

Glossary

- abiotic** Having an absence of life or living organisms.
- acid** A solution that has an excess of hydrogen ions (H+).
- acid rain** Acid precipitation falling as rain.
- agricultural wastes** Waste products resulting from agricultural processes that can be reused for other purposes.
- alcohol** An organic compound with a carbon bound to a hydroxyl group. Examples are methanol (CH₃OH) and ethanol (CH₃CH₂OH).
- alternative fuel vehicle (AFV)** Vehicle that operates using alternative fuel/s.
- alternative fuel** As defined in the Energy Policy Act of 1992 (EPACT): methanol, denatured ethanol and other alcohols, separately or in blends of at least 10 percent by volume with gasoline or other fuels; compressed natural gas; liquefied natural gas; liquefied propane gas; hydrogen; coal-derived liquid fuels; fuels other than alcohols derived from biological materials; electricity; biodiesel; and any other fuel determined to be substantially not petroleum and yielding potential energy security benefits and considerable environmental benefits.
- antioxidants** 1. A chemical compound or substance that inhibits oxidation; 2. A substance, such as vitamin E, vitamin C or beta carotene, thought to protect body cells from the damaging effects of oxidation.
- aromatic** A chemical that has a benzene ring in its molecular structure (benzene, toluene, xylene). Aromatic compounds have strong, characteristic odors.
- B-20** A mixture of 20 percent biodiesel and 80 percent petroleum diesel based on volume.
- bacteria** A small single-cell organism. Bacteria do not have an organized nucleus, but they do have a cell membrane and protective cell wall. Bacteria can be used to ferment sugars to ethanol.
- bacterial decay** The process for changing garbage in landfills to methane gas.
- base** A solution that has an excess of hydroxide ions (OH-) in an aqueous solution.
- benzene** A toxic six-carbon aromatic component of gasoline, which is a known carcinogen (cancer-causing agent).
- benzene ring** A six-sided ring of carbon atoms containing alternating single and double-bonded carbon atoms.
- biodegradable** Capable of decomposing rapidly under natural conditions.
- biodiesel** A biodegradable transportation fuel produced through transesterification, a process in which organically derived oils are combined with alcohol (ethanol or methanol) in the presence of a catalyst to form ethyl or methyl ester. The biomass-derived ethyl or methyl ester can be blended with conventional diesel fuel in engines or used as a neat fuel (100 percent biodiesel). Biodiesel can be made from soybean or rapeseed oils, animal fats, waste vegetable oils or microalgae oils.

- biodiversity** The relative abundance and variety of plant and animal species and ecosystems within particular habitats.
- bioenergy** Renewable energy produced from organic matter, through conversion of the complex carbohydrates in organic matter to energy. Organic matter may either be used directly as a fuel or processed into liquids or gases.
- biofuel/s** Liquid or gaseous fuels made from biomass. Biofuels include ethanol, biodiesel, hydrogen, methane, and methanol.
- biogas** A combustible gas derived from decomposing biological waste. Biogas normally consists of 50 to 60 percent methane gas.
- biomass** A renewable energy resource derived from organic matter, including wood, agricultural crops, residue and waste, and other living cell material that can be burned to produce heat energy. Algae, sewage and other organic components of municipal and industrial wastes may also be used to make energy through chemical processes, so are therefore considered biomass resources.
- biomaterials** A synthetic material used to replace part of a living system or to function in intimate contact with living tissue.
- biotic** Pertaining to life or living organisms.
- by-product** Material, other than the principal product, generated as a consequence of an industrial process or as a breakdown product in a living system.
- calorie** A unit of measurement defined as 4.184 absolute joules or the amount of energy it takes to raise the temperature of one gram of water from 15 to 16 degrees Celsius (or 1/100th the amount of energy needed to raise the temperature of one gram of water at one atmospheric pressure from 0 degrees C to 100 degrees C). Food calories are actually equal to 1,000 calories (1 food calorie = 1 kilocalorie).
- carbohydrate** A class of organic compounds including sugars and starches. Many (but not all) carbohydrates have the basic formula CH_2O .
- carbon dioxide** (CO_2) A colorless, odorless gas produced by respiration and combustion of carbon-containing fuels. Plants use it as a food in the photosynthesis process.
- carbon monoxide** (CO) A colorless, odorless, poisonous gas produced by incomplete combustion.
- cash crop** Any crop sold for money.
- catalyst** A substance that increases the rate of a chemical reaction, without being consumed or produced by the reaction. Enzymes are catalysts for many biochemical reactions.
- cellulase** A family of enzymes that breaks down cellulose into glucose molecules.
- cellulose** A carbohydrate that is the principal component of wood. It is made of linked glucose molecules that strengthen the cell walls of most plants.

Celsius A unit of temperature named after the Swedish astronomer Anders Celsius (1701–1744), who first proposed it in 1742. The Celsius temperature scale was designed so that the freezing point of water is 0 degrees and the boiling point is 100 degrees at standard atmospheric pressure.

cesspool A covered cistern; waste water and sewage flow into it.

cofiring Mixing a modest amount of clean, dry sawdust with coal and burning the sawdust coal mixture in the existing coal-firing equipment of a large, coal-burning, utility boiler, thereby reducing coal usage and lowering carbon dioxide emissions from fossil fuels.

combustion A chemical reaction between a fuel and oxygen that produces heat and, usually, light.

commodity An article of trade or commerce, especially an agricultural or mining product that can be processed and resold.

compression engine An engine that works on the basis of compression, in which the working substance in a heat engine, such as the vapor mixture in the cylinder of an internal-combustion engine, is compressed.

conservation tillage Minimal cultivation of the soil.

conversion 1. Something that is changed from one use, function or purpose to another; 2. The expression of a quantity in alternative units, such as length or weight.

corporation A business organization owned by a group of stockholders, each of whom enjoys limited liability.

cover crop Green temporary crop grown to prevent or reduce erosion and to improve the soil by building up its organic content.

decomposition A chemical reaction type in which a large compound is broken down into smaller, simpler compounds.

denatured Ethanol that has had a substance added to make it unfit for human consumption.

desertification The degradation of land in arid, semi-arid and dry sub-humid areas into desert, resulting from various factors including climatic variations and human activities.

diesel engine A compression-ignition piston engine in which diesel fuel is ignited by injecting it into air that has been heated (unlike a spark-ignition engine).

digestion The breaking down of large organic molecules into smaller ones.

E-10 A mixture of 10 percent ethanol and 90 percent gasoline based on volume.

E-85 A mixture of 85 percent denatured ethanol and 15 percent gasoline based on volume.

energy The ability to do work.

energy crop A crop grown specifically for its fuel value, including food crops such as corn and sugarcane, and nonfood crops such as poplar trees and switchgrass.

environment The external conditions that affect organisms and influence their development and survival.

enzyme A protein or protein-based molecule that speeds up chemical reactions occurring in living things. Enzymes act as catalysts for a single reaction, converting a specific set of reactants into specific products.

EPA Environmental Protection Agency

EPACT Energy Policy Act of 1992.

erosion General term for the processes by which the surface of the earth is constantly being worn away; the displacement of solids (soil, mud, rock, and so forth) by the principal agents of wind, running water, ice (mostly glaciers), near-shore waves, or other movement in response to gravity.

ester An ester is a compound formed from the reaction between an acid and an alcohol.

ethanol ($\text{CH}_3\text{CH}_2\text{OH}$) Ethyl alcohol, a colorless, flammable liquid, produced by sugar fermentation and distillation by yeast. Ethanol is used as a fuel oxygenate. Ethanol is the grain alcohol found in alcoholic beverages.

exothermic Releasing heat.

Farm Bureau A resource for agricultural learning and solutions.

fatty acid A carboxylic acid (an acid with a $-\text{COOH}$ group) with long hydrocarbon side chains.

feedstock Any material that can be converted to another form of fuel or energy product.

fermentation A biochemical reaction that breaks down complex organic molecules (such as carbohydrates) into simpler materials (such as ethanol, carbon dioxide and water). Bacteria or yeasts can ferment sugars to ethanol.

fertilizer Organic or inorganic material containing one or more of the nutrients — mainly nitrogen, phosphorus and potassium, and other essential elements required for plant growth. Added to the soil or other medium, fertilizers provide plant nutrients that are naturally lacking or that have been removed by harvesting or grazing, or by physical processes such as leaching or erosion.

field crops Agronomic crops such as corn, soybeans and wheat.

firelog Cost-effective wood substitute for burning.

flexible fuel vehicle (FFV) Also known as flex fuel vehicle, a vehicle with a single fuel tank designed to run on varying blends of unleaded gasoline with either ethanol or methanol.

forage Herbaceous plant material (mainly grasses and legumes) eaten by grazing animals.

fossil fuel/s Solid, liquid or gaseous fuels formed in the ground after millions of years by chemical and physical changes in plant and animal residues under high temperature and pressure. Oil, natural gas and coal are fossil fuels.

fungi Plant-like organisms with cells with distinct nuclei surrounded by nuclear membranes, incapable of photosynthesis. Fungi are decomposers of waste organisms and exist as yeast, mold or mildew.

geothermal Of or relating to the internal heat of the earth.

geothermal energy Energy derived from the natural heat of the Earth contained in hot rocks, hot water, hot brines or steam.

ginning To separate the seeds from a commodity or product, such as cotton.

global warming A term used to describe the increase in average global temperatures due to the greenhouse effect. Scientists generally agree that the Earth's surface has warmed by about 1 degree Fahrenheit in the past 140 years.

glucose (C₆H₁₂O₆) A six-carbon fermentable sugar.

glycerin (C₃H₈O₃) A liquid by-product of biodiesel production used in the manufacture of dynamite, cosmetics, liquid soaps, inks, and lubricants.

grain crops Crops for which standards have been established under the United States Grain Standards Act; namely, wheat, oats, corn, barley, rye, flaxseed, soybeans, grain sorghum, and mixed grains, and other crops yet to be determined.

gram A unit of measurement of mass, defined in the SI system of units as one one-thousandth of a kilogram (i.e., 1x10⁻³kg).

greenhouse effect The heat effect due to the trapping of the sun's radiant energy, so that it cannot be reradiated. In the earth's atmosphere, radiant energy is trapped by greenhouse gases produced from both natural and human sources.

greenhouse gas A gas, such as water vapor, carbon dioxide, tropospheric ozone, methane, and low-level ozone, which contributes to the greenhouse effect.

hydrocarbon (HC) An organic compound that contains only hydrogen and carbon. In vehicle emissions, these are usually vapors created from incomplete combustion or from vaporization of liquid gasoline. Emissions of hydrocarbons contribute to ground-level ozone.

hydrolysis A chemical reaction that releases sugars, which are normally linked together in complex chains. In ethanol production, hydrolysis reactions are used to break down the cellulose and hemicellulose in the biomass.

hydropower The harnessing of the energy of moving or falling water, usually in the form of hydroelectricity from a dam, but it can be used directly as a mechanical force. The term refers to a number of systems in which flowing water drives a water turbine or waterwheel.

joule (J) A unit of electrical energy equal to the work done when a current of one ampere passes through a resistance of one ohm for one second. Also called newton metre, or coulomb volt, this SI unit of energy and work, pronounced to rhyme with “tool,” is named in honor of the physicist James Prescott Joule (1818–1889). One joule is the work required to exert a force of one newton for a distance of one metre.

landfill gas Gas that is generated by decomposition of organic material at landfill disposal sites. Landfill gas is approximately 50 percent methane.

landfill An area designated to receive solid wastes, such as municipal solid waste (household trash), construction debris and sludge from sewage treatment and other processes.

legislature An officially elected or otherwise selected body of people vested with the responsibility and power to make laws for a political unit, such as a state or nation.

lignin An amorphous polymer that, together with cellulose, forms the cell walls of woody plants. Lignin acts as the bonding agent between cells.

linen Fabric, yarn or paper made from the fiber of flax, probably the first vegetable fiber known to people.

linseed oil A yellowish drying oil derived from the dried ripe seeds of the flax plant (*Linum usitatissimum*, *Linaceae*). It is obtained by pressing, followed by an optional stage of solvent extraction. Its uses include: animal feeds; putty; sealants; caulking compounds; brake linings; linoleum; textiles; foundry products; leather treatment; polishes, varnishes and oil paints; animal care products; wood preservation; synthetic resins. The linoleic acid in linseed oil is used as a dietary supplement.

lubricity The quality or condition of being lubricious, which is slippery or smooth.

malting The process of steeping a grain (usually barley) in water, partially germinated, then drying and curing it. The end product is used in brewing to convert cereal starches to sugars by means of the enzymes (chiefly diastase) produced during germination. Its high carbohydrate and protein content make it a valuable nutrient.

mass In physics, the quantity of matter in a body regardless of its volume or of any forces acting on it.

methane An odorless, colorless, flammable gas with the formula CH₄ that is the primary constituent of natural gas.

milliliter A unit of volume equal to one thousandth (10⁻³) of a liter.

moisture absorbent The property of a substance being able to absorb moisture.

monomer Small molecules that join in repeating patterns to form larger molecules (polymers).

mulch A protective covering, usually of organic matter such as leaves, straw or peat, placed around plants to prevent the evaporation of moisture, the freezing of roots and the growth of weeds.

municipal solid waste (MSW) Any organic matter, including sewage, industrial and commercial wastes, from municipal waste collection systems. Municipal waste does not include agricultural and wood wastes or residues.

natural gas A mixture of gaseous hydrocarbons, primarily methane, occurring naturally in the earth, used as fuel.

natural resource Resources (actual and potential material) supplied by nature.

nitrogen oxides (NO_x) A product of photochemical reactions of nitric oxide in ambient air and the major component of photochemical smog.

nonrenewable resources An energy resource that cannot be replaced as it is used. Although fossil fuels, such as coal and oil, are in fact fossilized biomass resources, they form at such a slow rate that, in practice, they are nonrenewable.

no-till A system for planting crops without plowing, using herbicides to control weeds and resulting in reduced soil erosion and the preservation of soil nutrients.

nuclear energy 1. The energy released by a nuclear reaction, especially by fission or fusion; 2. A source of power, also called atomic energy.

oilseed crops Oilseed crops are a very important component of semi-tropical and tropical agriculture, providing easily available and highly nutritious human and animal food. Many also have industrial uses and are relatively easy to incorporate into locally manufactured products. Oilseed crops include castor, groundnut, safflower, sesame, soya and sunflower, crambe, niger and jojoba.

organic compound Contains carbon chemically bound to hydrogen. Organic compounds often contain other elements (particularly O, N, halogens, or S).

organic matter Organic matter in soil consists of plant and animal material that is in the process of decomposing. When it has fully decomposed, it is called humus. This humus is important for soil structure because it holds individual mineral particles together in clusters.

oxygenate A compound which contains oxygen in its molecular structure. Ethanol and biodiesel act as oxygenates when they are blended with conventional fuels. Oxygenated fuel improves combustion efficiency and reduces tailpipe emissions of CO.

ozone A compound formed when oxygen and other compounds react in sunlight. In the upper atmosphere (stratosphere), ozone protects the earth from the sun's ultraviolet rays. Though beneficial in the upper atmosphere, at ground level, ozone is called photochemical smog, and is a respiratory irritant and considered a pollutant.

ozone depletion The phenomenon of reductions in the amount of ozone in the stratosphere.

particulate/s A fine discrete mass of solid or liquid matter that remains individually dispersed in gas or liquid emissions. Particulates take the form of aerosol, dust, fumes, mist, smoke, smog or spray, found in air or emissions. Each of these forms has different properties.

pectin An organic molecule found in the walls of plant cells.

petroleum Any petroleum-based substance comprising a complex blend of hydrocarbons derived from crude oil through the process of separation, conversion, upgrading, and finishing, including motor fuel, jet oil, lubricants, petroleum solvents, and used oil.

photosynthesis A complex process used by many plants and bacteria to build carbohydrates from carbon dioxide and water, using energy derived from light. Photosynthesis is the key initial step in the growth of biomass and is depicted by the equation: $\text{CO}_2 + \text{H}_2\text{O} + \text{light} + \text{chlorophyll} = (\text{CH}_2\text{O}) + \text{O}_2$.

plant residue The result of decaying plant matter which provides nutrients and organic matter to soil.

polymer A large molecule made by linking smaller molecules (“monomers”) together.

polysaccharide A carbohydrate consisting of a large number of linked simple sugar, or monosaccharide, units. Examples of polysaccharides are cellulose and starch.

potential energy Energy that is stored in matter as a function of that matter’s position.

power In physics, the amount of energy put out or produced in a given amount of time. The unit of power based on the English units of measurement is “horsepower,” devised for describing mechanical power by James Watt, who estimated that a horse can do 550 ft-lb of work per sec; a foot-pound is the work done when a weight (force) of 1 lb is moved through a distance of 1 ft. The unit of power in the metric system is the watt, named in honor of James Watt and equal to 1 joule per second; the watt is used for measuring electric power in most countries, even those still using English units for other quantities. In common usage, the terms power and energy have become synonymous; for example, electrical energy is usually referred to as electric power.

raw material/s 1. An unprocessed natural product used in manufacturing; 2. Unprocessed material of any kind.

reaction A chemical reaction is a dissociation, recombination or rearrangement of atoms.

recycle The process of recovering and reusing waste products — from household use, manufacturing, agriculture, and business — and thereby reducing their burden on the environment.

renewable Any commodity or resource that can be renewed, such as solar energy or firewood, that is inexhaustible or replaceable by new growth.

renewable energy All sources of energy that are captured from ongoing natural processes, such as solar power, wind power, water flow in streams (hydro power), biomass, biodiesel, and geothermal heat flows. Most renewable forms of energy, other than geothermal and tidal power, come from the sun.

renewable resources An energy resource that is replenished continuously in nature or that is replaced after use through natural means. Renewable energy resources include solar, wind, geothermal, hydro, and biomass. Municipal solid waste (MSW) is also considered to be a renewable energy resource.

replace 1. To substitute a person or thing for another that is broken or inefficient or lost or no longer working or yielding what is expected; 2. Take the place or move into the position of; 3. Put in the place of another; switch seemingly equivalent items; 4. Put something back where it belongs.

reuse To use again, especially after salvaging or special treatment or processing.

seed pieces Portions of plants from which new plants can be grown, such as potatoes.

silica A white or colorless crystalline compound, SiO_2 , occurring abundantly as quartz, sand, flint, agate, and many other minerals, and used to manufacture a wide variety of materials, especially glass and concrete. A usable material from the ash of rice hulls.

solar energy 1. Energy in our solar system; 2. In recent years, refers to any form of energy radiated by the sun, including light, radio waves and X rays.

starch A molecule composed of long chains of glucose molecules. Many plants store the energy produced in the photosynthesis process in the form of starch.

thermal energy Kinetic energy due to disordered motions and vibrations of microscopic particles such as molecules and atoms.

toxics As defined in the 1990 Clean Air Act Amendments, toxics include benzene, 1,3 butadiene, formaldehyde, acetaldehyde, and polycyclic organic matter.

transesterification A chemical process which reacts between an alcohol with the triglycerides contained in vegetable oils and animal fats to produce biodiesel and glycerin.

triglyceride A triglyceride is an ester of glycerol and three fatty acids. Most animal fats are composed primarily of triglycerides.

volatile A solid or liquid material that easily vaporizes.

volume A quantification of how much space an object occupies. The SI unit for volume is the cubic metre.

waste-to-energy plants Produce electricity in ways similar to a regular power plant, except WTE plants use a different fuel, burning waste as fuel to make electricity.

watt The common base unit of power in the metric system. One watt equals one joule per second. It is the power developed in a circuit by a current of one ampere flowing through a potential difference of one volt. One watt = 3.413 Btu/hr.

wind energy The energy present in the flow of air around the earth. The wind is driven by the temperature and pressure differences in the atmosphere arising from heating of the earth by the sun and it is further guided by topography. The energy stored in the atmosphere is in three forms: kinetic, potential and thermal. They all play a part in the motion of wind, but the main interest is in the kinetic energy from the wind's motion. The term "wind energy" is most often used to refer to the generation of useful energy from wind. This can be electrical, as in wind turbines, or mechanical, as used in wind pumps for simple agriculture. The kinetic energy of the wind is harnessed, initially by conversion to a rotation; this rotation can be used in a generator, or directly for a mechanical task such as pumping or milling.

yeast Any of various single-cell fungi capable of fermenting carbohydrates.

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