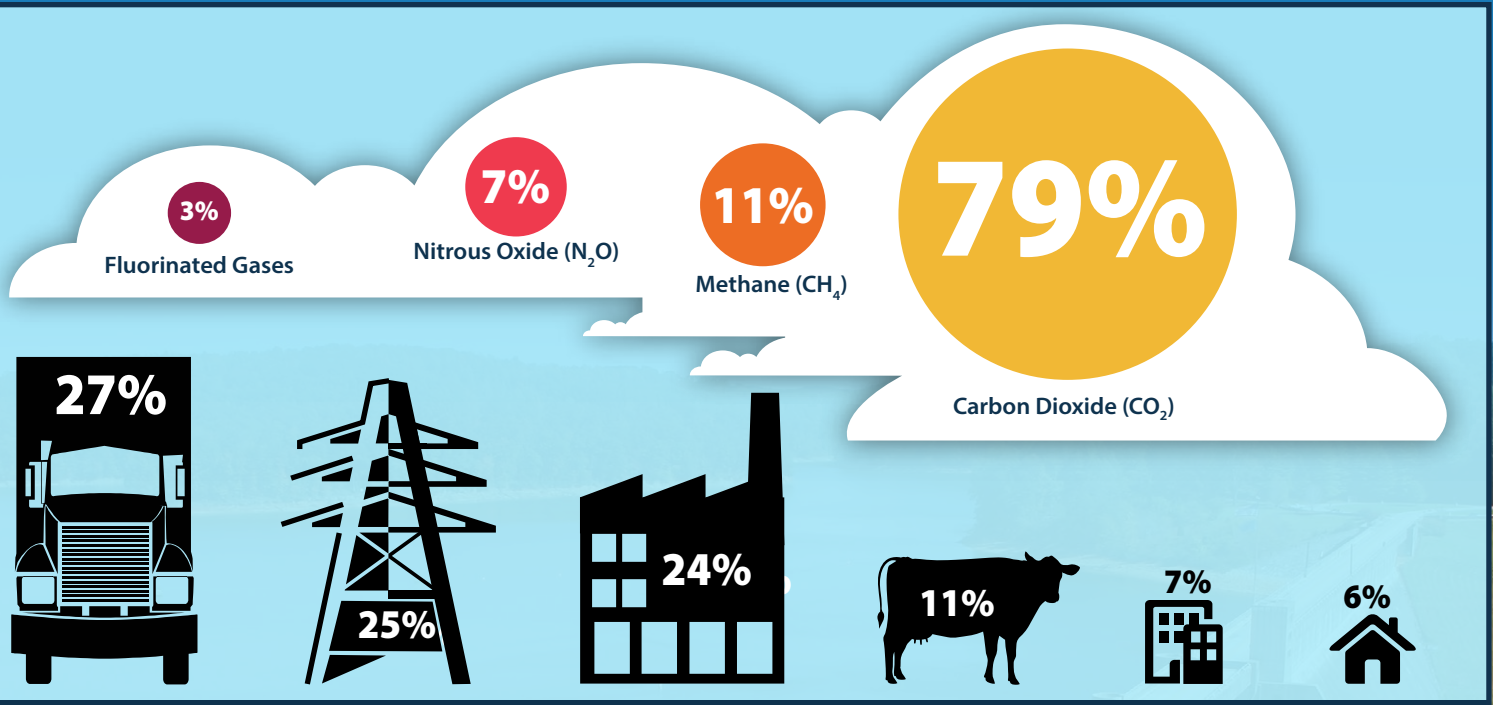
Fast Facts 1990–2020

National-Level U.S. Greenhouse Gas Inventory

U.S. Greenhouse Gas Emissions in 2020*



Total U.S. Greenhouse Gas Emissions by Economic Sector in 2020*

U.S. Greenhouse Gas Emissions*

2020 Total Emissions	2019–2020 Change	1990–2020 Change
5,981 million metric tons of CO_2 equivalent	↓ **-9.0%** total emissions	↓ **-7.3%** total emissions
CO_2 emissions from fossil fuel combustion: **72.6%** of total emissions	↓ **-10.3%** CO_2 emissions	↓ **-7.9%** CO_2 emissions
CO_2 removals by forests and other lands: **13.6%** of total emissions	↓ **-10.5%** CO_2 emissions from fossil fuel combustion	↓ **-8.2%** CO_2 emissions from fossil fuel combustion

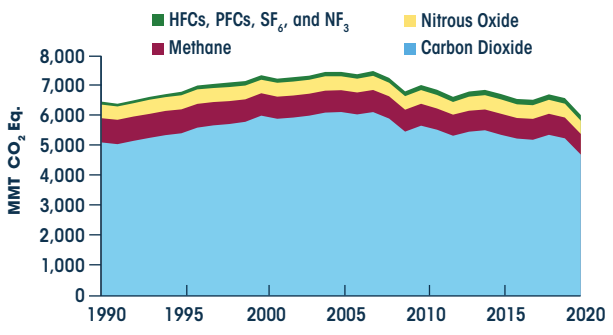
To learn more about the inventory, visit www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks, or explore the data at https://cfpub.epa.gov/ghgdata/inventoryexplorer.

* Percentages may not add to 100% due to independent rounding and the way the inventory qualifies U.S. territories (not shown) as a separate sector. Emissions from Land-Use, Land-Use Change and Forestry are reported separately and not shown in the figure.

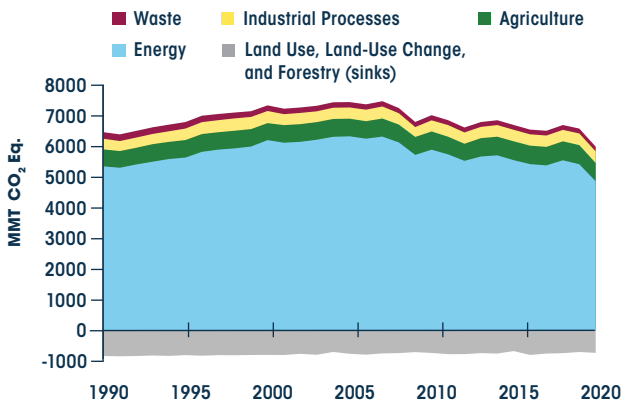
EPA United States Environmental Protection Agency

April 2022
EPA 430-F-22-001

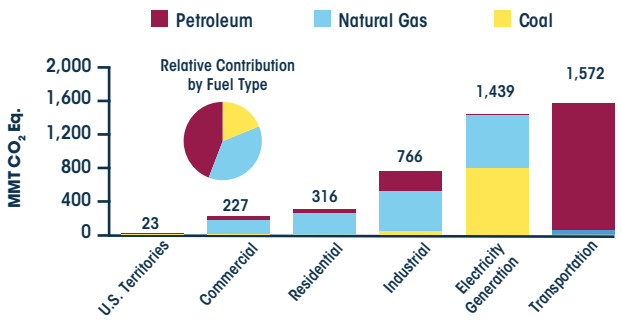
U.S. Greenhouse Gas Emissions by Gas



U.S. Greenhouse Gas Emissions/Sinks by Chapter/IPCC Sector

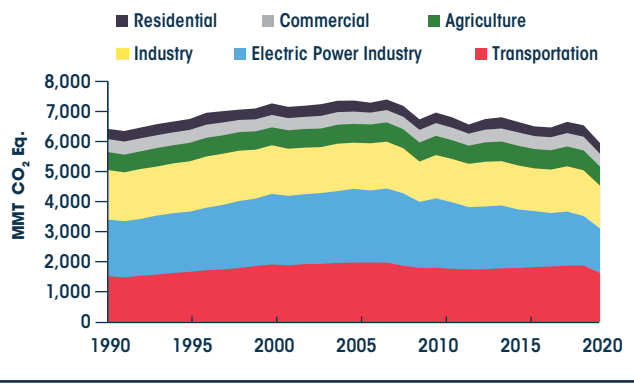


2020 U.S. CO_2 Emissions from Fossil Fuel Combustion by Fuel Type and End-Use Sector



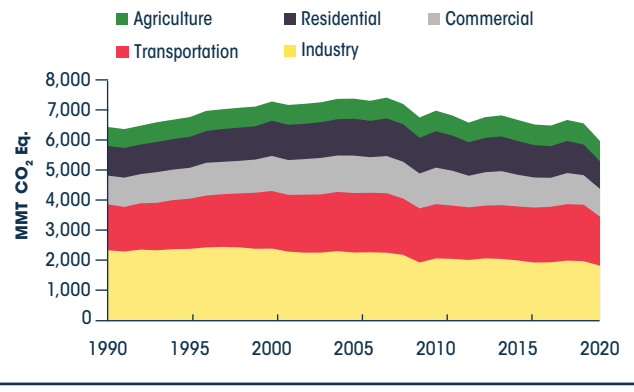
Note: Electricity generation also includes emissions of less than 0.5 Tg CO_2 Eq. from geothermal-based electricity generation.

U.S. Greenhouse Gas Emissions Allocated to Economic Sectors



Note: Does not include U.S. territories and LULUCF sector.

U.S. Greenhouse Gas Emissions with Electricity Distributed to Economic Sectors



Note: Does not include U.S. territories and LULUCF sector.

U.S. Greenhouse Gas Emissions and Sinks (MMT CO_2 Equivalents)

Gas/Source*	1990	2005	2016	2017	2018	2019	2020
CO_2	**5,122.5**	**6,137.6**	**5,251.8**	**5,211.0**	**5,376.7**	**5,259.1**	**4,715.7**
Fossil Fuel Combustion	4,731.2	5,752.0	4,909.6	4,853.3	4,989.3	4,852.3	4,342.7
Transportation	1,468.9	1,858.6	1,757.6	1,780.0	1,812.8	1,813.8	1,572.0
Electric Power Sector	1,820.0	2,400.1	1,808.9	1,732.0	1,752.9	1,606.1	1,439.0
Industrial	853.7	851.5	792.7	790.4	814.1	816.1	766.3
Residential	338.6	358.9	292.8	293.4	338.2	341.4	315.8
Commercial	228.3	227.1	231.5	232.0	245.8	250.7	226.8
U.S. Territories	21.7	55.9	26.0	25.5	25.5	24.3	22.7
Non-Energy Use of Fuels	112.2	128.9	99.5	112.6	128.9	126.8	121.0
Natural Gas Systems	31.9	24.9	29.8	31.1	32.4	38.7	35.4
Cement Production	33.5	46.2	39.4	40.3	39.0	40.9	40.7
Lime Production	11.7	14.6	12.6	12.9	13.1	12.1	11.3
Other Process Uses of Carbonates	6.2	7.5	10.8	9.9	7.4	9.8	9.8
Glass Production	2.3	2.4	2.1	2.0	2.0	1.9	1.9
Soda Ash Production	1.4	1.7	1.7	1.8	1.7	1.8	1.5
Carbon Dioxide Consumption	1.5	1.4	4.6	4.6	4.1	4.9	5.0
Incineration of Waste	12.9	13.3	14.4	13.2	13.3	12.9	13.1
Titanium Dioxide Production	1.2	1.8	1.7	1.7	1.5	1.5	1.3
Aluminum Production	6.8	4.1	1.3	1.2	1.5	1.9	1.7
Iron and Steel Production & Metallurgical Coke Production	104.7	70.1	43.6	40.6	42.6	43.1	37.7
Ferroalloy Production	2.2	1.4	1.8	2.0	2.1	1.6	1.4
Ammonia Production	13.0	9.2	10.2	11.1	12.2	12.3	12.7
Urea Consumption for Non-Agricultural Purposes	3.8	3.7	5.3	5.2	6.0	6.0	6.0
Phosphoric Acid Production	1.5	1.3	1.0	1.0	0.9	0.9	0.9
Petrochemical Production	21.6	27.4	28.1	28.9	29.3	30.7	30.0
Carbide Production and Consumption	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Lead Production	0.5	0.6	0.5	0.5	0.5	0.5	0.5
Zinc Production	0.6	1.0	0.8	0.9	1.0	1.0	1.0
Petroleum Systems	9.6	12.0	21.9	25.0	37.3	46.7	30.2
Liming	4.7	4.3	3.1	3.1	2.2	2.4	2.4
Urea Fertilization	2.4	3.5	4.7	4.9	5.0	5.1	5.3
Coal Mining	4.6	4.2	2.8	3.1	3.1	3.0	2.2
International Bunker Fuels[a]	*103.6*	*113.3*	*116.7*	*120.2*	*122.2*	*116.1*	*69.6*
Wood Biomass, Ethanol, and Biodiesel Consumption[b]	*219.4*	*230.7*	*316.9*	*312.7*	*319.8*	*317.2*	*291.6*
CH_4[c]	**780.8**	**697.5**	**657.6**	**663.8**	**671.1**	**668.8**	**650.4**
Stationary Combustion	8.6	7.8	7.9	7.7	8.6	8.8	7.9
Mobile Combustion	6.5	4.0	2.6	2.6	2.5	2.5	2.2
Coal Mining	96.5	64.1	53.8	54.8	52.7	47.4	41.2
Abandoned Underground Coal Mines	7.2	6.6	6.7	6.4	6.2	5.9	5.8
Natural Gas Systems	195.5	177.5	165.2	166.6	171.8	172.1	164.9
Petroleum Systems	47.8	41.4	40.4	40.5	38.6	40.4	40.2
Abandoned Oil and Gas Wells	6.5	6.8	6.9	6.9	6.9	7.0	6.9
Petrochemical Production	0.2	0.1	0.2	0.3	0.3	0.3	0.3
Enteric Fermentation	163.5	168.0	171.3	174.9	175.7	176.1	175.2
Manure Management	34.8	49.0	57.1	57.5	59.4	58.7	59.6
Rice Cultivation	16.0	18.0	15.8	14.9	15.6	15.1	15.7
Field Burning of Agricultural Residues	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Landfills	176.6	131.5	107.9	109.2	111.7	113.6	109.3
Wastewater Treatment	*20.3*	*20.1*	*18.7*	*18.5*	*18.3*	*18.1*	*18.3*
Composting	*0.4*	*1.9*	*2.3*	*2.5*	*2.3*	*2.3*	*2.3*
Anaerobic Digestion at Biogas Facilities	+	+	0.2	0.2	0.2	0.2	0.2
International Bunker Fuels[a]	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
N_2O[c]	**450.5**	**453.3**	**449.2**	**444.6**	**457.7**	**456.8**	**426.2**
Stationary Combustion	25.1	34.4	30.0	28.4	28.2	24.9	23.2
Mobile Combustion	44.6	41.4	21.1	20.1	19.2	20.0	17.4
Adipic Acid Production	15.2	7.1	7.1	7.5	10.5	5.3	8.3
Nitric Acid Production	12.1	11.3	10.1	9.3	9.6	10.0	9.3
Manure Management	13.9	16.3	18.4	19.0	19.3	19.5	19.7
Agricultural Soil Management	316.0	313.8	330.8	328.3	338.9	345.3	316.2
Field Burning of Agricultural Residues	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Wastewater Treatment	16.6	20.3	22.8	23.2	23.5	23.4	23.5
N_2O from Product Uses	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Caprolactam, Glyoxal, and Glyoxylic Acid Production	1.7	2.1	1.7	1.5	1.4	1.4	1.2
Incineration of Waste	0.5	0.4	0.4	0.4	0.4	0.4	0.4
Composting	0.3	1.7	2.0	2.2	2.0	2.0	2.0
Electronics Industry	+	0.1	0.2	0.3	0.3	0.2	0.3
International Bunker Fuels[a]	*0.9*	*1.0*	*1.0*	*1.1*	*1.1*	*1.0*	*0.6*
HFCs, PFCs, SF_6, and NF_3	**99.7**	**146.4**	**179.3**	**181.7**	**182.0**	**186.9**	**189.2**
HFCs	**46.5**	**127.4**	**168.3**	**171.1**	**171.0**	**175.9**	**178.8**
Substitution of Ozone Depleting Substances	0.2	107.2	165.1	165.5	167.3	171.8	176.2
HCFC-22 Production	46.1	20.0	2.8	5.2	3.3	3.7	2.1
Electronics Industry	0.2	0.2	0.3	0.4	0.4	0.4	0.4
Magnesium Production and Processing	+	+	0.1	0.1	0.1	0.1	0.1
PFCs	**24.3**	**6.7**	**4.4**	**4.2**	**4.8**	**4.6**	**4.4**
Aluminum Production	21.5	3.4	1.4	1.1	1.6	1.8	1.7
Electronics Industry	2.8	3.3	3.0	3.0	3.1	2.8	2.7
Substitution of Ozone Depleting Substances[d]	+	+	+	+	0.1	0.1	0.1
SF_6	**28.8**	**11.8**	**6.0**	**5.9**	**5.7**	**5.9**	**5.4**
Electrical Transmission and Distribution	23.2	8.3	4.1	4.2	3.8	4.2	3.8
Electronics Industry	0.5	0.7	0.8	0.7	0.8	0.8	0.7
Magnesium Production and Processing	5.2	2.7	1.1	1.0	1.0	0.9	0.9
NF_3	**+**	**0.5**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
Electronics Industry	+	0.5	0.6	0.6	0.6	0.6	0.6
Total Emissions	**6,453.5**	**7,434.8**	**6,537.9**	**6,501.0**	**6,687.5**	**6,571.7**	**5,981.4**
LULUCF Emissionsc	31.4	41.3	35.4	45.5	39.8	30.3	53.2
LULUCF CH_4 Emissions	27.2	30.9	28.3	34.0	30.7	25.5	38.1
LULUCF N_2O Emissions	4.2	10.5	7.1	11.5	9.1	4.8	15.2
LULUCF Carbon Stock Change[e]	(892.0)	(831.1)	(862.0)	(826.7)	(809.0)	(760.8)	(812.2)
LULUCF Sector Net Total[f]	(860.6)	(789.8)	(826.6)	(781.2)	(769.3)	(730.5)	(758.9)
Net Emissions (Sources and Sinks)	**5,592.8**	**6,645.0**	**5,711.2**	**5,719.8**	**5,918.2**	**5,841.2**	**5,222.4**

* Additional sources that do not exceed 0.05 MMT CO_2 Eq. in all listed years:
CO_2: Abandoned Oil and Gas Wells, Magnesium Production and Processing.
CH_4: Carbide Production and Consumption, Iron and Steel Production and Metallurgical Coke Production, Ferroalloy Production, Incineration of Waste.
N_2O: Natural Gas Systems, Petroleum Systems
PFCs: Electrical Transmission and Distribution

\+ Does not exceed 0.05 MMT CO_2 Eq.

[a] Emissions from international bunker fuels are not included in totals.

[b] Emissions from Wood Biomass, Ethanol, and Biodiesel Consumption are not included specifically in summing energy sector totals. Net carbon fluxes from changes in biogenic carbon reservoirs are accounted for in the estimates for land use, land-use change, and forestry.

[c] LULUCF emissions of CH_4 and N_2O are reported separately from gross emissions totals.

[d] Small amounts of PFC emissions also result from this source.

[e] LULUCF Carbon Stock Change is the net C stock change from the following categories: Forest Land Remaining Forest Land, Land Converted to Forest Land, Cropland Remaining Cropland, Land Converted to Cropland, Grassland Remaining Grassland, Land Converted to Grassland, Wetlands Remaining Wetlands, Land Converted to Wetlands, Settlements Remaining Settlements, and Land Converted to Settlements.

[f] The LULUCF Sector Net Total is the net sum of all CH_4 and N_2O emissions to the atmosphere plus net carbon stock changes.

Note: Totals may not sum due to independent rounding.

Global Warming Potentials (100-Year Time Horizon)

Gas*	GWP
CO_2	1
CH_4	25
N_2O	298
HFC-23	14,800
HFC-32	675
HFC-43-10mee	1,640
HFC-125	3,500
HFC-134a	1,430
HFC-143a	4,470
HFC-152a	124
HFC-227ea	3,220
HFC-236fa	9,810
CF_4	7,390
C_2F_6	12,200
C_3F_8	8,830
C_4F_{10}	8,860
c-C_4F_8	10,300
C_5F_{12}	9,160
C_6F_{14}	9,300
SF_6	22,800
NF_3	17,200

Global warming potential (GWP) is defined as the cumulative radiative forcing effects of a gas over a specified time horizon resulting from the emission of a unit mass of gas relative to a reference gas. The GWP-weighted emissions of direct greenhouse gases in the U.S. Inventory are presented in terms of equivalent emissions of carbon dioxide (CO_2), using units of million metric tons of carbon dioxide equivalents (MMT CO_2 Eq.).

Conversion:

1 million metric tons = 10^6 metric tons = 10^9 kg. The molecular weight of carbon is 12, and the molecular weight of oxygen is 16; therefore, the molecular weight of CO_2 is 44 (i.e., 12 + [16 × 2]), as compared to 12 for carbon alone. Thus, the weight ratio of carbon to carbon dioxide is 12/44.

Conversion from gigagrams of gas to million metric tons of carbon dioxide equivalents:

$$\text{MMT } CO_2 \text{ Eq.} = \left(\frac{\text{Gg}}{\text{of gas}}\right) \times (\text{GWP}) \times \left(\frac{\text{MMT}}{\text{1,000 Gg}}\right)$$

Source:
IPCC Fourth Assessment Report (2007)

* See Annex 6 of EPA's Inventory report for information about the full list of gases in the Inventory.

Carbon Information

Conversion Factors to Energy Units and Carbon Contents by Fuel Type

The values in this table provide conversion factors from physical units to energy equivalent units and from energy units to carbon contents. These factors can be used as default factors, if local data are not available.

Fuel Type	Heat Content	Carbon (C) Content Coefficients	Carbon Dioxide (CO_2) per Physical Unit
Solid Fuels	**Million Btu/Metric Ton**	**kg C/Million Btu**	**kg CO_2/Metric Ton**
Anthracite Coal	24.88	28.28	2,579.9
Bituminous Coal	26.33	25.43	2,455.1
Sub-bituminous Coal	18.89	26.49	1,834.8
Lignite	14.19	26.77	1,392.8
Coking Coal	31.56	25.60	2,962.4
Gas Fuels	**Btu/Cubic Foot**	**kg C/Million Btu**	**kg CO_2/Cubic Foot**
Natural Gas	1,037	14.43	0.0548
Liquid Fuels	**Million Btu/Petroleum Barrel**	**kg C/Million Btu**	**kg CO_2/Petroleum Barrel**
Motor Gasoline	5.05	19.27	356.8
Distillate Fuel Oil	5.83	20.22	432.2
Residual Fuel Oil	6.29	20.48	472.3
Jet Fuel	5.67	19.70	409.6
Aviation Gasoline	5.05	18.86	349.2
HGL	3.88	17.66	251.2
Kerosene	5.67	19.96	415.0
Still Gas	6.29	18.20	419.8
Petroleum Coke	6.02	27.85	615.2
Pentanes Plus	4.62	18.24	309.0
Propane	3.84	17.15	241.5

Note: For fuels with variable heat contents and carbon content coefficients, this table presents 2020 U.S. average values. All factors are presented in gross calorific values (GCV) (i.e., higher heating values). HGL=hydrocarbon gas liquids.

Energy Units

Btu	British thermal unit	1 Btu
MBtu	Thousand Btu	1×10^3 Btu
MMBtu	Million Btu	1×10^6 Btu
BBtu	Billion Btu	1×10^9 Btu
TBtu	Trillion Btu	1×10^{12} Btu
QBtu	Quadrillion Btu	1×10^{15} Btu

For more information on calculating CO_2 emissions per kWh, download eGRID data at www.epa.gov/energy/egrid.

For other related information, see www.epa.gov/ghgemissions and https://unfccc.int.

Unit Conversions

1 pound	= 0.454 kilograms	= 16 ounces	
1 kilogram	= 2.205 pounds	= 35.27 ounces	
1 short ton	= 0.9072 metric tons	= 2,000 pounds	
1 cubic foot	= 0.02832 cubic meters	= 28.3168 liters	
1 cubic meter	= 35.315 cubic feet	= 1,000 liters	
1 U.S. gallon	= 3.78541 liters	= 0.03175 barrels	= 0.02381 barrels petroleum
1 liter	= 0.2642 U.S. gallons	= 0.0084 barrels	= 0.0063 barrels petroleum
1 barrel	= 31.5 U.S. gallons	= 119 liters	= 0.75 barrels petroleum
1 barrel petroleum	= 42 U.S. gallons	= 159 liters	
1 mile	= 1.609 kilometers	= 5,280 feet	
1 kilometer	= 0.6214 miles	= 3,280.84 feet	
1 square mile	= 2.590 square kilometers	= 640 acres	
1 square kilometer	= 0.386 square miles	= 100 hectares	
1 acre	= 43,560 square feet	= 0.4047 hectares	= 4,047 square meters