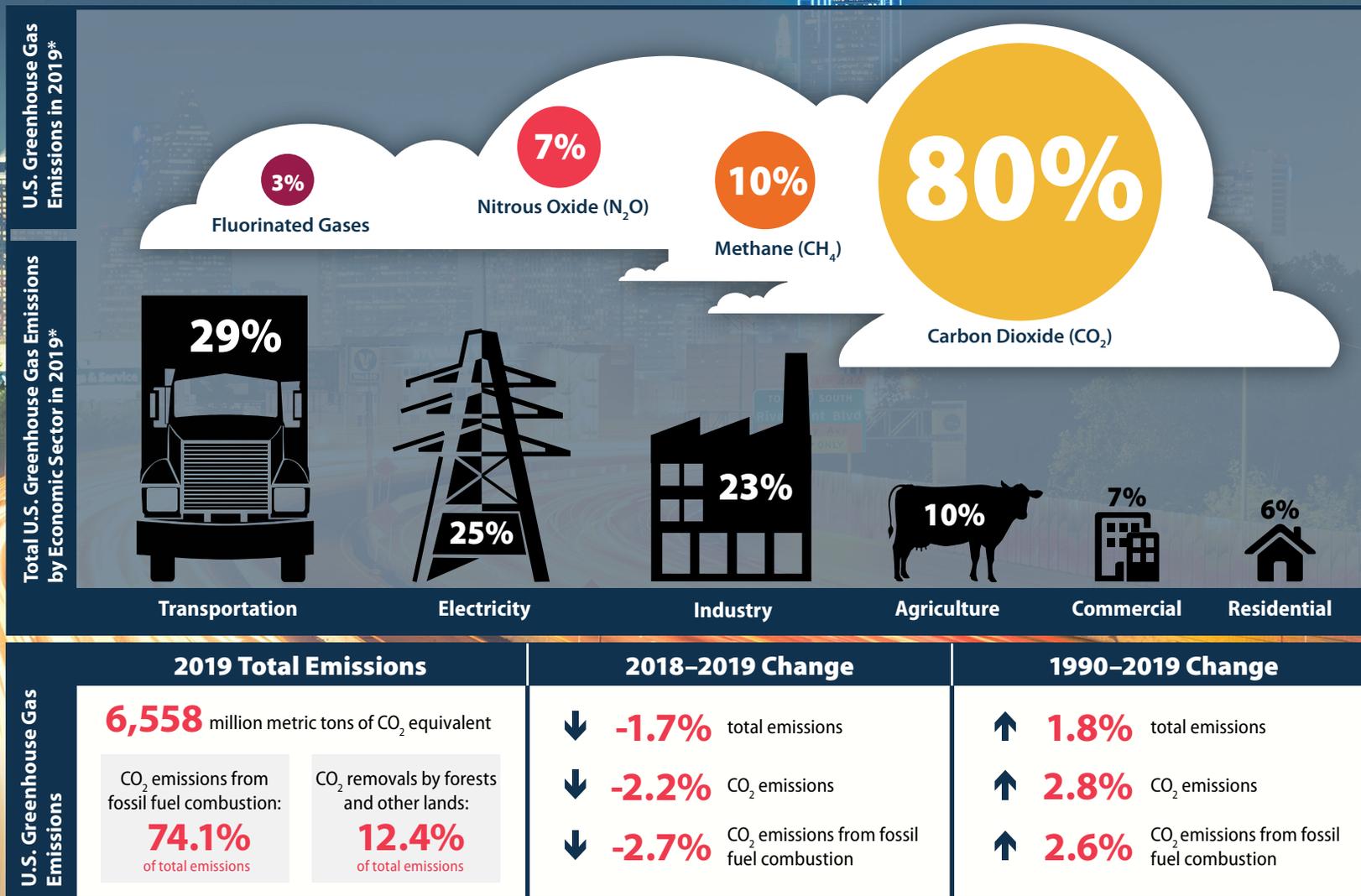


Fast Facts

1990-2019

National-Level U.S. Greenhouse Gas Inventory



* 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.

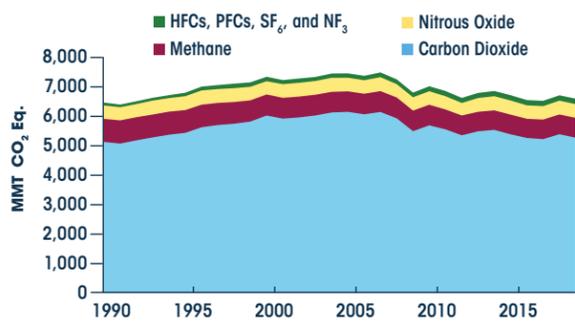
To learn more about the inventory, visit www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks, or explore the data at <https://cfpub.epa.gov/ghgdata/inventoryexplorer>.



April 2021
EPA 430-F-21-011

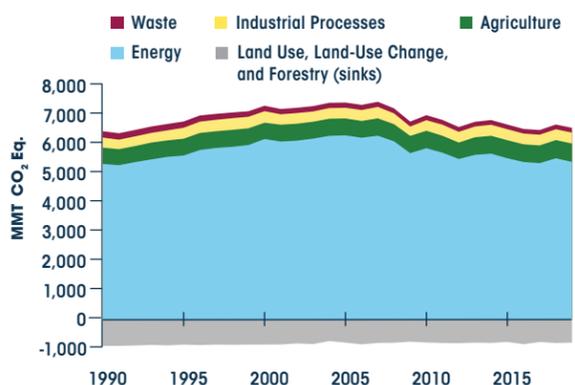
U.S. Greenhouse Gas Emissions

by Gas



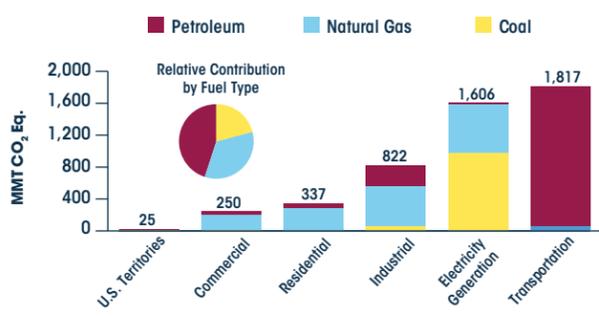
U.S. Greenhouse Gas Emissions/Sinks

by Chapter/IPCC Sector



2019 U.S. CO₂ Emissions

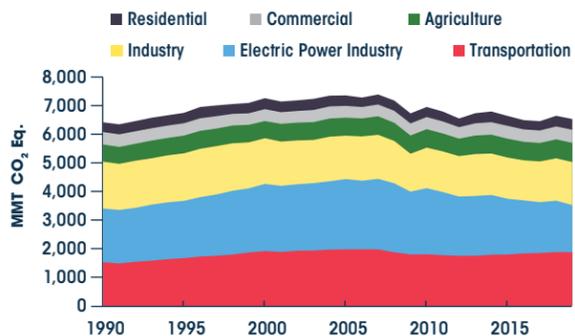
from Fossil Fuel Combustion by Fuel Type and End-Use Sector



Note: Electricity generation also includes emissions of less than 0.5 Tg CO₂ Eq. from geothermal-based electricity generation.

U.S. Greenhouse Gas Emissions

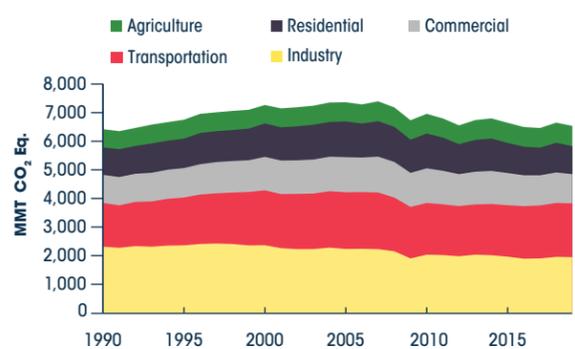
Allocated to Economic Sectors



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 CO₂ Equivalents)

Gas/Source*	1990	2005	2015	2016	2017	2018	2019
CO₂	5,113.5	6,134.5	5,371.8	5,248.0	5,207.8	5,375.5	5,255.8
Fossil Fuel Combustion	4,731.5	5,753.5	5,008.3	4,911.5	4,854.5	4,991.4	4,856.7
Transportation	1,469.1	1,858.6	1,719.2	1,759.9	1,782.4	1,816.6	1,817.2
Electric Power Sector	1,820.0	2,400.1	1,900.6	1,808.9	1,732.0	1,752.9	1,606.0
Industrial	853.8	852.9	797.3	792.5	790.1	813.6	822.5
Residential	338.6	358.9	317.3	292.8	293.4	338.1	336.8
Commercial	228.3	227.1	244.6	231.6	232.0	245.7	249.7
U.S. Territories	21.7	55.9	29.2	26.0	24.6	24.6	24.6
Non-Energy Use of Fuels	112.8	129.1	108.5	99.8	113.5	129.7	128.8
Petroleum Systems	9.7	12.1	32.4	21.8	25.0	37.1	47.3
Iron and Steel Production & Metallurgical Coke Production	104.7	70.1	47.9	43.6	40.6	42.6	41.3
Cement Production	33.5	46.2	39.9	39.4	40.3	39.0	40.9
Natural Gas Systems	32.0	25.2	29.1	30.1	31.2	33.9	37.2
Petrochemical Production	21.6	27.4	28.1	28.3	28.9	29.3	30.8
Ammonia Production	13.0	9.2	10.6	10.2	11.1	12.2	12.3
Lime Production	11.7	14.6	13.3	12.6	12.9	13.1	12.1
Incineration of Waste	8.1	12.7	11.5	11.5	11.5	11.5	11.5
Other Process Uses of Carbonates	6.3	7.6	12.2	11.0	9.9	7.5	7.5
Urea Consumption for Non-Agricultural Purposes	3.8	3.7	4.6	5.1	5.0	5.9	6.2
Urea Fertilization	2.4	3.5	4.7	4.9	5.1	5.2	5.3
Carbon Dioxide Consumption	1.5	1.4	4.9	4.6	4.6	4.1	4.9
Liming	4.7	4.3	3.7	3.1	3.1	2.2	2.4
Aluminum Production	6.8	4.1	2.8	1.3	1.2	1.5	1.9
Soda Ash Production	1.4	1.7	1.7	1.7	1.8	1.7	1.8
Ferroalloy Production	2.2	1.4	2.0	1.8	2.0	2.1	1.6
Titanium Dioxide Production	1.2	1.8	1.6	1.7	1.7	1.5	1.5
Glass Production	1.5	1.9	1.3	1.2	1.3	1.3	1.3
Zinc Production	0.6	1.0	0.9	0.8	0.9	1.0	1.0
Phosphoric Acid Production	1.5	1.3	1.0	1.0	1.0	0.9	0.9
Lead Production	0.5	0.6	0.5	0.5	0.5	0.5	0.5
Carbide Production and Consumption	0.4	0.2	0.2	0.2	0.2	0.2	0.2
Wood Biomass, Ethanol, and Biodiesel Consumption ^a	219.4	230.7	317.7	316.6	312.3	319.6	316.2
International Bunker Fuels ^b	103.5	113.2	110.9	116.6	120.1	122.1	116.1
CH₄^c	776.9	686.1	651.5	642.4	648.4	655.9	659.7
Enteric Fermentation	164.7	169.3	166.9	172.2	175.8	178.0	178.6
Natural Gas Systems	186.9	164.2	149.8	147.3	148.7	152.5	157.6
Landfills	176.6	131.4	111.4	108.0	109.4	112.1	114.5
Manure Management	37.1	51.6	57.9	59.6	59.9	61.7	62.4
Coal Mining	96.5	64.1	61.2	53.8	54.8	52.7	47.4
Petroleum Systems	48.9	39.5	41.5	39.2	39.3	37.3	39.1
Wastewater Treatment	20.2	20.1	18.8	18.7	18.5	18.4	18.4
Rice Cultivation	16.0	18.0	16.2	15.8	14.9	15.6	15.1
Stationary Combustion	8.6	7.8	8.5	7.9	7.6	8.5	8.7
Abandoned Oil and Gas Wells	6.8	7.2	7.4	7.4	7.2	7.3	6.6
Abandoned Underground Coal Mines	7.2	6.6	6.4	6.7	6.4	6.2	5.9
Mobile Combustion	6.4	4.0	2.6	2.5	2.5	2.4	2.4
Composting	0.4	1.9	2.1	2.3	2.4	2.3	2.3
Field Burning of Agricultural Residues	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Petrochemical Production	0.2	0.1	0.2	0.2	0.3	0.3	0.3
Anaerobic Digestion at Biogas Facilities	+	0.1	0.2	0.2	0.2	0.2	0.2
International Bunker Fuels ^b	0.2	0.1	0.1	0.1	0.1	0.1	0.1
N₂O^c	452.7	455.8	468.2	450.8	446.3	459.2	457.1
Agricultural Soil Management	315.9	313.4	348.5	330.1	327.6	338.2	344.6
Wastewater Treatment	18.7	23.0	25.4	25.9	26.4	26.1	26.4
Stationary Combustion	25.1	34.4	30.5	30.0	28.4	28.2	24.9
Manure Management	14.0	16.4	17.5	18.1	18.7	19.4	19.6
Mobile Combustion	44.7	41.6	21.7	20.8	19.8	18.8	18.0
Nitric Acid Production	12.1	11.3	11.6	10.1	9.3	9.6	10.0
Adipic Acid Production	15.2	7.1	4.3	7.0	7.4	10.3	5.3
N ₂ O from Product Uses	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Composting	0.3	1.7	1.9	2.0	2.2	2.0	2.0
Caprolactam, Glyoxal, and Glyoxylic Acid Production	1.7	2.1	1.9	1.7	1.5	1.4	1.4
Incineration of Waste	0.5	0.4	0.3	0.3	0.3	0.3	0.3
Electronics Industry	+	0.1	0.2	0.2	0.3	0.3	0.2
Field Burning of Agricultural Residues	0.2	0.2	0.2	0.2	0.2	0.2	0.2
International Bunker Fuels ^b	0.9	1.0	1.0	1.0	1.1	1.1	1.0
HFCs, PFCs, SF₆, and NF₃	99.7	146.6	179.6	179.1	180.9	180.8	185.7
HFCs	46.5	127.5	168.3	168.1	170.3	169.8	174.6
Substitution of Ozone Depleting Substances	0.2	107.3	163.6	164.9	164.7	166.0	170.5
HCFC-22 Production	46.1	20.0	4.3	2.8	5.2	3.3	3.7
Electronics Industry	0.2	0.2	0.3	0.3	0.4	0.4	0.3
Magnesium Production and Processing	+	+	0.1	0.1	0.1	0.1	0.1
PFCs	24.3	6.7	5.2	4.4	4.1	4.7	4.5
Electronics Industry	2.8	3.3	3.1	2.9	2.9	3.0	2.7
Aluminum Production	21.5	3.4	2.1	1.4	1.1	1.6	1.8
Substitution of Ozone Depleting Substances	+	+	+	+	+	0.1	0.1
SF₆	28.8	11.8	5.5	6.0	5.9	5.7	5.9
Electrical Transmission and Distribution	23.2	8.4	3.8	4.1	4.2	3.9	4.2
Magnesium Production and Processing	5.2	2.7	1.0	1.1	1.0	1.0	0.9
Electronics Industry	0.5	0.7	0.7	0.8	0.7	0.8	0.8
NF₃	+	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^d	6,442.7	7,423.0	6,671.1	6,520.3	6,483.3	6,671.4	6,558.3
LULUCF Emissions	7.9	16.8	27.8	13.2	26.0	23.4	23.5
LULUCF CH ₄ Emissions	5.0	9.3	16.6	7.7	15.3	13.8	13.8
LULUCF N ₂ O Emissions	3.0	7.5	11.3	5.5	10.6	9.7	9.7
LULUCF Carbon Stock Change	(908.7)	(804.8)	(791.7)	(856.0)	(792.0)	(824.9)	(812.7)
LULUCF Sector Net Total	(900.8)	(788.1)	(763.8)	(842.8)	(766.1)	(801.4)	(789.2)
Net Emissions (Sources and Sinks)	5,541.9	6,635.0	5,907.3	5,677.5	5,717.2	5,870.0	5,769.1

* Additional sources that do not exceed 0.05 MMT CO₂ Eq. in all listed years:
CO₂: Abandoned Oil and Gas Wells, Magnesium Production and Processing, Carbon Capture and Storage.
CH₄: Carbide Production and Consumption, Iron and Steel Production and Metallurgical Coke Production, Ferroalloy Production, Incineration of Waste.
N₂O: Natural Gas Systems, Petroleum Systems
Unspecified Mix of HFCs and PFCs: Electronics Industry.

+ Does not exceed 0.05 MMT CO₂ Eq.

^a 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.
^b Emissions from international bunker fuels are not included in totals.
^c LULUCF emissions of CH₄ and N₂O are reported separately from gross emissions totals.
^d Total gross emissions exclude the land use, land-use change, and forestry category. Net emissions include this category.

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 ₂ O	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 ₂ F ₆	12,200
C ₃ F ₈	8,830
C ₄ F ₁₀	8,860
c-C ₄ F ₈	10,300
C ₅ F ₁₂	9,160
C ₆ F 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 (CO₂), using units of million metric tons of carbon dioxide equivalents (MMT CO₂ Eq.).

Conversion:

1 million metric tons = 10⁶ metric tons = 10⁹ kg. The molecular weight of carbon is 12, and the molecular weight of oxygen is 16; therefore, the molecular weight of CO₂ 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:

$$\text{MMT CO}_2 \text{ Eq.} = \left(\frac{\text{Gg}}{\text{of gas}} \right) \times (\text{GWP}) \times \left(\frac{\text{MMT}}{1,000 \text{ Gg}} \right)$$

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.

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 CO₂ 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>.

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 CO₂/Metric Ton
Anthracite Coal	24.88	28.28	2,579.9
Bituminous Coal	26.33	25.41	2,453.2
Sub-bituminous Coal	18.89	26.49	1,834.8
Lignite	14.19	26.75	1,391.8
Coking Coal	31.56	25.59	2,961.3
Gas Fuels	Btu/Cubic Foot	kg C/Million Btu	kg CO₂/Cubic Foot
Natural Gas	1,038	14.43	0.0549
Liquid Fuels	Million Btu/Petroleum Barrel	kg C/Million Btu	kg CO₂/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	3.89	17.47	249.2
Kerosene	5.67	19.96	415.0
Still Gas	6.29	18.20	419.8
Petroleum Coke	6.13	27.85	626.0
Pentanes Plus	4.64	18.24	310.3
Propane	3.84	17.15	241.5

Note: For fuels with variable heat contents and carbon content coefficients, this table presents 2019 U.S. average values. All factors are presented in gross calorific values (GCV) (i.e., higher heating values). HGL=hydrocarbon gas liquids.

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