



# U.S. Energy Information Administration

## Independent Statistics and Analysis

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### Voluntary Reporting of Greenhouse Gases Program (Fuel and Energy Source Codes and Emission Coefficients)



#### Voluntary Reporting of Greenhouse Gases Program Fuel and Energy Source Codes and Emission Coefficients

1. Carbon Dioxide Emission Factors for Stationary Combustion <sup>1</sup>		
Fuel <sup>2</sup>	Emission Factor <sup>2</sup>	Units
<b>Coal<sup>2</sup></b>		
Anthracite	103.63	kg CO <sub>2</sub> / MMBtu
Bituminous	93.45	kg CO <sub>2</sub> / MMBtu
Sub-bituminous	97.10	kg CO <sub>2</sub> / MMBtu
Lignite	97.43	kg CO <sub>2</sub> / MMBtu
Electric Power Sector	94.70	kg CO <sub>2</sub> / MMBtu
Industrial Coking	93.71	kg CO <sub>2</sub> / MMBtu
Other Industrial	93.98	kg CO <sub>2</sub> / MMBtu
Residential/Commercial	95.35	kg CO <sub>2</sub> / MMBtu
<b>Natural Gas<sup>3</sup></b>		
Pipeline Natural Gas		
HHV of 975 - 1000 Btu/scf	54.01	kg CO <sub>2</sub> / MMBtu
	5.401	kg CO <sub>2</sub> / therm
HHV of 1000 - 1025 Btu/scf	52.91	kg CO <sub>2</sub> / MMBtu
	5.291	kg CO <sub>2</sub> / therm
HHV of 1025 - 1050 Btu/scf	53.06	kg CO <sub>2</sub> / MMBtu
	5.306	kg CO <sub>2</sub> / therm
HHV of 1050 - 1075 Btu/scf	53.46	kg CO <sub>2</sub> / MMBtu
	5.346	kg CO <sub>2</sub> / therm
HHV of 1075 - 1100 Btu/scf	53.72	kg CO <sub>2</sub> / MMBtu
	5.372	kg CO <sub>2</sub> / therm
Weighted National Average (1029 <sup>2</sup> Btu/scf)	53.06	kg CO <sub>2</sub> / MMBtu
	5.306	kg CO <sub>2</sub> / therm
Flared Natural Gas	54.71	kg CO <sub>2</sub> / MMBtu
	5.471	kg CO <sub>2</sub> / therm
<b>Petroleum Fuels<sup>3</sup></b>		
Middle Distillate Fuels (No. 1, No. 2, No. 4 fuel oil, diesel,	73.15	kg CO <sub>2</sub> / MMBtu

home heating oil)	10.15	kg CO <sub>2</sub> / gallon
Jet Fuel ( Jet A, JP-8)	70.88	kg CO <sub>2</sub> / MMBtu
	9.57	kg CO <sub>2</sub> / gallon
Kerosene	72.31	kg CO <sub>2</sub> / MMBtu
	9.76	kg CO <sub>2</sub> / gallon
Heavy Fuel Oil (No. 5, 6 fuel oil), bunker fuel	78.80	kg CO <sub>2</sub> / MMBtu
	11.80	kg CO <sub>2</sub> / gallon
Ethane	59.58	kg CO <sub>2</sub> / MMBtu
	4.14	kg CO <sub>2</sub> / gallon
Propane	63.10	kg CO <sub>2</sub> / MMBtu
	5.75	kg CO <sub>2</sub> / gallon
Isobutane	65.08	kg CO <sub>2</sub> / MMBtu
	6.45	kg CO <sub>2</sub> / gallon
n-Butane	64.97	kg CO <sub>2</sub> / MMBtu
	6.70	kg CO <sub>2</sub> / gallon
Unspecified LPG	62.33	kg CO <sub>2</sub> / MMBtu
	-	kg CO <sub>2</sub> / gallon
Refinery (Still) Gas	64.20	kg CO <sub>2</sub> / MMBtu
	9.17	kg CO <sub>2</sub> / gallon
Crude Oil	74.43	kg CO <sub>2</sub> / MMBtu
	10.28	kg CO <sub>2</sub> / gallon
Petroleum Coke	102.12	kg CO <sub>2</sub> / MMBtu
	14.65	kg CO <sub>2</sub> / gallon
<b>Other Fuels</b>		
Tires/Tire Derived Fuel <sup>4</sup>	85.97	kg CO <sub>2</sub> / MMBtu
Waste Oil <sup>5,6</sup>	9.98	kg CO <sub>2</sub> / gallon
Waste Oil Blended with Residual Fuel Oil <sup>5</sup>	66.53	kg CO <sub>2</sub> / MMBtu
Waste Oil Blended with Distillate Fuel Oil <sup>5</sup>	71.28	kg CO <sub>2</sub> / MMBtu
Municipal Solid Waste (MSW) <sup>7,8</sup>	411.37	kg CO <sub>2</sub> / short ton MSW
Municipal Solid Waste (MSW) <sup>7,8</sup>	41.14	kg CO <sub>2</sub> / MMBtu MSW
Plastics Portion of MSW <sup>7</sup>	2,539.80	kg CO <sub>2</sub> / short ton plastics

<sup>1</sup> All factors assume 100 percent combustion except those for MSW, which assume 98 percent combustion.

<sup>2</sup> U. S. Energy Information Administration, Documentation for Emissions of Greenhouse Gases in the United States 2008, DOE/EIA-0638 (2006), October 2008, Table 6-2, p. 183.

<sup>3</sup> Energy Information Administration, Documentation for Emissions of Greenhouse Gases in the United States 2005, DOE/EIA-0638 (2005), October 2007, Tables 6-1, 6-2, 6-4, and 6-5.

<sup>4</sup> U.S. Department of Energy, Technical Guidelines Voluntary Reporting of Greenhouse Gases (1605(b)) Program, Chapter 1, Part C, Stationary Source Combustion, January 2007.

<sup>5</sup> U.S. EPA, AP 42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, <http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s11.pdf>

<sup>6</sup> To convert to an energy basis (kg/MMBtu), divide by the heating value of the oil in units of MMBtu/gal, if known. If the heating value is not known, use the default values below depending on whether the waste oil is blended with residual or distillate fuel oil.

<sup>7</sup> Emissions factors for components of MSW calculated from 2006 data in U.S. Environmental Protection

Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006, Public Review Draft, February 22, 2008, Section 3.9 and Annex 3.6. Weighted emission factor based on MSW composition for 2006 reported in U.S. Environmental Protection Agency, 2006 MSW Characterization Data Tables, <http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/06data.pdf>.<sup>8</sup>

<sup>8</sup> Emissions from other components of municipal solid waste are excluded because they are considered to be biogenic.

<b>2. Carbon Dioxide Emission Factors for Transportation Fuels<sup>1</sup></b>			
<b>Transportation Fuel</b>	<b>Emission Factors</b>		
	<b>Kilograms CO<sub>2</sub> Per Unit of Volume</b>	<b>Kilograms CO<sub>2</sub> Per Million Btu</b>	
Aviation Gasoline	8.32	per gallon	69.19
Biodiesel			
-B100	0.00	per gallon	0.00
-B20	8.12	per gallon	59.44
-B10	9.13	per gallon	66.35
-B5	9.64	per gallon	69.76
-B2	9.94	per gallon	71.80
Diesel Fuel (No. 1 and No. 2)	10.15	per gallon	73.15
Ethanol/Ethanol Blends			
-E100	0.00	per gallon	0.00
-E85	1.33	per gallon	14.71
-E10 (Gasohol)	7.98	per gallon	65.94
Methanol/Methanol Blends			
-M85	4.84	per gallon	65.76
Motor Gasoline	8.86	per gallon	70.88
Jet Fuel, Kerosene	9.57	per gallon	70.88
Natural Gas	54.60	per Mcf	53.06
Propane	5.75	per gallon	63.10
Residual Fuel (No. 5 and No. 6 Fuel Oil)	11.79	per gallon	78.80

<sup>1</sup> Emissions factors calculated from data in: (1) Energy Information Administration, Documentation for Emissions of Greenhouse Gases in the U.S. 2005, DOE/EIA-0638 (2005), October 2007, Tables 6-1, 6-4, and 6-5. (Non-biogenic carbon content and gross heat of combustion for motor gasoline and diesel (distillate fuel)).

(2) U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Alternative Fuels & Advanced Vehicles Data Center, Fuel Properties web page (<http://www.eere.energy.gov/afdc/fuels/properties.html>). (Biodiesel gross heat of combustion).

(3) Energy Information Administration, Annual Energy Review 2006, DOE/EIA-0384(2006), June 2007, Table A3, p. 361. (Gross heat of combustion for ethanol).

(4) Stacy C. Davis and Susan W. Diegel, Transportation Energy Data Book, Edition 26, Oak Ridge National Laboratory, ORNL-6978, 2007, Table B.7 Tables 6.7 and B.4. (Density and gross heat of combustion of methanol.) Emission factors for methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) are available at [http://www.eia.doe.gov/oiaf/1605/emission\\_factors.html](http://www.eia.doe.gov/oiaf/1605/emission_factors.html).