

**Table 12.1 U.S. Default Factors for Calculating CO<sub>2</sub> Emissions from Fossil Fuel  
and Biomass Combustion**

<b>Fuel Type</b>	<b>Heat Content</b>	<b>Carbon Content (Per Unit Energy)</b>	<b>Fraction Oxidized</b>	<b>CO<sub>2</sub> Emission Factor (Per Unit Energy)</b>	<b>CO<sub>2</sub> Emission Factor (Per Unit Mass or Volume)</b>
<b>Coal and Coke</b>	<b>MMBtu / short ton</b>	<b>kg C / MMBtu</b>		<b>kg CO<sub>2</sub> / MMBtu</b>	<b>kg CO<sub>2</sub> / short ton</b>
Anthracite	25.09	28.24	1	103.54	2597.82
Bituminous	24.93	25.47	1	93.40	2328.46
Subbituminous	17.25	26.46	1	97.02	1673.60
Lignite	14.21	26.28	1	96.36	1369.28
Coke	24.80	27.83	1	102.04	2530.59
Mixed Electric Utility/Electric Power	19.73	25.74	1	94.38	1862.12
Unspecified Residential/Com*	22.06	25.71	1	94.27	2079.50
Mixed Commercial Sector	21.39	25.98	1	95.26	2037.61
Mixed Industrial Coking	26.28	25.54	1	93.65	2461.12
Mixed Industrial Sector	22.35	25.61	1	93.91	2098.89
<b>Natural Gas</b>	<b>Btu / scf</b>	<b>kg C / MMBtu</b>		<b>kg CO<sub>2</sub> / MMBtu</b>	<b>kg CO<sub>2</sub> / scf</b>
US Weighted Average	1028	14.46	1	53.02	0.0545
Greater than 1,000 Btu**	>1000	14.47	1	53.06	Varies
975 to 1,000 Btu**	975 – 1,000	14.73	1	54.01	Varies
1,000 to 1,025 Btu**	1,000 – 1,025	14.43	1	52.91	Varies
1,025 to 1,035 Btu**	1,025 – 1,035	14.45	1	52.98	Varies
1,025 to 1,050 Btu**	1,025 – 1,050	14.47	1	53.06	Varies
1,050 to 1,075 Btu**	1,050 – 1,075	14.58	1	53.46	Varies
1,075 to 1,100 Btu**	1,075 – 1,100	14.65	1	53.72	Varies
Greater than 1,100 Btu**	>1,100	14.92	1	54.71	Varies
(EPA 2010) Full Sample*		14.48	1	53.09	n/a
(EPA 2010) <1.0% CO <sub>2</sub> *		14.43	1	52.91	n/a
(EPA 2010) <1.5% CO <sub>2</sub> *		14.47	1	53.06	n/a
(EPA 2010) <1.0% CO <sub>2</sub> and <1,050 Btu/scf*	<1,050	14.42	1	52.87	n/a
(EPA 2010) <1.5% CO <sub>2</sub> and <1,050 Btu/scf*	<1,050	14.47	1	53.06	n/a
(EPA 2010) Flare Gas*	>1,100	15.31	1	56.14	n/a

**Table 12.1 U.S. Default Factors for Calculating CO<sub>2</sub> Emissions from Fossil Fuel  
and Biomass Combustion**

<b>Fuel Type</b>	<b>Heat Content</b>	<b>Carbon Content (Per Unit Energy)</b>	<b>Fraction Oxidized</b>	<b>CO<sub>2</sub> Emission Factor (Per Unit Energy)</b>	<b>CO<sub>2</sub> Emission Factor (Per Unit Mass or Volume)</b>
<b>Petroleum Products</b>	<b>MMBtu / gallon</b>	<b>kg C / MMBtu</b>		<b>kg CO<sub>2</sub> / MMBtu</b>	<b>kg CO<sub>2</sub> / gallon</b>
Distillate Fuel Oil No. 1	0.139	19.98	1	73.25	10.18
Distillate Fuel Oil No. 2	0.138	20.17	1	73.96	10.21
Distillate Fuel Oil No. 4	0.146	20.47	1	75.04	10.96
Residual Fuel Oil No. 5	0.140	19.89	1	72.93	10.21
Residual Fuel Oil No. 6	0.150	20.48	1	75.10	11.27
Still Gas*	0.143	18.20	1	66.72	9.54
Used Oil	0.135	20.18	1	74.00	9.99
Kerosene	0.135	20.51	1	75.20	10.15
LPG	0.092	17.18	1	62.98	5.79
Propane (Liquid)	0.091	16.76	1	61.46	5.59
Propylene	0.091	17.99	1	65.95	6.00
Ethane	0.069	17.08	1	62.64	4.32
Ethylene	0.100	18.39	1	67.43	6.74
Isobutane	0.097	17.70	1	64.91	6.30
Isobutylene	0.103	18.47	1	67.74	6.98
Butane	0.101	17.77	1	65.15	6.58
Butylene	0.103	18.47	1	67.73	6.98
Naptha (<401 deg F)	0.125	18.55	1	68.02	8.50
Natural Gasoline	0.110	18.23	1	66.83	7.35
Other Oil (>401 deg F)	0.139	20.79	1	76.22	10.59
Pentanes Plus	0.110	19.10	1	70.02	7.70
Petrochemical Feedstocks	0.129	19.36	1	70.97	9.16
Petroleum Coke (Liquid)	0.143	27.93	1	102.41	14.64
Special Naptha	0.125	19.73	1	72.34	9.04
Unfinished Oils	0.139	20.32	1	74.49	10.35
Heavy Gas Oils	0.148	20.43	1	74.92	11.09
Lubricants	0.144	20.26	1	74.27	10.69
Motor Gasoline	0.125	19.15	1	70.22	8.78
Aviation Gasoline	0.120	18.89	1	69.25	8.31
Kerosene Type Jet Fuel	0.135	19.70	1	72.22	9.75
Asphalt and Road Oil	0.158	20.55	1	75.36	11.91
Crude Oil	0.138	20.32	1	74.49	10.28
Waxes*	0.132	19.80	1	72.60	9.57
<b>Fossil Fuel-derived Fuels (gaseous)</b>	<b>MMBtu / scf</b>	<b>kg C / MMBtu</b>		<b>kg CO<sub>2</sub> / MMBtu</b>	<b>kg CO<sub>2</sub> / scf</b>
Acetylene***	0.00147	19.53	1	71.61	0.1053

**Table 12.1 U.S. Default Factors for Calculating CO<sub>2</sub> Emissions from Fossil Fuel  
and Biomass Combustion**

<b>Fuel Type</b>	<b>Heat Content</b>	<b>Carbon Content (Per Unit Energy)</b>	<b>Fraction Oxidized</b>	<b>CO<sub>2</sub> Emission Factor (Per Unit Energy)</b>	<b>CO<sub>2</sub> Emission Factor (Per Unit Mass or Volume)</b>
<b>Fossil Fuel-derived Fuels (solid)</b>	<b>MMBtu / short ton</b>	<b>kg C / MMBtu</b>		<b>kg CO<sub>2</sub> / mmBtu</b>	<b>kg CO<sub>2</sub> / short ton</b>
Municipal Solid Waste	9.95	24.74	1	90.7	902.47
Tires	26.87	23.45	1	85.97	2310.01
Plastics	38	20.45	1	75	2850.00
Petroleum Coke (Solid)	30	27.93	1	102.41	3072.30
<b>Fossil Fuel-derived Fuels (gaseous)</b>	<b>MMBtu / scf</b>	<b>kg C / MMBtu</b>		<b>kg CO<sub>2</sub> / MMBtu</b>	<b>kg CO<sub>2</sub> / scf</b>
Blast Furnace Gas	0.000092	74.81	1	274.32	0.0252
Coke Oven Gas	0.000599	12.78	1	46.85	0.0281
Propane (Gas)	0.002516	16.76	1	61.46	0.1546
Fuel Gas	0.001388	16.09	1	59.00	0.0819
<b>Biomass Fuels-Solid</b>	<b>MMBtu / short ton</b>	<b>kg C / MMBtu</b>		<b>kg CO<sub>2</sub> / MMBtu</b>	<b>kg CO<sub>2</sub> / short ton</b>
Wood and Wood Residuals (12% moisture content)	15.38	25.58	1	93.80	1442.64
Agricultural Byproducts	8.25	32.23	1	118.17	974.90
Peat	8.00	30.50	1	111.84	894.72
Solid Byproducts	25.83	28.78	1	105.51	2725.32
Kraft Black Liquor (NA hardwood)****	11.98	25.75	1	94.42	1131.11
Kraft Black Liquor (NA softwood)****	12.24	25.95	1	95.15	1164.64
Municipal Solid Waste (Biomass)	9.95	24.74	1	90.7	902.47
<b>Biomass Fuels-Gaseous</b>	<b>MMBtu / scf</b>	<b>kg C / MMBtu</b>		<b>kg CO<sub>2</sub> / MMBtu</b>	<b>kg CO<sub>2</sub> / scf</b>
Biogas (Captured Methane)	0.000841	14.20	1	52.07	0.0438
Landfill Gas (50% CH <sub>4</sub> /50%CO <sub>2</sub> )****	0.0005025	14.20	1	52.07	0.0262
Wastewater Treatment Biogas****	Varies	14.20	1	52.07	Varies
<b>Biomass Fuels - Liquid</b>	<b>MMBtu / gallon</b>	<b>kg C / MMBtu</b>		<b>kg CO<sub>2</sub> / MMBtu</b>	<b>kg CO<sub>2</sub> / gallon</b>
Ethanol (100%)	0.084	18.67	1	68.44	5.75
Biodiesel (100%)	0.128	20.14	1	73.84	9.45
Rendered Animal Fat	0.125	19.38	1	71.06	8.88
Vegetable Oil	0.120	22.24	1	81.55	9.79

**Table 12.1 U.S. Default Factors for Calculating CO<sub>2</sub> Emissions from Fossil Fuel  
and Biomass Combustion**

Fuel Type	Heat Content	Carbon Content (Per Unit Energy)	Fraction Oxidized	CO <sub>2</sub> Emission Factor (Per Unit Energy)	CO <sub>2</sub> Emission Factor (Per Unit Mass or Volume)
<p>Source: Heat Content and CO<sub>2</sub> Emission factors per unit energy are from EPA Final Mandatory Reporting of Greenhouse Gases Rule Table C-1. Carbon Content derived using the heat content and default emission factor. Except those marked with * are from US Inventory of Greenhouse Gas Emissions and Sinks 1990-2009 (April 2011) Annex 2.2, Tables A-40 - A-43 (heat content factor for Unspecified Residential/Com. from U.S. Energy Information Administration, Annual Energy Review 2010 (October 2011), Table A-5) and **US Inventory of Greenhouse Gas Emissions and Sinks 1990-2007 (April 2009) Annex 2.2, Table A-38 and *** derived from the API Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry (August 2009), Section 6.3.6, Table 3-8. A fraction oxidized value of 1.00 is from the Intergovernmental Panel on Climate Change (IPCC), Guidelines for National Greenhouse Gas Inventories (2006) and ****EPA Climate Leaders Technical Guidance (2008) Table B-2.</p> <p><b>NOTE:</b> Where not provided from the EPA Final Mandatory Reporting of Greenhouse Gases Rule, default CO<sub>2</sub> emission factors (per unit energy) are calculated as: Carbon Content × Fraction Oxidized × 44/12. Default CO<sub>2</sub> emission factors (per unit mass or volume) are calculated using the equation: Heat Content × Carbon Content × Fraction Oxidized × 44/12 × Conversion Factor (if applicable).</p>					

**Table 12.2 Canadian Default Factors for Calculating CO<sub>2</sub> Emissions from Combustion of Natural Gas, Petroleum Products, and Biomass**

Fuel Type	Carbon Content (Per Unit Energy)	Heat Content	Fraction Oxidized	CO <sub>2</sub> Emission Factor (Per Unit Mass or Volume)
Natural Gas	kg C / GJ	GJ / megalitre		g CO <sub>2</sub> / m <sup>3</sup>
Electric Utilities, Industry, Commercial, Pipelines, Agriculture, Residential*	n/a	38.26	1	1900.46
Producer Consumption*	n/a	38.26	1	2400.95
Newfoundland and Labrador				
Marketable	n/a	38.26	1	1900.46
NonMarketable	n/a	38.26	1	2494.41
Nova Scotia				
Marketable	n/a	38.26	1	1900.46
NonMarketable	n/a	38.26	1	2494.41
New Brunswick				
Marketable		38.26	1	1900.46
NonMarketable		38.26	1	NO
Quebec				
Marketable	n/a	38.26	1	1887.39
NonMarketable	n/a	38.26	1	NO
Ontario				
Marketable	n/a	38.26	1	1888.40
NonMarketable	n/a	38.26	1	NO
Manitoba				
Marketable	n/a	38.26	1	1886.39
NonMarketable	n/a	38.26	1	NO
Saskatchewan				
Marketable	n/a	38.26	1	1829.10
NonMarketable	n/a	38.26	1	2441.15
Alberta				
Marketable	n/a	38.26	1	1927.59
NonMarketable	n/a	38.26	1	2391.90
British Columbia				
Marketable	n/a	38.26	1	1925.58
NonMarketable	n/a	38.26	1	2161.76
Northwest Territories				
Marketable	n/a	38.26	1	2466.27
NonMarketable	n/a	38.26	1	2466.27

**Table 12.2 Canadian Default Factors for Calculating CO<sub>2</sub> Emissions from Combustion of Natural Gas, Petroleum Products, and Biomass**

<b>Fuel Type</b>	<b>Carbon Content (Per Unit Energy)</b>	<b>Heat Content</b>	<b>Fraction Oxidized</b>	<b>CO<sub>2</sub> Emission Factor (Per Unit Mass or Volume)</b>
<b>Natural Gas Liquids</b>	<b>kg C / GJ</b>	<b>GJ / kilolitre</b>		<b>g CO<sub>2</sub> / L</b>
Propane				
Residential Propane	n/a	25.31	1	1517.55
Other Uses Propane	n/a	25.31	1	1517.55
Ethane	n/a	17.22	1	980.88
Butane	n/a	28.44	1	1738.65
<b>Petroleum Products</b>	<b>kg C / GJ</b>	<b>GJ / kilolitre</b>		<b>g CO<sub>2</sub> / L</b>
Light Fuel Oil Electric Utilities	n/a	38.80	1	2752.25
Light Fuel Oil Industrial	n/a	38.80	1	2752.25
Light Fuel Oil Producer Consumption	n/a	38.80	1	2669.43
Light Fuel Oil Residential	n/a	38.80	1	2752.25
Light Fuel Oil Forestry, Construction, Public Administration, Commercial/Institutional	n/a	38.80	1	2752.25
Heavy Fuel Oil (Electric Utility, Industrial, Forestry, Construction, Public Administration, Commercial/Institutional)	n/a	42.50	1	3155.24
Heavy Fuel Oil (Residential)	n/a	42.50	1	3155.24
Heavy Fuel Oil (Producer Consumption)	n/a	42.50	1	3189.58
Kerosene (Electric Utility, Industrial, Producer Consumption, Residential, Forestry, Construction, Public Administration, Commercial/Institutional)	n/a	37.68	1	2559.34
Diesel	n/a	38.30	1	2689.63
Petroleum Coke from Upgrading Facilities	n/a	40.57	1	3528.94
Petroleum Coke from Refineries & Others	n/a	46.35	1	3854.16
<b>Still Gas</b>	<b>kg C / TJ</b>	<b>TJ / GL</b>		<b>g / m<sup>3</sup></b>
Upgrading Facilities	n/a	43.24	1	2161.4
Refineries & Others	n/a	36.08	1	1740.23

**Table 12.2 Canadian Default Factors for Calculating CO<sub>2</sub> Emissions from Combustion of Natural Gas, Petroleum Products, and Biomass**

Fuel Type	Carbon Content (Per Unit Energy)	Heat Content	Fraction Oxidized	CO <sub>2</sub> Emission Factor (Per Unit Mass or Volume)
<b>Biomass</b>	<b>kg C / GJ</b>	<b>GJ / t</b>		<b>g CO<sub>2</sub> / kg</b>
Wood Fuel/Wood Waste	n/a	18	1	848.4
Spent Pulping Liquor	n/a	14	1	935.55
<b>Biomass</b>				<b>kg CO<sub>2</sub> / TJ</b>
Landfill Gas**	n/a	n/a	1	51,686

NO=Not Occurring, n/a=not available. Source: Default CO<sub>2</sub> emission factors: Environment Canada, *National Inventory Report, 1990-2009: Greenhouse Gas Sources and Sinks in Canada* (2011), Annex 8: Emission Factors, Tables A8-1, A8-3, A8-4, A8-5, A8-26, A8-27 (2009 data). Except those marked with \* are from Environment Canada, National Inventory Report, 1990-2006: Greenhouse Gas Sources and Sinks in Canada (2008), Annex 12: Emission Factors, Tables A12-1 (2006 data) and those marked with \*\* Environment Canada, Greenhouse Gas Division, (2009 data); Default Heat Content: Statistics Canada, *Report on Energy Supply and Demand in Canada, 2008* (2011), Energy conversion factors, p. 125; Default Carbon Content: Canada-specific carbon content coefficients are not available. If you cannot obtain measured carbon content values specific to your fuels, you should use the default emission factor; Default Fraction Oxidized: Intergovernmental Panel on Climate Change (IPCC), *Guidelines for National Greenhouse Gas Inventories* (2006). Note: CO<sub>2</sub> emission factors from Environment Canada originally included fraction oxidized factors of less than 100%. Values were converted to include a 100% oxidation rate using 99.5% for natural gas, NGLs; 99% for petroleum products and wood fuel/wood waste; and 95% for spent pulping liquor based on the rates used to calculate the original factors.

**Table 12.3 Canadian Default Factors for Calculating CO<sub>2</sub> Emissions from  
Combustion of Coal**

<b>Province and Coal Type</b>	<b>Carbon Content</b>	<b>Heat Content</b>	<b>Fraction Oxidized</b>	<b>CO<sub>2</sub> Emission Factor</b>
<b>Newfoundland and Labrador</b>	<b>kg C / GJ</b>	<b>GJ / t</b>		<b>g CO<sub>2</sub> / kg</b>
Canadian Bituminous	n/a	28.96	1	2344
Anthracite	n/a	27.70	1	2411
<b>Prince Edward Island</b>	<b>kg C / GJ</b>	<b>GJ / t</b>		<b>g CO<sub>2</sub> / kg</b>
Canadian Bituminous	n/a	28.96	1	2344
<b>Nova Scotia</b>	<b>kg C / GJ</b>	<b>GJ / t</b>		<b>g CO<sub>2</sub> / kg</b>
Canadian Bituminous	n/a	28.96	1	2344
Foreign Bituminous	n/a	29.82	1	2566
Sub-Bituminous	n/a	19.15	1	1844
<b>New Brunswick</b>	<b>kg C / GJ</b>	<b>GJ / t</b>		<b>g CO<sub>2</sub> / kg</b>
Canadian Bituminous	n/a	28.96	1	2333
Foreign Bituminous	n/a	29.82	1	2566
<b>Quebec</b>	<b>kg C / GJ</b>	<b>GJ / t</b>		<b>g CO<sub>2</sub> / kg</b>
Canadian Bituminous	n/a	28.96	1	2344
Foreign Bituminous	n/a	29.82	1	2566
Anthracite	n/a	27.70	1	2411
<b>Ontario</b>	<b>kg C / GJ</b>	<b>GJ / t</b>		<b>g CO<sub>2</sub> / kg</b>
Canadian Bituminous	n/a	28.96	1	2212
Foreign Bituminous	n/a	29.82	1	2566
Sub-Bituminous	n/a	19.15	1	1844
Lignite	n/a	15.00	1	1402
Anthracite	n/a	27.70	1	2411
<b>Manitoba</b>	<b>kg C / GJ</b>	<b>GJ / t</b>		<b>g CO<sub>2</sub> / kg</b>
Canadian Bituminous	n/a	26.02	1	2212
Foreign Bituminous	n/a	29.82	1	2566
Sub-Bituminous	n/a	19.15	1	1844
Lignite	n/a	15.00	1	1402
Anthracite	n/a	27.70	1	2411
<b>Saskatchewan</b>	<b>kg C / GJ</b>	<b>GJ / t</b>		<b>g CO<sub>2</sub> / kg</b>
Canadian Bituminous	n/a	25.43	1	2212
Lignite	n/a	15.00	1	1402
<b>Alberta</b>	<b>kg C / GJ</b>	<b>GJ / t</b>		<b>g CO<sub>2</sub> / kg</b>
Canadian Bituminous	n/a	25.43	1	2212
Foreign Bituminous	n/a	29.82	1	2566
Sub-Bituminous	n/a	19.15	1	1742
Anthracite	n/a	27.70	1	2411
<b>British Columbia</b>	<b>kg C / GJ</b>	<b>GJ / t</b>		<b>g CO<sub>2</sub> / kg</b>
Canadian Bituminous	n/a	26.02	1	2212
Foreign Bituminous	n/a	29.82	1	2566

**Table 12.3 Canadian Default Factors for Calculating CO<sub>2</sub> Emissions from Combustion of Coal**

Province and Coal Type	Carbon Content	Heat Content	Fraction Oxidized	CO <sub>2</sub> Emission Factor
Sub-Bituminous	n/a	19.15	1	1742
<b>All Provinces</b>	<b>kg C / GJ</b>	<b>GJ / t</b>		<b>g CO<sub>2</sub> / kg</b>
Coke	n/a	28.83	1	2504
<b>All Provinces</b>	<b>kg C / GJ</b>	<b>GJ / megalitre</b>		<b>g / m<sup>3</sup></b>
Coke Oven Gas*	n/a	19.14	1	888

Source: Default CO<sub>2</sub> Emission Factors: Environment Canada, Greenhouse Gas Division, (2009 data) Except those marked with \* are from *National Inventory Report, 1990-2009: Greenhouse Gas Sources and Sinks in Canada* (2011), Annex 8: Emission Factors, Table A8-8 (2009 data). Default Heat Content: Statistics Canada, *Report on Energy Supply and Demand in Canada, 2008* (2011), Energy conversion factors, p. 125 (value for Foreign Bituminous uses heat content of "Imported bituminous"); Default Carbon Content: Canada-specific carbon content coefficients are not available. If you cannot obtain measured carbon content values specific to your fuels, you should use the default emission factor; Default Fraction Oxidized: Intergovernmental Panel on Climate Change (IPCC), *Guidelines for National Greenhouse Gas Inventories* (2006). Note: CO<sub>2</sub> emission factors from Environment Canada originally included a fraction oxidized factor of 99%. Values were converted to instead include a 100% oxidation rate.

**Table 12.4 Canadian Default Factors for Calculating CH<sub>4</sub> and N<sub>2</sub>O Emissions from Combustion of Natural Gas, Petroleum Products, Coal, and Biomass**

<b>Fuel Type</b>	<b>CH<sub>4</sub> Emission Factor (Per Unit Mass or Volume)</b>	<b>N<sub>2</sub>O Emission Factor (Per Unit Mass or Volume)</b>
<b>Natural Gas</b>	<b>g CH<sub>4</sub> / m<sup>3</sup></b>	<b>g N<sub>2</sub>O / m<sup>3</sup></b>
Electric Utilities	0.49	0.049
Industrial	0.037	0.033
Producer Consumption (NonMarketable)	6.5	0.06
Pipelines	1.9	0.05
Cement	0.037	0.034
Manufacturing Industries	0.037	0.033
Residential, Construction, Commercial/Institutional, Agriculture	0.037	0.035
<b>Natural Gas Liquids</b>	<b>g CH<sub>4</sub> / L</b>	<b>g N<sub>2</sub>O / L</b>
Propane (Residential)	0.027	0.108
Propane (All Other Uses)	0.024	0.108
Ethane	n/a	n/a
Butane	0.024	0.108
<b>Refined Petroleum Products</b>	<b>g CH<sub>4</sub> / L</b>	<b>g N<sub>2</sub>O / L</b>
Light Fuel Oil (Electric Utilities)	0.18	0.031
Light Fuel Oil (Industrial and Producer Consumption)	0.006	0.031
Light Fuel Oil (Residential)	0.026	0.006
Light Fuel Oil (Forestry, Construction, Public Administration, and Commercial/Institutional)	0.026	0.031
Heavy Fuel Oil (Electric Utilities)	0.034	0.064
Heavy Fuel Oil (Industrial and Producer Consumption)	0.12	0.064
Heavy Fuel Oil (Residential, Forestry, Construction, Public Administration, and Commercial/Institutional)	0.057	0.064
Kerosene (Electric Utilities, Industrial, and Producer Consumption)	0.006	0.031
Kerosene (Residential)	0.026	0.006
Kerosene (Forestry, Construction, Public Administration, and Commercial/Institutional)	0.026	0.031
Diesel	0.133	0.4
Still Gas	n/a	0.00002
<b>Petroleum Coke</b>	<b>g CH<sub>4</sub> / L</b>	<b>g N<sub>2</sub>O / L</b>
Upgrading Facilities	0.12	0.0222
Refineries & Others	0.12	0.0199
<b>Coal</b>	<b>g CH<sub>4</sub> / kg</b>	<b>g N<sub>2</sub>O / kg</b>
Coal (Electric Utilities)	0.022	0.032
Coal (Industry and Heat & Steam Plants)	0.03	0.02
Coal (Residential, Public Administration)	4	0.02
Coke	0.03	0.02

**Table 12.4 Canadian Default Factors for Calculating CH<sub>4</sub> and N<sub>2</sub>O Emissions from Combustion of Natural Gas, Petroleum Products, Coal, and Biomass**

<b>Fuel Type</b>	<b>CH<sub>4</sub> Emission Factor</b> (Per Unit Mass or Volume)	<b>N<sub>2</sub>O Emission Factor</b> (Per Unit Mass or Volume)
<b>Coal (gas)</b>	<b>g CH<sub>4</sub> / m<sup>3</sup></b>	<b>g N<sub>2</sub>O / m<sup>3</sup></b>
Coke Oven Gas	0.037	0.035
<b>Biomass</b>	<b>g CH<sub>4</sub> / kg</b>	<b>g N<sub>2</sub>O / kg</b>
Wood Fuel/Wood Waste (Industrial Combustion)	0.09	0.02
Spent Pulping Liquor (Industrial Combustion)	0.02	0.02
Stoves and Fireplaces (Advance Technology or Catalytic Control)	6.9	0.16
Stoves and Fireplaces (Conventional, Inserts, and Other Wood-Burning Equipment)	15	0.16
<b>Landfill Gas</b>	<b>g CH<sub>4</sub> / GJ</b>	<b>g N<sub>2</sub>O / GJ</b>
Landfill Gas (Industrial Combustion)	1	0.1
Source: Environment Canada, <i>National Inventory Report, 1990-2009 Greenhouse Gas Sources and Sinks in Canada</i> (2011) Annex 8: Emission Factors, Tables A8-2, A8-3, A8-4, A8-6, A8-9, A8-26 (2009 data).		

**Table 12.5 Default CH<sub>4</sub> and N<sub>2</sub>O Emission Factors by Technology Type for the Electricity Generation Sector**

Fuel Type and Basic Technology	Configuration	CH <sub>4</sub> (g / MMBtu)	N <sub>2</sub> O (g / MMBtu)
<b>Liquid Fuels</b>			
Residual Fuel Oil/Shale Oil Boilers	Normal Firing	0.8	0.3
	Tangential Firing	0.8	0.3
Gas/Diesel Oil Boilers	Normal Firing	0.9	0.4
	Tangential Firing	0.9	0.4
Large Diesel Oil Engines >600hp (447kW)		4	NA
<b>Solid Fuels</b>			
Pulverized Bituminous Combustion Boilers	Dry Bottom, wall fired	0.7	0.5
	Dry Bottom, tangentially fired	0.7	1.4
	Wet Bottom	0.9	1.4
Bituminous Spreader Stoker Boilers	With and without re-injection	1	0.7
Bituminous Fluidized Bed Combustor	Circulating Bed	1	61.1
	Bubbling Bed	1	61.1
Bituminous Cyclone Furnace		0.2	1.6
Lignite Atmospheric Fluidized Bed		NA	71.2
<b>Natural Gas</b>			
Boilers		0.9	0.9
Gas-Fired Gas Turbines >3MW		3.8	0.9
Large Dual-Fuel Engines		245	NA
Combined Cycle		0.9	2.8
<b>Peat</b>			
Peat Fluidized Bed Combustor	Circulating Bed	3	7
	Bubbling Bed	3	3
<b>Biomass</b>			
Wood/Wood Waste Boilers		9.3	5.9
Wood Recovery Boilers		0.8	0.8
Source: IPCC, Guidelines for National Greenhouse Gas Inventories (2006), Chapter 2: Stationary Combustion, Table 2.6. Values were converted back from LHV to HHV using IPCC's assumption that LHV are five percent lower than HHV for coal and oil, 10 percent lower for natural gas, and 20 percent lower for dry wood. (The IPCC converted the original factors from units of HHV to LHV, so the same conversion rates used by the IPCC were used here to obtain the original values in units of HHV.) Values were converted from kg/TJ to g/MMBtu using 1 kg = 1000 g and 1 MMBtu = 0.001055 TJ. NA = data not available.			

**Table 12.6 Default CH<sub>4</sub> and N<sub>2</sub>O Emission Factors for Kilns, Ovens, and Dryers**

Industry	Source	CH <sub>4</sub> (g / MMBtu)	N <sub>2</sub> O (g / MMBtu)
Cement, Lime	Kilns - Natural Gas	1.04	NA
Cement, Lime	Kilns – Oil	1	NA
Cement, Lime	Kilns – Coal	1	NA
Coking, Steel	Coke Oven	1	NA
Chemical Processes, Wood, Asphalt, Copper, Phosphate	Dryer - Natural Gas	1.04	NA
Chemical Processes, Wood, Asphalt, Copper, Phosphate	Dryer – Oil	1	NA
Chemical Processes, Wood, Asphalt, Copper, Phosphate	Dryer – Coal	1	NA

Source: IPCC, Guidelines for National Greenhouse Gas Inventories (2006), Chapter 2: Stationary Combustion, Table 2.8. Values were converted back from LHV to HHV using IPCC's assumption that LHV are five percent lower than HHV for coal and oil and 10 percent lower for natural gas. Values were converted from kg/TJ to g/MMBtu using 1 kg = 1000 g and 1 MMBtu = 0.001055 TJ. NA = data not available.

**Table 12.7 Default CH<sub>4</sub> and N<sub>2</sub>O Emission Factors by Technology Type for the Industrial Sector**

Fuel Type and Basic Technology	Configuration	CH <sub>4</sub> (g / MMBtu)	N <sub>2</sub> O (g / MMBtu)
<b>Liquid Fuels</b>			
Residual Fuel Oil Boilers		3	0.3
Gas/Diesel Oil Boilers		0.2	0.4
Large Stationary Diesel Oil Engines >600hp (447 kW)		4	NA
Liquefied Petroleum Gases Boilers		0.9	4
<b>Solid Fuels</b>			
Other Bituminous/Sub-bit. Overfeed Stoker Boilers		1	0.7
Other Bituminous/Sub-bit. Underfeed Stoker Boilers		14	0.7
Other Bituminous/Sub-bituminous Pulverized	Dry Bottom, wall fired	0.7	0.5
	Dry Bottom, tangentially fired	0.7	1.4
	Wet Bottom	0.9	1.4
Other Bituminous Spreader Stokers		1	0.7
Other Bituminous/Sub-bit. Fluidized Bed Combustor	Circulating Bed	1	61.1
	Bubbling Bed	1	61.1
<b>Natural Gas</b>			
Boilers		0.9	0.9
Gas-Fired Gas Turbines >3MW		3.8	0.9
Natural Gas-fired Reciprocating Engines	2-Stroke Lean Burn	658	NA
	4-Stroke Lean Burn	566.9	NA
	4-Stroke Rich Burn	104.4	NA
<b>Biomass</b>			
Wood/Wood Waste Boilers		9.3	5.9
Source: IPCC, Guidelines for National Greenhouse Gas Inventories (2006), Chapter 2: Stationary Combustion, Table 2.7. Values were converted from LHV to HHV assuming that LHV are five percent lower than HHV for coal and oil, 10 percent lower for natural gas, and 20 percent lower for dry wood. (The IPCC converted the original factors from units of HHV to LHV, so the same conversion rates used by the IPCC were used here to obtain the original values in units of HHV.) Values were converted from kg/TJ to g/MMBtu using 1 kg = 1000 g and 1 MMBtu = 0.001055 TJ. NA = data not available.			

**Table 12.8 Default CH<sub>4</sub> and N<sub>2</sub>O Emission Factors by Technology Type for the Commercial Sector**

<b>Fuel Type and Basic Technology</b>	<b>Configuration</b>	<b>CH<sub>4</sub> (g / MMBtu)</b>	<b>N<sub>2</sub>O (g / MMBtu)</b>
<b>Liquid Fuels</b>			
Residual Fuel Oil Boilers		1.4	0.3
Gas/Diesel Oil Boilers		0.7	0.4
Liquefied Petroleum Gases Boilers		0.9	4
<b>Solid Fuels</b>			
Other Bituminous/Sub-bit. Overfeed Stoker Boilers		1	0.7
Other Bituminous/Sub-bit. Underfeed Stoker Boilers		14	0.7
Other Bituminous/Sub-bit. Hand-fed Units		87.2	0.7
Other Bituminous/Sub-bituminous Pulverized Boilers	Dry Bottom, wall fired	0.7	0.5
	Dry Bottom, tangentially fired	0.7	1.4
	Wet Bottom	0.9	1.4
Other Bituminous Spreader Stokers		1	0.7
Other Bituminous/Sub-bit. Fluidized Bed Combustor	Circulating Bed	1	61.1
	Bubbling Bed	1	61.1
<b>Natural Gas</b>			
Boilers		0.9	0.9
Gas-Fired Gas Turbines >3MWa		3.8	1.3
<b>Biomass</b>			
Wood/Wood Waste Boilers		9.3	5.9
<p>Source: IPCC, Guidelines for National Greenhouse Gas Inventories (2006), Chapter 2: Stationary Combustion, Table 2.10. Values were converted from LHV to HHV assuming that LHV are five percent lower than HHV for coal and oil, 10 percent lower for natural gas, and 20 percent lower for dry wood. (The IPCC converted the original factors from units of HHV to LHV, so the same conversion rates used by the IPCC were used here to obtain the original values in units of HHV.) Values were converted from kg/TJ to g/MMBtu using 1 kg = 1000 g and 1 MMBtu = 0.001055 TJ.</p>			

**Table 12.9 Default CH<sub>4</sub> and N<sub>2</sub>O Emission Factors By Fuel Type Industrial and Energy Sectors**

Fuel Type / End-Use Sector	CH <sub>4</sub> (kg / MMBtu)	N <sub>2</sub> O (kg / MMBtu)
<b>Coal</b>		
Industrial	0.011	0.0016
Energy Industry	0.011	0.0016
<b>Coke</b>		
Industrial	0.011	0.0016
Energy Industry	0.011	0.0016
<b>Petroleum Products</b>		
Industrial	0.003	0.0006
Energy Industry	0.003	0.0006
<b>Natural Gas</b>		
Industrial	0.001	0.0001
Energy Industry	0.001	0.0001
<b>Municipal Solid Waste</b>		
Industrial	0.032	0.0042
Energy Industry	0.032	0.0042
<b>Tires</b>		
Industrial	0.032	0.0042
Energy Industry	0.032	0.0042
<b>Blast Furnace Gas</b>		
Industrial	0.000022	0.0001
Energy Industry	0.000022	0.0001
<b>Coke Oven Gas</b>		
Industrial	0.00048	0.0001
Energy Industry	0.00048	0.0001
<b>Biomass Fuels Solid</b>		
Industrial	0.032	0.0042
Energy Industry	0.032	0.0042
<b>Biogas</b>		
Industrial	0.0032	0.00063
Energy Industry	0.0032	0.00063
<b>Biomass Fuels Liquid</b>		
Industrial	0.0011	0.00011
Energy Industry	0.0011	0.00011
<b>Pulping Liquors</b>		
Industrial*	0.00025	0.0002
Source: EPA Final Mandatory Reporting of Greenhouse Gases Rule Table C-2. Except those marked with * are from the National Council for Air and Stream Improvement, Inc. (NCASI), Calculation Tools for Estimating Greenhouse Gas Emissions from Pulp and Paper Mills. Version 1.3.		

**Table 12.9 Default CH<sub>4</sub> and N<sub>2</sub>O Emission Factors By Fuel Type Residential and Commercial Sectors**

Fuel Type / End-Use Sector	CH <sub>4</sub> (g / MMBtu)	N <sub>2</sub> O (g / MMBtu)
<b>Coal</b>		
Residential	316	1.6
Commercial	11	1.6
<b>Petroleum Products</b>		
Residential	11	0.6
Commercial	11	0.6
<b>Natural Gas</b>		
Residential	5	0.1
Commercial	5	0.1
<b>Wood</b>		
Residential	316	4.2
Commercial	316	4.2
Source: IPCC, Guidelines for National Greenhouse Gas Inventories (2006), Chapter 2: Stationary Combustion, Tables 2.4 and 2.5. Values were converted from kg/TJ to g/MMBtu based on the conversion factor of 0.95 MMBtu/GJ.		

**Table 13.1 US Default CO<sub>2</sub> Emission Factors for Transport Fuels**

Fuel Type	Carbon Content (Per Unit Energy)	Heat Content	Fraction Oxidized	CO <sub>2</sub> Emission Factor (Per Unit Volume)
<b>Fuels Measured in Gallons</b>				
	<b>kg C / MMBtu</b>	<b>MMBtu / barrel</b>		<b>kg CO<sub>2</sub> / gallon</b>
Gasoline	19.15	5.25	1	8.78
Diesel Fuel	20.17	5.80	1	10.21
Aviation Gasoline	18.89	5.04	1	8.31
Jet Fuel (Jet A or A-1)	19.70	5.67	1	9.75
Kerosene	20.51	5.67	1	10.15
Residual Fuel Oil No. 5	19.89	5.88	1	10.21
Residual Fuel Oil No. 6	20.48	6.30	1	11.27
Crude Oil	20.32	5.80	1	10.28
Biodiesel (B100)	20.14	5.38	1	9.45
Ethanol (E100)	18.67	3.53	1	5.75
Methanol*	NA	NA	1	4.10
Liquefied Natural Gas (LNG)*	NA	NA	1	4.46
Liquefied Petroleum Gas (LPG)	17.18	3.86	1	5.79
Propane (Liquid)	16.76	3.82	1	5.59
Ethane	17.08	2.90	1	4.32
Isobutane	17.70	4.07	1	6.30
n-Butane	17.77	4.24	1	6.58
<b>Fuels Measured in Standard Cubic Feet</b>				
	<b>kg C / MMBtu</b>	<b>Btu / Standard cubic foot</b>		<b>kg CO<sub>2</sub> / Standard cubic foot</b>
Compressed Natural Gas (CNG)*	14.47	1,027	1	0.054
Propane (Gas)	16.76	2,516	1	0.1546

Source: Heat Content and Default Emission factors are from EPA Final Mandatory Reporting of Greenhouse Gases Rule Table C-1. Carbon Content derived using the heat content and default emission factor . Except those marked \* are from EPA Climate Leaders, Mobile Combustion Guidance, Tables B-4, B-5, (2008). A fraction oxidized value of 1.00 is from the IPCC, *Guidelines for National Greenhouse Gas Inventories* (2006).

Note: Default CO<sub>2</sub> emission factors are calculated using Equation 12d: Heat Content × Carbon Content × Fraction Oxidized × 44/12 × Conversion Factor. Heat content factors are based on higher heating values (HHV). NA = data not available.

**Table 13.2 Canadian Default CO<sub>2</sub> Emission Factors for Transport Fuels**

Fuel Type	Carbon Content (kg C / GJ)	Heat Content	Fraction Oxidized	CO <sub>2</sub> Emission Factors
		GJ / kiloliter		g CO <sub>2</sub> / L
Gasoline	n/a	35.00	1	2311.89
Diesel	n/a	38.30	1	2689.63
Light Fuel Oil	n/a	38.80	1	2752.25
Heavy Fuel Oil	n/a	42.50	1	3155.24
Aviation Gasoline	n/a	33.52	1	2365.42
Aviation Turbo Fuel	n/a	37.40	1	2559.34
Propane	n/a	25.31	1	1532.65
Ethanol	n/a	n/a	1	1568.70
Biodiesel	n/a	n/a	1	2571.45
		GJ / megaliter		g CO <sub>2</sub> / L
Natural Gas	n/a	38.26	1	1.92

Source: Default CO<sub>2</sub> Emission Factors: Environment Canada, National Inventory Report, 1990-2009: Greenhouse Gas Sources and Sinks in Canada (2011) Annex 8: Emission Factors, Table A8-11 (2009 data); Default Heat Content: Statistics Canada, Report on Energy Supply and Demand in Canada, 2008 (2011), Energy conversion factors, p. 125; Default Carbon Content: Not available for Canada, If you cannot obtain measured carbon content values specific to your fuels, you should use the default emission factor. Default Fraction Oxidized: A value of 1.00 is used following the Intergovernmental Panel on Climate Change (IPCC), *Guidelines for National Greenhouse Gas Inventories* (2006).  
 Note: CO<sub>2</sub> emission factors from Environment Canada originally included fraction oxidized factors of less than 100%. Values were converted to 100% oxidation rate using 99% for all fuels except natural gas and propane, where a value of 99.5% was used, and Ethanol, where a value of 95% was used, based on the rates used to calculate the original factors.

**Table 13.3 Canadian Default Factors for Calculating CH<sub>4</sub> and N<sub>2</sub>O Emissions from Mobile Combustion**

Vehicle Type	CH <sub>4</sub> Emission Factor (g CH <sub>4</sub> / L)	N <sub>2</sub> O Emission Factor (g N <sub>2</sub> O / L)
<b>Light-Duty Gasoline Vehicles (LDGVs)</b>		
Tier 2	0.14	0.022
Tier 1	0.23	0.47
Tier 0	0.32	0.66
Oxidation Catalyst	0.52	0.2
Non-Catalytic Controlled	0.46	0.028
<b>Light-Duty Gasoline Trucks (LDGTs)</b>		
Tier 2	0.14	0.022
Tier 1	0.24	0.58
Tier 0	0.21	0.66
Oxidation Catalyst	0.43	0.2
Non-Catalytic Controlled	0.56	0.028
<b>Heavy-Duty Gasoline Vehicles (HDGVs)</b>		
Three-Way Catalyst	0.068	0.2
Non-Catalytic Controlled	0.29	0.047
Uncontrolled	0.49	0.084
<b>Gasoline Motorcycles</b>		
Non-Catalytic Controlled	0.77	0.041
Uncontrolled	2.3	0.048
<b>Light-Duty Diesel Vehicles (LDDVs)</b>		
Advance Control*	0.051	0.22
Moderate Control	0.068	0.21
Uncontrolled	0.1	0.16
<b>Light-Duty Diesel Trucks (LDDTs)</b>		
Advance Control*	0.068	0.22
Moderate Control	0.068	0.21
Uncontrolled	0.085	0.16
<b>Heavy-Duty Diesel Vehicles (HDDVs)</b>		
Advance Control	0.11	0.151
Moderate Control	0.14	0.082
Uncontrolled	0.15	0.075
<b>Gas Fueled Vehicles</b>		
Natural Gas Vehicles	9 x 10 <sup>-3</sup>	6 x 10 <sup>-5</sup>
Propane Vehicles	0.64	0.028
<b>Off-Road Vehicles</b>		
Off-Road Gasoline	2.7	0.05
Off-Road Diesel	0.15	1.1
<b>Railways</b>		
Diesel Train	0.15	1.1

**Table 13.3 Canadian Default Factors for Calculating CH<sub>4</sub> and N<sub>2</sub>O Emissions from Mobile Combustion**

Vehicle Type	CH <sub>4</sub> Emission Factor (g CH <sub>4</sub> / L)	N <sub>2</sub> O Emission Factor (g N <sub>2</sub> O / L)
<b>Marine</b>		
Gasoline Boats	1.3	0.066
Diesel Ships	0.15	1.1
Light Fuel Oil Ships	0.26	0.073
Heavy Fuel Oil Ships	0.28	0.079
<b>Aviation</b>		
Aviation Gasoline	2.2	0.23
Aviation Turbo Fuel	0.028	0.071
<b>Renewable Fuels</b>		
Biodiesel	**	**
Ethanol	***	***
<p>Source: Environment Canada, National Inventory Report, 1990-2009: Greenhouse Gas Sources and Sinks in Canada (2011) Annex 8: Emission Factors, Table A8-11 (2009 data).</p> <p>* Advanced control diesel emission factors shall be used for Tier 2 diesel vehicles.</p> <p>** Diesel CH<sub>4</sub> and N<sub>2</sub>O emission factors (by mode and technology) shall be used to calculate biodiesel emissions</p> <p>*** Gasoline CH<sub>4</sub> and N<sub>2</sub>O emission factors (by mode and technology) shall be used to calculate ethanol emissions.</p>		

**Table 13.4 Default CH<sub>4</sub> and N<sub>2</sub>O Emission Factors for Highway Vehicles  
by Technology Type**

Vehicle Type/Control Technology	CH <sub>4</sub> (g / mi)	N <sub>2</sub> O (g / mi)
<b>Gasoline Passenger Cars</b>		
EPA Tier 2	0.0173	0.0036
Low Emission Vehicles	0.0105	0.015
EPA Tier 1	0.0271	0.0429
EPA Tier 0	0.0704	0.0647
Oxidation Catalyst	0.1355	0.0504
Non-Catalyst Control	0.1696	0.0197
Uncontrolled	0.178	0.0197
<b>Gasoline Light Trucks (Vans, Pickup Trucks, SUVs)</b>		
EPA Tier 2	0.0163	0.0066
Low Emission Vehicles	0.0148	0.0157
EPA Tier 1	0.0452	0.0871
EPA Tier 0	0.0776	0.1056
Oxidation Catalyst	0.1516	0.0639
Non-Catalyst Control	0.1908	0.0218
Uncontrolled	0.2024	0.022
<b>Gasoline Medium and Heavy-Duty Vehicles Trucks and Busses</b>		
EPA Tier 2	0.0333	0.0134
Low Emission Vehicles	0.0303	0.032
EPA Tier 1	0.0655	0.175
EPA Tier 0	0.263	0.2135
Oxidation Catalyst	0.2356	0.1317
Non-Catalyst Control	0.4181	0.0473
Uncontrolled	0.4604	0.0497
<b>Diesel Passenger Cars</b>		
Advanced	0.0005	0.001
Moderate	0.0005	0.001
Uncontrolled	0.0006	0.0012
<b>Diesel Light Trucks</b>		
Advanced	0.001	0.0015
Moderate	0.0009	0.0014
Uncontrolled	0.0011	0.0017
<b>Diesel Medium and Heavy-Duty Vehicles (Trucks and Busses)</b>		
Aftertreatment	0.0051	0.0048
Advanced	0.0051	0.0048
Moderate	0.0051	0.0048
Uncontrolled	0.0051	0.0048

**Table 13.4 Default CH<sub>4</sub> and N<sub>2</sub>O Emission Factors for Highway Vehicles  
by Technology Type**

Vehicle Type/Control Technology	CH <sub>4</sub> (g / mi)	N <sub>2</sub> O (g / mi)
<b>Motorcycles</b>		
Non-Catalyst Control	0.0672	0.0069
Uncontrolled	0.0899	0.0087
Source: US Inventory of Greenhouse Gas Emissions and Sinks 1990-2009 (April 2011) Annex 3, Table A-101.		

**Table 13.5 CH<sub>4</sub> and N<sub>2</sub>O Emission Factors for Highway Vehicles by Model Year**

<b>Vehicle Type and Year</b>	<b>CH<sub>4</sub> (g / mi)</b>	<b>N<sub>2</sub>O (g / mi)</b>
<b>Gasoline Passenger Cars</b>		
Model Years 1984-1993	0.0704	0.0647
Model Year 1994	0.0531	0.0560
Model Year 1995	0.0358	0.0473
Model Year 1996	0.0272	0.0426
Model Year 1997	0.0268	0.0422
Model Year 1998	0.0249	0.0393
Model Year 1999	0.0216	0.0337
Model Year 2000	0.0178	0.0273
Model Year 2001	0.0110	0.0158
Model Year 2002	0.0107	0.0153
Model Year 2003	0.0114	0.0135
Model Year 2004	0.0145	0.0083
Model Year 2005	0.0147	0.0079
Model Year 2006	0.0161	0.0057
Model Year 2007	0.0170	0.0041
Model Year 2008	0.0172	0.0038
Model Year 2009	0.0173	0.0036
<b>Gasoline Light Trucks (Vans, Pickup Trucks, SUVs)</b>		
Model Years 1987-1993	0.0813	0.1035
Model Year 1994	0.0646	0.0982
Model Year 1995	0.0517	0.0908
Model Year 1996	0.0452	0.0871
Model Year 1997	0.0452	0.0871
Model Year 1998	0.0391	0.0728
Model Year 1999	0.0321	0.0564
Model Year 2000	0.0346	0.0621
Model Year 2001	0.0151	0.0164
Model Year 2002	0.0178	0.0228
Model Year 2003	0.0155	0.0114
Model Year 2004	0.0152	0.0132
Model Year 2005	0.0157	0.0101
Model Year 2006	0.0159	0.0089
Model Year 2007	0.0161	0.0079
Model Year 2008	0.0163	0.0066
Model Year 2009	0.0163	0.0066

**Table 13.5 CH<sub>4</sub> and N<sub>2</sub>O Emission Factors for Highway Vehicles by Model Year**

Vehicle Type and Year	CH <sub>4</sub> (g / mi)	N <sub>2</sub> O (g / mi)
<b>Gasoline Medium and Heavy-Duty Trucks and Busses</b>		
Model Years 1985-1986	0.4090	0.0515
Model Year 1987	0.3675	0.0849
Model Years 1988-1989	0.3492	0.0933
Model Years 1990-1995	0.3246	0.1142
Model Year 1996	0.1278	0.1680
Model Year 1997	0.0924	0.1726
Model Year 1998	0.0641	0.1693
Model Year 1999	0.0578	0.1435
Model Year 2000	0.0493	0.1092
Model Year 2001	0.0528	0.1235
Model Year 2002	0.0526	0.1307
Model Year 2003	0.0533	0.1240
Model Year 2004	0.0341	0.0285
Model Year 2005	0.0326	0.0177
Model Year 2006	0.0326	0.0175
Model Year 2007	0.0327	0.0173
Model Year 2008	0.0327	0.0171
Model Year 2009	0.0327	0.0169
<b>Diesel Passenger Cars</b>		
Model Years 1960-1982	0.0006	0.0012
Model Years 1983-2009	0.0005	0.001
<b>Diesel Light Duty Trucks</b>		
Model Years 1960-1982	0.001	0.0017
Model Years 1983-1995	0.0009	0.0014
Model Years 1996-2009	0.001	0.0015
<b>Diesel Medium and Heavy-Duty Trucks and Busses</b>		
All Model Years 1960-2009	0.0051	0.0048
Source: US Inventory of Greenhouse Gas Emissions and Sinks 1990-2009 (April 2011) Annex 3, Tables A-97 - A-101.		

**Table 13.6 US Default CH<sub>4</sub> and N<sub>2</sub>O Emission Factors for Alternative Fuel Vehicles**

Vehicle Type	CH <sub>4</sub> (g / mi)	N <sub>2</sub> O (g / mi)
<b>Light Duty Vehicles</b>		
Methanol	0.018	0.067
CNG	0.737	0.050
LPG	0.037	0.067
Ethanol	0.055	0.067
Biodiesel (BD20)	0.0005	0.001
<b>Medium and Heavy Duty Vehicles</b>		
Methanol	0.066	0.175
CNG	1.966	0.175
LNG	1.966	0.175
LPG	0.066	0.175
Ethanol	0.197	0.175
Biodiesel (BD20)	0.005	0.005
<b>Buses</b>		
Methanol	0.066	0.175
CNG	1.966	0.175
Ethanol	0.197	0.175
Biodiesel (BD20)	0.005	0.005
Source: US Inventory of Greenhouse Gas Emissions and Sinks 1990-2009 (April 2011) Annex 3, Table A-102.		

**Table 13.7 US Default CH<sub>4</sub> and N<sub>2</sub>O Emission Factors for Non-Highway Vehicles**

Vehicle Type / Fuel Type	CH <sub>4</sub> (g / gallon)	N <sub>2</sub> O (g / gallon)
<b>Ships and Boats</b>		
Residual Fuel Oil	0.11	0.60
Diesel Fuel	0.74	0.26
Gasoline	0.06	0.39
<b>Locomotives</b>		
Diesel Fuel	0.80	0.26
<b>Agricultural Equipment</b>		
Gasoline	1.26	0.22
Diesel Fuel	1.44	0.26
<b>Construction/Mining Equipment</b>		
Gasoline	0.50	0.22
Diesel Fuel	0.58	0.26
<b>Other Non-Highway</b>		
Snowmobiles (Gasoline)	0.50	0.22
Other Recreational (Gasoline)	0.50	0.22
Other Small Utility (Gasoline)	0.50	0.22
Other Large Utility (Gasoline)	0.50	0.22
Other Large Utility (Diesel)	0.58	0.26
<b>Aircraft</b>		
Jet Fuel	0.27	0.31
Aviation Gasoline	7.05	0.11
Source: US Inventory of Greenhouse Gas Emissions and Sinks 1990-2009 (April 2011) Annex 3, Table A-103. Original factors converted to g/gallon fuel using fuel density defaults from U.S. EPA Climate Leaders, Mobile Combustion Guidance (2008) Table A-6.		

**Table 14.1 US Emission Factors by eGRID Subregion**

eGRID 2010 Subregion	eGRID 2010 Subregion Name	2007 Emission Rates		
		(lbs CO <sub>2</sub> / MWh)	(lbs CH <sub>4</sub> / GWh)	(lbs N <sub>2</sub> O / GWh)
AKGD	ASCC Alaska Grid	1,284.72	27.11	7.44
AKMS	ASCC Miscellaneous	535.73	22.65	4.48
AZNM	WECC Southwest	1,252.61	18.80	16.57
CAMX	WECC California	681.01	28.29	6.23
ERCT	ERCOT All	1,252.57	17.76	13.99
FRCC	FRCC All	1,220.11	41.19	15.25
HIMS	HICC Miscellaneous	1,343.82	135.15	21.71
HIOA	HICC Oahu	1,620.76	91.05	20.89
MROE	MRO East	1,692.32	28.79	29.05
MROW	MRO West	1,722.67	28.97	29.19
NEWE	NPCC New England	827.95	76.98	15.20
NWPP	WECC Northwest	858.79	16.34	13.64
NYCW	NPCC NYC/Westchester	704.80	26.22	3.35
NYLI	NPCC Long Island	1,418.74	90.50	13.10
NYUP	NPCC Upstate NY	683.27	17.41	9.90
RFCE	RFC East	1,059.32	27.40	17.03
RFCM	RFC Michigan	1,651.11	32.55	27.79
RFCW	RFC West	1,551.52	18.37	25.93
RMPA	WECC Rockies	1,906.06	23.63	28.89
SPNO	SPP North	1,798.71	21.22	29.20
SPSO	SPP South	1,624.03	24.52	22.42
SRMV	SERC Mississippi Valley	1,004.10	21.80	11.15
SRMW	SERC Midwest	1,779.27	20.57	29.60
SRSO	SERC South	1,495.47	23.64	24.57
SRTV	SERC Tennessee Valley	1,540.85	19.87	25.48
SRVC	SERC Virginia/Carolina	1,118.41	22.26	19.08
US Territories (not an eGRID Region)*	n/a	1,891.57	75.91	17.13

Source: U.S. EPA eGRID2010 Version 1.0 (2007 data: eGRID subregion annual CO<sub>2</sub> total output emission rate). Except \* from Department of Energy Guidance on Voluntary Reporting of Greenhouse Gases, Form EIA-1605 (2007), Appendix F, Electricity Emission Factors, Table F-1. Factors do not include emissions from transmission and distribution losses.

**Table 14.2 Canadian Emission Factors for Grid Electricity by Province**

Province	2008 Emission Rates		
	g CO <sub>2</sub> / kWh	g CH <sub>4</sub> / kWh	g N <sub>2</sub> O / kWh
Alberta	950	0.04	0.02
British Columbia	26	0.007	0.0007
Manitoba	12	0.0003	0.0003
New Brunswick	542	0.022	0.01
Newfoundland and Labrador	20	0.0002	0.0004
Nova Scotia	830	0.025	0.01
Ontario	170	0.01	0.003
Prince Edward Island	3	0	0
Quebec	2	0.0003	0.0001
Saskatchewan	680	0.03	0.02
Yukon, Northwest Territories & Nunavut	70	0.003	0.01

Source: Greenhouse Gas Division, Environment Canada, National Inventory Report, 1990-2009: Greenhouse Gas Sources and Sinks in Canada (2011) Annex 13: Emission Factors, Table A13-2 - A13-12 (2008 data).

**Table 14.3 Mexican Emission Factors for Grid Electricity**

Year	Emission Rates (kg CO <sub>2</sub> -e/MWh)
2000	604.1
2001	625.0
2002	600.0
2003	571.2
2004	549.6
2005	550.1
<p>Source: Asociación de Técnicos y Profesionistas en Aplicación Energética (ATPAE), 2003, Metodologías para calcular el Coeficiente de Emisión Adecuado para Determinar las Reducciones de GEI Atribuibles a Proyectos de EE/ER – Justificación para la selección de la Metodología, versión final 4.1 (junio de 2003), proyecto auspiciado por la Agencia Internacional de Estados Unidos para el Desarrollo Internacional, México, D.F., México.</p> <p>Note: Emission rates include emissions of CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O. Factors are a national average of all the power plants operating and delivering electricity to the National Electric System and do not include transmission and distribution losses. Factors for 2002 to 2005 were not calculated with actual data but instead estimated using the Electricity Outlooks published by Mexico's Ministry of Energy.</p>	

**Table 14.4 Non-North American Emission Factors  
for Electricity and Heat Generation**

<b>Region / Country / Economy</b>	<b>2009 Emission Rates g CO<sub>2</sub> / kWh</b>
Albania	11
Algeria	576
Angola	237
Argentina	355
Armenia	108
Australia	853
Austria	163
Azerbaijan	443
Bahrain	665
Bangladesh	585
Belarus	302
Belgium	218
Benin	725
Bolivia	393
Bosnia and Herzegovina	776
Botswana	2,063
Brazil	64
Brunei Darussalam	755
Bulgaria	463
Cambodia	1,151
Cameroon	243
Chile	373
Taiwan	743
Chinese Taipei	635
Colombia	175
Congo	207
Costa Rica	40
Côte d'Ivoire	426
Croatia	283
Cuba	752
Cyprus	744
Czech Republic	514
Dem. Rep. of Congo	3
Denmark	303
Dominican Republic	591
DPR of Korea	499
Ecuador	290
Egypt	466
El Salvador	319
Eritrea	672
Estonia	704

**Table 14.4 Non-North American Emission Factors  
for Electricity and Heat Generation**

<b>Region / Country / Economy</b>	<b>2009 Emission Rates g CO<sub>2</sub> / kWh</b>
Ethiopia	118
Finland	205
France	90
FYR of Macedonia	710
Gabon	322
Georgia	129
Germany	430
Ghana	187
Gibraltar	740
Greece	722
Guatemala	349
Haiti	547
Honduras	344
Hong Kong, China	763
Hungary	302
Iceland	0
India	951
Indonesia	746
Iraq	684
Ireland	465
Islamic Rep. of Iran	630
Israel	695
Italy	386
Jamaica	544
Japan	415
Jordan	581
Kazakhstan	480
Kenya	395
Korea	498
Kuwait	870
Kyrgyzstan	81
Latvia	153
Lebanon	717
Libyan Arab Jamahiriya	872
Lithuania	111
Luxembourg	384
Malaysia	649
Malta	850
Mongolia	535
Morocco	638
Mozambique	1

**Table 14.4 Non-North American Emission Factors  
for Electricity and Heat Generation**

<b>Region / Country / Economy</b>	<b>2009 Emission Rates g CO<sub>2</sub> / kWh</b>
Myanmar	196
Namibia	237
Nepal	4
Netherlands	374
Netherlands Antilles	707
New Zealand	167
Nicaragua	506
Nigeria	416
Norway	17
Oman	842
Pakistan	458
Panama	302
People's Rep. of China	743
Peru	236
Philippines	478
Poland	640
Portugal	368
Qatar	494
Republic of Moldova	400
Romania	414
Russian Federation	317
Saudi Arabia	757
Senegal	614
Serbia	680
Singapore	519
Slovak Republic	222
Slovenia	316
South Africa	926
Spain	299
Sri Lanka	460
Sudan	356
Sweden	43
Switzerland	40
Syrian Arab Republic	641
Tajikistan	29
Thailand	513
Togo	202
Trinidad and Tobago	719
Tunisia	538
Turkey	480
Turkmenistan	789

**Table 14.4 Non-North American Emission Factors  
for Electricity and Heat Generation**

<b>Region / Country / Economy</b>	<b>2009 Emission Rates g CO<sub>2</sub> / kWh</b>
Ukraine	374
United Arab Emirates	631
United Kingdom	450
United Rep. of Tanzania	281
Uruguay	253
Uzbekistan	461
Venezuela	199
Vietnam	384
Yemen	630
Zambia	3
Zimbabwe	619
Source: CO <sub>2</sub> Emissions from Fuel Combustion Highlights (2011)© OECD/IEA, 2011 CO <sub>2</sub> emissions per kWh from electricity and heat generation.	

**U.S. Default Factors for Calculating CO<sub>2</sub> Emissions  
from Geothermal Energy Production**

<b>Fuel Type</b>	<b>Carbon Content (Per Unit Energy)</b>	<b>CO<sub>2</sub> Emission Factor (Per Unit Energy)</b>
<b>Geothermal</b>	<b>kg C / MMBtu</b>	<b>kg CO<sub>2</sub> / MMBtu</b>
Geothermal	2.05	7.52
Source: US Inventory of Greenhouse Gas Emissions and Sinks 1990-2009 (April 2011) Annex 2.2, Tables A-32		