.5	0.5	0.5	0.5	0.4	0.4	-23%
CO ₂ / GDP PPP (kgCO ₂ per 2010 USD)	0.45	0.4	0.4	0.4	0.3	0.3	0.3	-33%
CO ₂ / population (tCO ₂ per capita)	3.9	3.7	3.8	4.2	4.4	4.4	4.4	12%
Share of electricity output from fossil fuels	63%	62%	65%	67%	68%	67%	66%	
CO ₂ / kWh of electricity (gCO ₂ /kWh)	532	533	537	541	528	504	490	-8%
CO₂ emissions and drivers - Kaya decomposition (1990=100) ¹								
CO ₂ emissions index	100	104	113	132	149	157	157	57%
Population index	100	108	116	123	131	139	141	41%
GDP PPP per population index	100	103	116	131	147	165	168	68%
Energy intensity index - TPES / GDP PPP	100	94	85	81	76	68	66	-34%
Carbon intensity index - CO ₂ / TPES	100	99	99	101	101	101	100	0%

1. Please see the chapter *Indicator sources and methods* for methodological notes. Based on GDP in 2010 USD, using purchasing power parities.

2016 CO₂ emissions by sector

<i>million tonnes of CO₂</i>	Coal	Oil	Natural gas	Other ²	Total	%change 90-16
CO₂ fuel combustion	14 265.3	11 231.8	6 605.1	212.0	32 314.2	57%
Electricity and heat generation	9 539.9	789.7	2 935.0	147.8	13 412.4	76%
Other energy industry own use	306.1	601.8	683.6	1.3	1 592.9	63%
Manufacturing industries and construction	3 814.7	980.3	1 263.1	51.2	6 109.3	55%
Transport	0.3	7 626.4	239.3	x	7 866.0	71%
<i>of which: road</i>	x	5 754.0	98.6	x	5 852.6	77%
Other	604.2	1 233.6	1 484.0	11.8	3 333.6	-1%
<i>of which: residential</i>	286.6	584.4	1 012.9	x	1 883.9	3%
<i>of which: services</i>	134.4	255.8	440.3	6.4	836.8	8%
<i>Memo: international marine bunkers</i>	x	682.2	0.1	x	682.4	84%
<i>Memo: international aviation bunkers</i>	x	557.7	x	x	557.7	115%

2. Other includes industrial waste and non-renewable municipal waste. 3. World includes international marine bunkers and international aviation bunkers.

Key categories for CO₂ emissions from fuel combustion in 2016

IPCC source category	CO ₂ emissions (MtCO ₂)	1990 CO ₂ emissions (MtCO ₂)	Share in total GHG ³ (%)	Cumulative total (%)
Main activity prod. elec. and heat - coal	8742.5	4618.6	17.8	17.8
Road - oil	5754.0	3299.1	11.7	29.5
Manufacturing industries - coal	3814.7	2059.7	7.8	37.2
Main activity prod. elec. and heat - gas	2462.4	1035.0	5.0	42.2
Other transport - oil	1872.4	1127.1	3.8	46.0
Manufacturing industries - gas	1263.1	851.0	2.6	48.6
Residential - gas	1012.9	645.6	2.1	50.7
Manufacturing industries - oil	980.3	1033.8	2.0	52.6
Unallocated autoproducers - coal	797.5	387.3	1.6	54.3
<i>Memo: total CO₂ from fuel combustion</i>	<i>32314.2</i>	<i>20518.2</i>	<i>65.7</i>	<i>65.7</i>

4. Percent calculated using the total GHG estimate excluding CO₂ emissions/removals from agriculture, forestry and other land use.

3. SUMMARY TABLES

CO₂ emissions from fuel combustionmillion tonnes of CO₂

	1971	1975	1980	1985	1990	1995	2000	2005	2010	2015	2016	% change 90-16
World ¹	13 945.3	15 486.9	17 708.8	18 249.6	20 518.2	21 379.6	23 223.4	27 069.7	30 489.9	32 276.0	32 314.2	57.5%
<i>Annex I Parties</i>	..	..	..	..	13 719.3	12 986.3	13 619.4	13 858.0	13 224.1	12 332.1	12 239.8	-10.8%
<i>Annex II Parties</i>	8 580.8	8 845.0	9 419.3	9 072.9	9 654.2	10 032.4	10 896.4	11 087.4	10 397.8	9 670.4	9 563.6	-0.9%
<i>North America</i>	4 629.3	4 732.9	5 018.1	4 908.2	5 222.7	5 522.9	6 246.1	6 243.3	5 881.6	5 461.4	5 373.8	2.9%
<i>Europe</i>	3 043.6	3 066.3	3 307.4	3 059.4	3 113.0	3 088.4	3 161.9	3 274.9	2 992.6	2 646.0	2 619.8	-15.8%
<i>Asia Oceania</i>	907.9	1 045.8	1 093.8	1 105.3	1 318.6	1 421.2	1 488.3	1 569.3	1 523.6	1 563.1	1 569.9	19.1%
<i>Annex I EIT</i>	..	..	..	..	3 930.1	2 792.4	2 513.3	2 545.0	2 548.6	2 335.2	2 329.9	-40.7%
<i>Non-Annex I Parties</i>	..	..	..	..	6 168.3	7 674.7	8 749.9	12 217.5	16 145.6	18 750.0	18 834.3	205.3%
<i>Annex B Kyoto Parties</i>	..	..	..	..	5 382.7	4 795.8	4 656.0	4 876.5	4 632.0	4 126.7	4 141.0	-23.1%
Intl. aviation bunkers	169.2	173.9	202.1	224.9	258.9	290.3	355.6	422.7	457.6	531.8	557.7	115.4%
Intl. marine bunkers	353.9	341.1	357.1	306.3	371.7	428.2	498.4	571.5	662.7	662.2	682.4	83.6%
Non-OECD Total	4 078.3	5 214.2	6 566.0	7 377.5	8 870.8	9 151.1	9 840.3	13 242.5	17 031.7	19 433.4	19 482.7	119.6%
OECD Total	9 344.0	9 757.7	10 583.7	10 340.9	11 016.7	11 509.9	12 529.1	12 833.0	12 338.0	11 648.7	11 591.4	5.2%
Canada	340.2	377.1	422.3	393.9	419.6	449.0	516.3	540.0	529.5	541.8	540.8	28.9%
Chile	21.0	17.1	21.4	19.6	29.4	37.1	48.6	54.4	68.6	81.2	85.3	189.8%
Mexico	93.7	134.6	204.6	241.2	257.0	291.3	359.7	412.4	440.5	442.4	445.5	73.4%
United States	4 289.0	4 355.8	4 595.8	4 514.3	4 803.1	5 073.9	5 729.9	5 703.2	5 352.1	4 919.6	4 833.1	0.6%
OECD Americas	4 744.1	4 884.6	5 244.1	5 169.0	5 509.1	5 851.3	6 654.5	6 710.1	6 390.7	5 985.0	5 904.6	7.2%
Australia	143.4	179.5	206.7	220.1	259.7	285.3	334.6	371.9	389.1	379.3	392.4	51.1%
Israel ²	13.8	16.4	18.9	24.3	32.8	44.9	54.8	58.8	68.4	64.4	63.7	94.2%
Japan	751.0	849.9	870.6	866.2	1 037.1	1 111.9	1 124.7	1 163.7	1 104.2	1 152.6	1 147.1	10.6%
Korea	52.9	77.7	125.6	155.7	231.8	357.3	431.9	457.7	550.9	582.0	589.2	154.2%
New Zealand	13.5	16.4	16.5	18.9	21.8	23.9	29.0	33.7	30.4	31.2	30.5	40.0%
OECD Asia Oceania	974.6	1 139.9	1 238.3	1 285.3	1 583.2	1 823.4	1 975.1	2 085.8	2 143.0	2 209.5	2 222.9	40.4%
Austria	48.6	49.5	54.4	52.6	56.2	59.5	61.8	74.3	68.3	62.5	62.9	11.8%
Belgium	118.0	115.6	125.5	101.0	106.3	111.5	113.8	107.4	103.7	92.6	91.6	-13.9%
Czech Republic	153.5	155.0	168.0	175.3	150.2	123.2	121.2	118.4	112.6	99.6	101.4	-32.5%
Denmark	55.4	52.6	63.1	61.0	51.0	58.4	50.8	48.5	47.3	32.0	33.5	-34.4%
Estonia	..	..	..	..	35.0	15.9	14.4	16.7	18.6	15.1	16.4	-53.2%
Finland	39.9	44.2	54.9	48.3	53.8	55.7	54.6	54.9	62.0	42.4	45.5	-15.4%
France	423.4	423.1	455.2	351.8	345.6	343.6	364.7	371.9	341.0	292.2	292.9	-15.2%
Germany	978.1	973.4	1 048.2	1 004.3	940.0	856.6	812.3	786.7	758.8	729.7	731.6	-22.2%
Greece	25.1	34.1	45.2	54.5	69.9	76.5	87.9	95.2	83.4	64.5	63.1	-9.7%
Hungary	60.3	70.2	82.6	79.8	65.7	56.2	53.3	54.7	47.1	42.7	43.9	-33.1%
Iceland	1.4	1.6	1.7	1.6	1.9	2.0	2.2	2.2	1.9	2.1	2.1	8.9%
Ireland	21.6	21.1	25.9	26.5	30.1	32.6	40.9	44.4	39.5	35.4	36.9	22.4%
Italy	289.4	317.1	355.4	342.0	389.4	401.1	420.4	456.4	392.0	329.7	325.7	-16.4%
Latvia	..	..	..	..	18.8	8.9	6.8	7.6	8.1	6.8	6.8	-63.8%
Luxembourg	16.5	12.7	12.5	10.3	10.7	8.2	8.1	11.5	10.6	8.8	8.5	-21.1%
Netherlands	127.7	132.0	145.4	138.4	147.8	163.6	161.6	167.2	170.1	156.1	157.1	6.3%
Norway	23.0	23.6	27.2	26.4	27.5	31.4	31.9	34.5	38.4	36.1	35.5	29.3%
Poland	287.4	338.9	416.0	422.4	344.8	333.3	289.6	296.3	307.5	282.7	293.1	-15.0%
Portugal	14.4	18.0	23.8	23.9	37.9	47.2	57.9	61.4	47.6	47.0	47.4	25.0%
Slovak Republic	38.9	43.2	55.8	54.4	54.8	41.2	36.9	37.3	34.6	29.4	30.2	-44.9%
Slovenia	..	..	..	..	13.5	14.1	14.1	15.4	15.4	12.8	13.6	0.4%
Spain	119.1	155.8	186.3	173.0	202.6	228.2	278.6	333.7	262.1	247.1	238.6	17.8%
Sweden	82.0	79.0	73.1	58.4	52.1	56.9	52.0	49.1	46.1	37.1	38.0	-27.0%
Switzerland	38.9	36.8	39.3	41.8	40.7	41.5	42.0	44.0	43.3	37.3	37.9	-6.9%
Turkey	41.7	59.6	71.5	95.4	128.8	154.0	201.2	215.9	267.8	319.0	338.8	163.1%
United Kingdom	621.1	576.0	570.6	543.5	549.4	513.8	520.6	531.6	476.6	393.5	371.1	-32.4%
OECD Europe	3 625.3	3 733.1	4 101.3	3 886.6	3 924.5	3 835.2	3 899.5	4 037.2	3 804.3	3 454.2	3 464.0	-11.7%
<i>IEA/Accession/Association</i>	10 525.3	11 327.4	12 690.3	12 873.8	14 272.7	15 970.6	17 567.1	20 546.4	23 103.5	24 387.5	24 301.1	70.3%
<i>European Union - 28</i>	..	..	..	..	4 027.2	3 812.3	3 786.1	3 921.7	3 612.4	3 206.6	3 192.3	-20.7%
<i>G20</i>	..	..	..	..	16 791.9	17 724.2	19 185.9	22 237.2	24 922.3	26 220.5	26 099.8	55.4%
<i>Africa</i>	249.0	324.0	397.7	465.7	529.1	576.4	658.3	857.4	995.4	1 141.0	1 157.6	118.8%
<i>Americas</i>	5 081.6	5 293.1	5 750.6	5 653.3	6 062.5	6 504.0	7 435.2	7 566.6	7 410.5	7 122.4	7 003.4	15.5%
<i>Asia</i>	2 160.4	2 707.0	3 453.0	4 100.4	5 832.8	7 312.1	8 147.3	11 317.9	14 892.1	17 316.9	17 426.7	198.8%
<i>Europe</i>	3 766.7	3 892.5	4 300.1	4 056.5	7 176.2	5 953.3	5 757.6	5 917.5	5 642.0	5 076.6	5 048.6	-29.6%
<i>Oceania</i>	161.1	201.1	228.4	244.6	286.9	315.2	370.9	416.2	429.7	425.2	437.8	52.6%

1. Total world includes non-OECD total, OECD total as well as international marine bunkers and international aviation bunkers.

2. Please refer to the chapter Geographical coverage.

CO₂ emissions from fuel combustion - coalmillion tonnes of CO₂

	1971	1975	1980	1985	1990	1995	2000	2005	2010	2015	2016	% change 90-16
World ¹	5 229.1	5 647.6	6 601.2	7 394.0	8 297.6	8 519.7	8 951.1	11 469.5	13 783.2	14 536.3	14 265.3	71.9%
<i>Annex I Parties</i>	..	..	..	..	5 222.8	4 690.4	4 784.1	4 816.6	4 481.3	3 786.1	3 583.8	-31.4%
<i>Annex II Parties</i>	2 704.6	2 668.3	3 033.8	3 392.9	3 559.1	3 474.5	3 711.1	3 784.5	3 419.1	2 850.9	2 648.1	-25.6%
<i>North America</i>	1 169.7	1 285.2	1 515.6	1 762.9	1 933.3	2 039.3	2 297.9	2 290.5	2 074.8	1 539.3	1 427.5	-26.2%
<i>Europe</i>	1 254.1	1 080.5	1 209.2	1 251.5	1 183.6	950.1	865.4	866.8	723.5	686.5	597.3	-49.5%
<i>Asia Oceania</i>	280.8	302.6	309.0	378.5	442.1	485.1	547.8	627.1	620.8	625.0	623.4	41.0%
<i>Annex I EIT</i>	..	..	..	..	1 601.5	1 151.1	981.3	943.4	936.6	799.7	784.1	-51.0%
<i>Non-Annex I Parties</i>	..	..	..	..	3 074.8	3 829.3	4 166.9	6 652.8	9 301.9	10 750.2	10 681.4	247.4%
<i>Annex B Kyoto Parties</i>	..	..	..	..	2 378.5	1 888.4	1 668.6	1 707.6	1 594.8	1 437.4	1 356.0	-43.0%
Intl. aviation bunkers	x	x	x	x	x	x	x	x	x	x	x	x
Intl. marine bunkers	0.1	x	x	x	x	x	x	x	x	x	x	x
Non-OECD Total	2 028.8	2 440.9	2 917.9	3 272.2	4 055.4	4 404.6	4 548.0	6 967.8	9 519.2	10 836.6	10 768.5	165.5%
OECD Total	3 200.2	3 206.7	3 683.3	4 121.8	4 242.3	4 115.1	4 403.0	4 501.7	4 264.0	3 699.7	3 496.8	-17.6%
Canada	63.9	59.0	82.1	100.8	96.2	100.7	125.9	111.3	92.6	74.1	71.3	-25.8%
Chile	5.1	3.6	4.8	5.0	9.8	8.9	11.7	10.3	17.5	27.8	29.3	199.3%
Mexico	5.2	6.7	7.3	11.7	15.1	21.8	26.4	48.1	53.6	55.0	47.7	214.9%
United States	1 105.8	1 226.2	1 433.5	1 662.0	1 837.2	1 938.6	2 172.0	2 179.2	1 982.2	1 465.2	1 356.1	-26.2%
OECD Americas	1 180.0	1 295.5	1 527.8	1 779.5	1 958.3	2 070.0	2 335.9	2 348.9	2 145.9	1 622.2	1 504.5	-23.2%
Australia	75.2	92.9	106.6	119.4	140.8	156.4	190.1	208.1	202.0	172.9	177.7	26.2%
Israel ²	0.0	0.0	0.0	7.3	9.5	16.5	25.6	29.5	29.3	25.6	21.9	131.0%
Japan	201.6	205.5	198.4	255.2	297.9	325.3	353.2	410.1	413.2	446.6	441.0	48.0%
Korea	22.2	32.1	50.5	84.0	90.8	106.5	180.5	200.1	284.3	311.4	303.3	234.1%
New Zealand	4.0	4.2	3.9	4.0	3.4	3.4	4.5	9.0	5.6	5.6	4.7	38.3%
OECD Asia Oceania	303.0	334.7	359.5	469.8	542.4	608.1	753.9	856.7	934.4	962.0	948.6	74.9%
Austria	16.3	13.9	14.2	17.4	16.5	14.3	15.0	16.2	14.4	12.8	11.7	-29.1%
Belgium	44.2	38.6	41.9	39.2	40.4	34.7	30.3	20.6	14.0	11.7	11.0	-72.9%
Czech Republic	132.0	124.2	132.1	138.9	116.6	91.4	86.2	78.0	74.2	63.1	63.5	-45.5%
Denmark	6.1	8.1	24.2	29.0	24.2	25.8	15.7	14.7	15.5	7.3	8.4	-65.4%
Estonia	..	..	..	..	23.6	11.3	10.4	12.0	14.2	10.8	11.8	-49.8%
Finland	8.7	9.6	20.1	20.3	21.7	23.8	21.6	20.8	28.8	16.3	18.0	-16.8%
France	140.1	108.3	125.6	94.5	75.9	59.3	59.6	55.9	45.6	31.6	27.6	-63.6%
Germany	558.0	499.5	561.2	591.5	516.2	380.3	345.9	334.5	314.3	316.0	301.0	-41.7%
Greece	6.7	10.8	13.2	24.8	33.5	37.1	38.3	38.5	33.6	23.6	20.1	-40.1%
Hungary	35.9	33.8	37.3	35.6	24.6	17.5	15.6	12.5	10.7	9.3	8.7	-64.7%
Iceland	0.0	-	0.1	0.3	0.3	0.2	0.4	0.4	0.4	0.4	0.4	53.3%
Ireland	8.9	7.3	8.1	10.7	14.7	12.5	10.6	11.0	8.2	9.0	8.7	-40.9%
Italy	32.6	31.3	44.4	59.8	56.6	45.5	43.9	63.8	52.4	48.0	42.7	-24.5%
Latvia	..	..	..	..	2.8	1.1	0.5	0.3	0.4	0.2	0.2	-94.1%
Luxembourg	12.3	8.1	8.4	6.7	5.2	2.1	0.4	0.3	0.3	0.2	0.2	-96.0%
Netherlands	15.2	12.4	14.4	24.0	29.9	33.7	29.7	31.1	29.1	43.2	40.0	33.8%
Norway	3.8	4.0	4.0	4.5	3.5	3.9	4.0	2.9	2.6	2.9	3.0	-14.1%
Poland	254.5	292.7	356.9	365.9	291.1	273.5	221.4	215.5	214.6	193.5	194.0	-33.4%
Portugal	2.5	1.7	1.7	2.9	10.8	14.2	15.0	13.4	6.5	12.9	11.3	4.3%
Slovak Republic	24.2	24.2	32.8	34.2	31.4	21.6	16.4	16.0	14.5	12.1	11.9	-62.0%
Slovenia	..	..	..	..	6.6	5.8	5.6	6.3	6.0	4.4	4.8	-28.5%
Spain	38.2	38.8	49.0	70.7	75.2	72.9	83.4	81.9	32.4	53.2	40.4	-46.3%
Sweden	5.5	7.0	5.5	10.7	10.5	9.6	8.3	10.1	9.2	6.9	6.6	-37.4%
Switzerland	1.9	1.0	1.4	2.0	1.4	0.8	0.6	0.6	0.6	0.5	0.5	-66.6%
Turkey	16.4	21.2	27.6	46.4	61.2	64.6	91.6	88.6	125.6	135.5	151.7	147.8%
United Kingdom	352.9	280.1	271.9	242.4	247.1	179.5	142.6	150.1	115.7	90.0	45.7	-81.5%
OECD Europe	1 171.1	1 576.6	1 796.0	1 872.5	1 741.6	1 437.0	1 313.2	1 296.1	1 183.7	1 115.5	1 043.8	-40.1%
<i>IEA/Accession/Association</i>	4 000.2	4 198.5	4 992.7	5 813.1	6 460.7	7 159.4	7 642.9	9 984.3	12 182.6	12 970.3	12 659.7	96.0%
<i>European Union - 28</i>	..	..	..	..	1 771.2	1 441.0	1 274.5	1 272.2	1 116.4	1 031.9	937.8	-47.1%
<i>G20</i>	..	..	..	..	7 447.8	7 888.0	8 313.3	10 689.2	12 873.1	13 559.9	13 241.0	77.8%
<i>Africa</i>	143.7	183.4	190.1	205.2	228.4	238.6	261.8	346.4	369.9	373.4	376.6	64.9%
<i>Americas</i>	1 197.3	1 314.7	1 556.8	1 822.8	2 005.2	2 123.8	2 404.3	2 419.1	2 227.2	1 726.2	1 602.0	-20.1%
<i>Asia</i>	1 118.1	1 338.9	1 701.6	2 248.4	3 057.8	3 848.8	4 187.0	6 617.0	9 254.0	10 710.1	10 658.9	248.6%
<i>Europe</i>	1 768.5	1 632.4	1 860.5	1 933.3	2 861.6	2 148.2	1 902.7	1 869.3	1 723.1	1 546.1	1 443.4	-49.6%
<i>Oceania</i>	80.2	97.4	110.9	123.8	144.7	160.3	195.3	217.7	209.0	180.5	184.5	27.5%

1. Total world includes non-OECD total, OECD total as well as international marine bunkers and international aviation bunkers.

2. Please refer to the chapter Geographical coverage.