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Standard Terminology Relating to Biomass Fuels¹

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aerobic—able to live, grow, or take place only where free oxygen is present.

aerobic fermentation—fermentation processes that require the presence of air.

alcohols—the family name of a group of organic compounds that vary in chain length and consist of a hydrocarbon plus one or more hydroxyl groups; for example, the straight chain series $\text{CH}_3-(\text{CH}_2)_n-\text{OH}$. Includes methanol, ethanol, butanol, propanol, and higher alcohols. If the hydrocarbon is aromatic, the compounds are called phenols.

anaerobic—living or active in an airless environment.

anaerobic bacteria—microbes whose metabolisms require the absence of free oxygen.

anaerobic digester—a chemical reactor in which anaerobic bacteria are used to decompose biomass or organic wastes to produce methane and carbon dioxide.

anaerobic digestion—degradation of organic matter by microbes in the absence of air (oxygen) to produce methane and carbon dioxide (biogas).

anaerobic fermentation—fermentation processes conducted in the absence of air. The following anaerobic fermentation processes are significant in obtaining useful forms of energy from biomass: (1) alcoholic fermentation, fermentation processes whereby certain microorganisms convert glucose and other substrates with alcohol as an end product, (2) methane fermentation, generally termed anaerobic digestion (See also **anaerobic digestion**).

anhydrous—a material that does not contain water either absorbed on its surface or as water of crystallization; a water-free product.

ash—inorganic residue remaining after combustion, determined by definite prescribed methods.

ash fusion temperature—melting point of ash, usually expressed in degrees Fahrenheit. Variations include oxidizing atmosphere or reducing atmosphere, initial softening, or final fluid temperature. Some specifications include two intermediate points between initial softening and final fluid.

bagasse—residue remaining after extraction of a sugar-containing juice from plants like sugar cane.

bioconversion—a general term describing the use of biological

systems to transform one compound into another. Examples are digestion of organic wastes or sewage by microorganisms to produce methane.

biofuel—biomass-derived fuel.

biogas—a gaseous mixture of mainly carbon dioxide and methane produced by the anaerobic digestion of organic matter.

biomass—total weight of living matter in a given volume. When considered as an energy source, biomass is further subdivided into: (1) primary biomass, rapidly growing plant material that may be used directly or after a conversion process for the production of energy, and (2) secondary biomass, biomass residues remaining after the production of fiber, food, or other products of agriculture, or biomass by-products from animal husbandry or food preparation that are modified physically rather than chemically. Examples include waste materials from agriculture and forestry industries (manure, sewage, etc.) from which energy may be produced. The above distinction noted between primary and secondary biomass is based on economic factors; these are defined differently in ecological science.

DISCUSSION—material, excluding fossil fuels, which is or was a living organism that can be used as a fuel directly or after a conversion process. Wood, peanut hulls, agricultural waste, corn and other grains, sugar, and bagasse are all examples of biomass. Matter formed from living cells.

DISCUSSION—the living materials in the biosphere and their refuse and waste products. Defined in the Energy Security Act (P.L. 96-294) as any organic matter that is available on a renewable basis, including agricultural crops and agricultural wastes and residues, wood and wood wastes and residues, animal wastes, municipal wastes, and aquatic plants.

biomass—any material, excluding fossil fuels, which is or was a living organism that can be used as a fuel directly or after a conversion process. Peat is not a biomass.

DISCUSSION—Wood, peanut hulls, agricultural waste, corn and other grains, sugar, and bagasse are all examples of biomass.

biomass fuel—fuel derived from biomass.

biomass pellet—see **fuel pellet**.

corn stover—the stalks of the maize plant.

denatured fuel ethanol—fuel ethanol to which chemicals (denaturants) have been added to make the ethanol unfit for human consumption in accordance with the regulations of the Bureau of Alcohol, Tobacco, and Firearms of the U. S. Treasury Department.

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densification—see **finely sized biomass materials**.

densified biomass fuels—fuel made by compressing biomass to increase the density and to form the fuel into a specific shape such as cubes, pressed logs, pellets, or briquettes. Also see **fuel pellet**.

densified particulate biomass fuels—a fuel made by mechanical compression of biomass to increase the bulk density and to press the fuel into a specific shape, such as pellets and briquettes. The fuel can have a maximum volume of 16.39 cm³ (1 in.³) such that the largest dimension is 7.62 cm (3 in.).

digester—a bioreactor in which anaerobic bacteria are used to decompose biomass or organic wastes into methane and carbon dioxide.

dry basis moisture content—of biomass fuels, the ratio of the weight of the water in a sample to the weight of the dry material. It is expressed as a percent.

ethanol (ethyl alcohol, grain alcohol)—CH₃CH₂OH; can be produced chemically from ethylene or biologically from the fermentation of various sugars from carbohydrates found in agricultural crops and cellulosic residues from crops or wood.

fermentation—decomposition of organic compounds, by microorganisms, to fuels and chemicals such as alcohols, acids, and energy-rich gases.

fermentation fuel—a fuel produced by fermentation of biomass.

DISCUSSION—Ethyl alcohol is the most common form of fermentation fuel.

fixed carbon—carbon remaining after heating in a prescribed manner to decompose thermally unstable components and to distill volatiles.

fuel alcohol—ethyl, methyl, or higher alcohols with impurities (including water but excluding denatureants) produced for use as a fuel alone or as an addition to other fuels, such as gasoline.

fuel ethanol—ethanol with impurities (including water but excluding denaturants).

DISCUSSION—Fuel ethanol produced by fermentation normally contains trace amounts of methanol and small quantities of higher alcohols. These higher alcohols are collectively called “fusel oils.”

fuel ethanol manufacturing facility—a manufacturing facility of any size designed to produce fuel ethanol by a fermentation process.

fuel pellet—a densified fuel form, usually cylindrical, die-formed, usually by extrusion, with random lengths and open broken ends. Generally of high density.

furfural—an aldehyde derivative of certain biomass conversion processes, used as a solvent.

fusel oil—a clear, colorless, poisonous, liquid mixture of alcohols obtained as a by-product of grain fermentation; generally amyl, isoamyl, propyl, isopropyl, butyl, and isobutyl alcohols and acetic and lactic acids.

gasification—any chemical or heat process used to convert a feedstock to a gaseous fuel.

gasifier—a device that converts solid fuel to gas. Generally refers to thermochemical processes. Major types are moving bed (fixed bed), entrained bed, and fluidized bed.

gasohol—a blend of unleaded gasoline and up to 10 % anhydrous ethanol.

herbaceous plants—nonwoody species of vegetation, usually of low lignin content such as grasses.

hogged fuel—ground wood fuel that is usually a by-product of a wood products manufacturing process.

landfill gas—biogas produced from the natural degradation of the organic material in landfills.

lignin—the noncarbohydrate, polyphenolic, structural constituent of wood and some other plant tissues that encrusts the cell walls and cements the cells together.

methanogenic bacteria—microorganisms capable of producing methane.

methanol (methyl alcohol, wood alcohol)—an alcohol, CH₃OH, formed by catalytically combining carbon monoxide (CO) with hydrogen (H₂) in a 1:2 ratio, under high temperature and pressure. Commercially, it is often manufactured by steam reforming natural gas. It is also formed in the destructive distillation of wood.

moisture content—the amount of water contained in the biomass, expressed as either a percentage of the mass of the oven-dry biomass or of the wet biomass.

$$\text{moisture content, dry basis} = \frac{(\text{weight, wet sample} - \text{weight, dry sample})}{\text{weight, dry sample}} \times 100 \quad (1)$$

$$\text{moisture content, wet basis} = \frac{(\text{weight, wet sample} - \text{weight, dry sample})}{\text{weight, wet sample}} \times 100 \quad (2)$$

municipal solid wastes (MSW)—the refuse materials collected from urban areas in the form of organic matter, glass, plastics, waste paper, etc., not including human wastes.

oven dry wood—wood that has been dried to constant weight at about 217°F ± 2°F (103°C ± 1°C) and low humidity. By definition, oven dry wood has zero moisture content.

particulate wood fuel—any wood fuel with a maximum particle volume of 16.39 cm³ (1 in.³) such that the largest dimension is 7.62 cm (3 in.).

DISCUSSION—These fuels include sanderdust, sawdust, pellets, green tree chips, and hogged fuel.

pellet—see **fuel pellet**.

pelletized biomass fuel—see **densified particulate biomass fuels**.

proximate analysis—the determination, by prescribed methods, of moisture, volatile matter, fixed carbon (by difference), and ash. The term **proximate analysis** does not include determinations of chemical elements or determinations other than those named.

pyrolysis—the breaking apart of complex molecules by heating (over the range from 392° to 932° (200° to 500°C)) in the absence of oxygen, producing solid, liquid, and gaseous fuels.

quad—one quadrillion (10¹⁵) Btu.

refuse-derived fuel (RDF)—fuel processed from industrial waste, municipal waste, garbage, or sewage sludge.

refuse derived fuel 3 (RDF-3)—as defined by Committee E-38 on Resource Recovery, RDF-3 is a shredded fuel derived from municipal solid waste (MSW) that has been