

# Biogas glossary

Term	Description
<b>Acid</b>	Traditionally considered any chemical compound that, when dissolved in water, gives a solution with pH < 7.0
<b>Acetogenesis</b>	The conversion of volatile fatty acids (VFA) and alcohols by acetogenic bacteria into acetate, hydrogen and carbon dioxide
<b>Acidogenesis</b>	The conversion of the monomers into volatile fatty acids (VFA), alcohols, hydrogen gas, ammonia and carbon dioxide
<b>Ammoniacal nitrogen (N-NH<sub>4</sub> or N-NH<sub>3</sub>)</b>	A parameter expressing the concentration of a sample in ammoniacal nitrogen is liquid (N-NH <sub>4</sub> ) or gaseous (N-NH <sub>3</sub> ). This is essential in monitoring anaerobic digestion process. As high ammonia concentrations are toxic, it is important to monitor it closely. Ammonia originates primarily from the digestion of proteins. It is necessary to calculate free ammonia content as a function of pH and temperature. This value allows us to standardize the ratio of ammonia to total nitrogen of the input.
<b>Ammonia</b>	A gaseous compound of hydrogen and nitrogen, NH <sub>3</sub> , with a pungent smell and taste
<b>Anaerobic bacteria</b>	Micro-organisms that live and reproduce in an environment containing no "free" or dissolved oxygen; used for anaerobic digestion
<b>Anaerobic digestion (AD)</b> <i>Synonym: digestion, fermentation</i>	Process of the treatment of organic matter by fermentation in the absence of oxygen. The process of biological degradation is carried out in one or more anaerobic digesters. The output is a digestate, in the form of a more or less liquid fraction, as well as biogas.
<b>Artificial fertiliser</b>	See inorganic fertiliser
<b>Base</b>	Traditionally considered any chemical compound that, when dissolved in water, gives a solution with a pH > 7.0
<b>Biochemical conversion</b>	The use of biochemical processes to produce fuels and chemicals from organic sources
<b>Biochemical methane potential (BMP)</b>	Maximal potential production of biogas by a substrate (m <sup>3</sup> biogas/US-ton; 1 US-ton = 907.18474 kg)
<b>Bioenergy</b> <i>Synonym: Biomass energy</i>	Useful, renewable energy produced from organic matter. The conversion into energy of the carbohydrates in organic matter. Organic matter may either be used directly as a fuel or processed into liquids and gases.
<b>Biogas</b>	Gas produced by the fermentation of organic matter in the absence of oxygen. Biogas consists of 60 to 80% methane (CH <sub>4</sub> ), 30 to 40% carbon dioxide (CO <sub>2</sub> ) and other trace gases, such as hydrogen sulphide (H <sub>2</sub> S), ammonia (NH <sub>3</sub> ), and hydrogen (H). Or: A combustible gas derived from decomposing biological waste under anaerobic conditions. Biogas normally consists of 50-60% methane.

Term	Description
<b>Biogas production and % CH<sub>4</sub></b>	System performance measures. These should be as stable as possible. They reflect performance and accuracy in the stability of other parameters, so they are a consequence, a symptom.
<b>Biological oxygen demand (BOD)</b>	Chemical procedure for determining how fast biological organisms use up oxygen in a body of water
<b>Biomass feedstock</b>	Organic matter available on a renewable basis. Biomass includes forest and mill residues, agricultural crops and wastes, wood and wood wastes, animal wastes, livestock operation residues, aquatic plants, fast-growing trees and plants, and municipal and industrial wastes.
<b>Biomethane, methane</b>	Gas obtained by the purification of biogas that can be injected into a gas network or used as a replacement for natural gas
<b>Bioreactor</b> <i>Synonym: digester</i>	Device for optimising the anaerobic digestion of biomass and/ or animal manure, and possibly to recover biogas for energy production
<b>Bio-slurry</b> <i>Synonym: AD residues, digestate, digested biomass, digested slurry, effluent</i>	The product from bio-digesters, generated through anaerobic digestion of organic materials (often animal manure). <b>NB: in West Africa the most current French translation is 'effluent'</b>
<b>Bio-slurry enriched compost (BEC)</b>	Compost generated using (amongst other inputs) bio-slurry <b>NB: in West Africa it translates as 'Compost enrichie en effluent de biodigisteur (CEB)'</b>
<b>Buffer capacity</b>	Indicates the ability of the environment to be influenced by bases or acids. Used to characterize inputs and to monitor anaerobic digestion processes. A too low buffer capacity means too little organic matter buffer, resulting in faster digestibility. A buffer capacity that is too high can indicate the presence of organic acids or buffered compounds, such as proteins.
<b>C/N ratio</b>	Represents the carbon portion of the organic material on the total nitrogen portion; usually calculated for inputs and digestate; closely related to the other N <sub>prot</sub> /N <sub>tot</sub> and N-NH <sub>3</sub> /N <sub>tot</sub> values
<b>Capacity</b>	The maximum power that a machine or system can produce or carry safely (maximum instantaneous output of a resource under specific conditions). The generating equipment capacity is generally expressed in kW or mW.
<b>Centralised anaerobic digestion (CAD)</b>	Supplying slurry from several animal farms to a centrally located biogas plant, to be co-digested with other suitable feedstock
<b>Certificates (reCs)</b>	A tradable commodity proving that certain electricity is generated using renewable energy sources. Typically, one certificate represents generation of 1 megawatt hour (MWh) of electricity.

Term	Description
<b>Chemical fertiliser</b>	Fertiliser in which nitrogen is an important element (e.g., ammonium nitrate, urea) or any combination of mineral and chemical/synthetic fertiliser (e.g., NPK).
<b>Chips</b>	Woody material cut into short, thin wafers. Chips are used as a raw material for pulping and fibreboard or as biomass fuel.
<b>Chlorofluorocarbons (CFCs) &amp; hydrochloro-fluorocarbons (HCFCs)</b>	Fully or partly halogenated hydrocarbons that contain carbon (C), hydrogen (H), chlorine (Cl), and fluorine (F), produced as volatile derivatives of methane, ethane, and propane
<b>CO<sub>2</sub>-equivalents</b>	A unit used to standardise measurements. For example, tonne for tonne, methane is a greenhouse gas that is 21 times more powerful than carbon dioxide in causing the global greenhouse effect. Therefore, one tonne of methane represents 21 tonnes of CO <sub>2</sub> equivalent.
<b>Co-generation</b>	See combined heat and power generation (CHP)
<b>Combined heat and power generation (CHP)</b> <i>Synonym: co-generation</i>	The sequential production of electricity and useful thermal energy from a common fuel source. Reject heat from industrial processes can be used to power an electric generator (bottoming cycle). Conversely, surplus heat from an electric generating plant can be used for industrial processes, or space and water heating purposes (topping cycle).
<b>Compost</b>	Consists of composted biomass, this may or may not include bio-slurry. Under ABC, only bio-slurry enriched compost (BEC) will be considered.
<b>Composting</b>	Biological decomposition and stabilization of organic matter under aerobic conditions allowing development of elevated temperatures as the result of produced heat; when complete, the final product is sufficiently stable for storage and application to land without adverse environmental effects
<b>Dedicated energy crops (DEC)</b>	Crops grown specifically for their fuel value. These include food crops such as corn and sugarcane, and non-food crops such as poplar trees and switchgrass. Currently, two energy crops are under development: short-rotation woody crops, which are fast-growing hardwood trees harvested in 5 to 8 years, and herbaceous energy crops, such as perennial grasses, which are harvested annually after taking 2 to 3 years to reach full productivity.
<b>Digestate</b>	See bio-slurry
<b>Digester, biodigester</b>	A sealed container unit or tank, where the anaerobic digestion of animal manure or organic matter occurs
<b>Digestion temperature</b>	Anaerobic digestion can occur at various temperature ranges. Three ranges are distinguished: psychrophilic: 15-25°C (optimal: 20°C); mesophilic: 30-40°C (optimal: 37°C); thermophilic: 50-60°C (optimal: 55°C)
<b>Dry materials (DM)</b>	That what is obtained when water is removed from a product
<b>Effluent</b>	See bio-slurry

Term	Description
<b>Emissions</b>	Fumes or gases that come out of smokestacks and tailpipes, seep from inside factories or enter the atmosphere directly from oil well flares, garbage dumps, rotting vegetation and decaying trees and other sources. They include carbon dioxide, methane and nitrous oxide, which cause most of the global greenhouse effect.
<b>Energy balance</b>	Quantifies the energy used and produced by the process
<b>Farmyard manure (FYM)</b>	Decomposed mixture of dung, urine, straw and litter and fodder residues. It is a form of solid manure.
<b>Feedstock</b>	Liquid and solid material fed to the biodigester. Any material which is converted to another form or product.
<b>Fermentation</b>	See anaerobic digestion
<b>Fertilising residual materials (FRM)</b>	Organic residual materials used as fertilisers in agricultural, horticultural and forestry applications or for the rehabilitation of degraded sites
<b>Fly ash</b>	Small ash particles carried in suspension in combustion products
<b>Fossil fuel</b>	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. Crude oil, natural gas, and coal are fossil fuels.
<b>FOS/TAC ratio</b>	Indicator for assessing fermentation processes. The TAC value is an estimation of the buffer capacity of the sample and the FOS value corresponds to the volatile fatty acids content. It is calculated empirically according to the Nordmann method.
<b>Fuel cell</b>	A device that converts the energy of a fuel directly to electricity and heat, without combustion
<b>Gas turbine</b> <i>Synonym: combustion turbine</i>	Converts the energy of hot compressed gases (produced by burning fuel in compressed air) into mechanical power. The used fuel is normally natural gas or fuel oil.
<b>Gasification</b>	The process in which a solid fuel is converted into a gas; also known as pyrolytic distillation or pyrolysis
<b>Gigawatt (GW)</b>	A measure of electric capacity equal to 1 billion watt or 1 million kilowatt (kW)
<b>Global warming</b>	A gradual warming of the Earth's atmosphere reportedly caused by the burning of fossil fuels and industrial pollutants
<b>Green certificates</b> <i>Synonym: renewable energy generator</i>	A device for converting mechanical energy to electrical energy
<b>Greenhouse effect</b>	The effect of certain gases in the Earth's atmosphere in trapping heat from the sun.
<b>Greenhouse gas (GHG)</b>	An atmospheric gas, which is transparent to incoming solar radiation but absorbs the infrared radiation emitted by the Earth's surface. The main greenhouse gases are carbon dioxide, methane, and CFCs.
<b>Grid</b>	The electric utility companies' transmission and distribution system that links power plants to customers through high power transmission line service (110 kilovolts [kV] - 765 kV); high voltage primary service for industrial

Term	Description
	applications and street rail and bus systems (23 kV-138 kV); medium voltage primary service for commercial and industrial applications (4 kV - 35 kV); and secondary service for commercial and residential customers (120 V - 480 V). Grid can also refer to the layout of a gas distribution system of a city or town in which pipes are laid in both directions in the streets and connected at intersections.
<b>Grid system</b>	An arrangement of power lines connecting power plants and consumers over a large area
<b>Heat exchanger</b>	Device built for efficient heat transfer from one fluid to another, whether the fluids are separated by a solid wall so that they never mix, or the fluids are directly contacted
<b>Heat transfer efficiency</b>	Useful heat output released/ actual heat produced in the firebox
<b>Heating value</b>	The maximum amount of energy that is available from burning a substance
<b>Hydraulic retention time (HRT)</b>	The average length of time the liquid influent remains in the digester for treatment; HRT may go up to 50 days
<b>Hydrolysis</b>	Stage during which the macromolecules (proteins, lipids, carbohydrates) are hydrolysed to monomers
<b>Hygienisation</b>	Stage of conditioning the inputs or the digestate which consists in heating them during a given time, to reduce their content in pathogens (pasteurisation)
<b>Installed capacity</b>	The total capacity of electrical generation devices in a power station or system.
<b>Inorganic fertiliser</b>	Fertiliser not including organic matter; it contains any combination of mineral and/or chemical/synthetic fertiliser components; where a text does not require a distinction this term is preferred, to contrast with organic fertiliser.
<b>Joule (J)</b>	Metric unit of energy, equivalent to the work done by a force of one Newton applied over a distance of one meter. 1 joule (J) = 0.239 calories; 1 calorie (cal) = 4.187 J.
<b>Kilovolt (kV)</b>	1,000 Volt. The amount of electric force carried through a high-voltage transmission line is measured in kilovolts.
<b>Mesophilic digestion</b>	Takes place optimally around 37° - 41°C or at ambient temperatures between 20° - 45°C where mesophiles are the primary micro-organism present
<b>Methane (CH<sub>4</sub>)</b>	A flammable, explosive, colourless, odourless, tasteless gas that is slightly soluble in water and soluble in alcohol and ether; boils at 161.6°C and freezes at -182.5°C. It is formed in marshes and swamps from decaying organic matter, and is a major explosion hazard underground. Methane is a major constituent (up to 97%) of natural gas, and is used as a source of petrochemicals and as a fuel.
<b>Methanogenesis</b>	Conversion of acetate, hydrogen and carbon dioxide into methane and carbon dioxide by methanogenic bacteria
<b>Micro-turbine</b>	Small combustion turbine with an output of 25 to 500 kW. Microturbines are composed of a compressor, combustor, turbine, alternator, recuperator and generator. Relative to other technologies for small-scale power generation, micro-turbines offer a number of advantages, including: a small number of moving parts, compact

Term	Description
	size, light weight, greater efficiency, lower emissions, lower electricity costs, potential for low-cost mass production, and opportunities to utilise waste fuels.
<b>Mineral fertiliser</b>	Fertiliser with only mineral (soil-mined) mineral components, e.g., phosphate, potassium and various micro-nutrients like sulphate, manganese, copper, and no Nitrogen-containing components.
<b>Mini-grid</b>	An integrated local generation, transmission and distribution system serving numerous customers
<b>Municipal solid waste (MSW)</b>	All types of solid waste generated by a community (households and commercial establishments), usually collected by local government bodies
<b>Nutrients</b>	Organic or non-organic chemical compounds essential for plant growth
<b>Oil equivalent</b>	The tonne of oil equivalent (TOE) is a unit of energy: the amount of energy released by burning one tonne of crude oil, approx. 42 GJ
<b>Organic fertiliser</b>	Any biobased fertiliser which may include bio-slurry and compost, and other organic fertilisers such as biochar and bokashi (fermented organic matter). Organic fertiliser enriched with minerals (e.g., phosphorus, potassium, lime) is still organic fertiliser. Organic fertiliser in which chemical (N-based) fertiliser is added is not.
<b>Organic loading rate (OLR)</b>	Amount of organic matter arriving at the anaerobic digestion system every day, expressed in kg of volatile solids per day per cubic meter of digester (kg VS/d/m <sup>3</sup> ). This feeding rate is calculated based on system performance and the hydraulic retention time (HRT). This dictates the nutritional pressure of VS applied to the bacteria. The higher the OLR, the less the digestate will be degraded and the more likely it is to reduce the burden of methanogenic microorganisms. A low OLR with high HRT may create metabolites lethal to methanogens. An OLR of between 2.5 and 4 kg VS/J/m <sup>3</sup> in mesophile and between 4 and 6.5 kg VS/J/m <sup>3</sup> in thermophile complies with the sound operation of a digester.
<b>Organic matter (OM)</b>	See soil organic matter (SOM)
<b>pH</b>	An expression of the intensity of the alkaline or acidic strength of water. Values range from 0-14, where 0 is the most acidic, 14 is the most alkaline and 7 is neutral
<b>Photosynthesis</b>	Process by which chlorophyll-containing cells in green plants convert incident light to chemical energy, capturing carbon dioxide in the form of carbohydrates
<b>Physical parameters</b>	Parameters allowing to control the quantity and quality of inputs; can also predict trends during atypical feeding (pH, Buffer capacity, Redox, FOS-TAC, C/N, Ntot, Nprot, N-NH <sub>3</sub> , Nprot/Ntot, N-NH <sub>3</sub> /Ntot, buffer capacity/Nprot)
<b>Pilot scale</b>	The size of a system between the small laboratory model size (bench scale) and a full-size system
<b>Plant</b>	A facility containing prime movers, electric generators, and other equipment for producing electric energy

Term	Description
<b>Plug-flow digester</b>	A constant volume, flow-through, controlled temperature biological treatment unit designed to maximize biological treatment, methane production, and odour control as part of a manure management facility with methane recovery
<b>Power</b>	The amount of work done or energy transferred per unit of time
<b>Process heat</b>	Heat used in an industrial process
<b>Protein nitrogen (Nprot)</b>	Protein nitrogen is used to characterize the protein content of inputs and digestate. The difference between the two measures informs us about the proportion of degraded proteins.
<b>Redox</b>	Redox (reduction–oxidation) is a type of chemical reaction in which the oxidation states of atoms are changed. Redox reactions are characterized by the actual or formal transfer of electrons between chemical species, most often with one species (the reducing agent) undergoing oxidation (losing electrons) while another species (the oxidizing agent) undergoes reduction (gains electrons).
<b>Renewable resources</b>	Naturally replenishable, but flow-limited energy resources. They are virtually inexhaustible in duration, but limited in the amount of energy that is available per unit of time. Some (such as geothermal and biomass) may be stock-limited in that stocks are depleted by use, but on a time scale of decades, or perhaps centuries, they can probably be replenished. Renewable energy resources include: biomass, hydro, geothermal, solar and wind. In the future they could also include the use of ocean thermal, wave, and tidal action technologies. Utility renewable resource applications include bulk electricity generation, onsite electricity generation, distributed electricity generation, non-grid connected generation, and demand-reduction (energy efficiency) technologies.
<b>Sludge</b>	Biosolids separated from liquids during processing. Sludge may contain up to 97% water by volume.
<b>Soil Organic Matter (SOM)</b>	<b>Soil organic matter</b> (SOM) is the <a href="#">organic matter</a> component of <a href="#">soil</a> , consisting of plant and animal <a href="#">detritus</a> at various stages of <a href="#">decomposition</a> , cells and tissues of <a href="#">soil microbes</a> , and substances that soil microbes synthesize. SOM provides numerous benefits to the physical and chemical properties of soil and its capacity to provide regulatory <a href="#">ecosystem services</a> . SOM is especially critical for <a href="#">soil functions</a> and <a href="#">quality</a> . (Wikipedia)
<b>Status parameters</b>	Allow to track and control the process in a stable and secure manner (HRT, ORL, CH <sub>4</sub> , pH, T°C, Buffer capacity, Redox, FOS-TAC, Carbon balance, N-NH <sub>3</sub> , N-NH <sub>3</sub> /Ntot, N-NH <sub>3</sub> /CT)
<b>Sustainable</b>	An ecosystem condition in which biodiversity, renewability and resource productivity is maintained over time.
<b>Synthetic fertiliser</b>	See chemical fertiliser
<b>Thermophilic digestion</b>	Anaerobic digestion which takes place optimally around 50°C-52°C but also, at elevated temperatures up to 70°C, where thermophiles are the primary micro-organisms (bacteria) present.

Term	Description
<b>Total nitrogen (N<sub>tot</sub>)</b>	Total nitrogen is a measure used to characterize inputs, but it remains a vague measure because it will have to be broken down by a calculation of protein nitrogen (N <sub>prot</sub> ) and ammonia nitrogen (N-NH <sub>4</sub> ). The latter will, however, be a parameter for monitoring the process.
<b>Total solids (%TS)</b>	Parameter expressing the rate of solids in the feedstock
<b>Total solids biogas</b> <i>Synonym: dry solids</i>	The residue remaining when water is evaporated away from the residue and dried under heat
<b>Turbine</b>	A machine for converting the heat energy in steam or high temperature gas into mechanical energy. In a turbine, a high velocity flow of steam or gas passes through successive rows of radial blades fastened to a central shaft.
<b>Volatile acids</b>	These are produced in the digester by acid-forming bacteria and then used by the methane-forming bacteria to produce methane.
<b>Volatile fatty acids (VFA)</b>	An analysis of the volatile fatty acids (VFA) profile allows to identify an unstable or even toxic biochemical state. Because short chain fatty acids are lethal to some bacteria this can impair digestion and production. Such imbalance could also create, under certain conditions, a problem of foaming. Analysis of the VFA profile is not done on a regular basis but rather in case of problems, quality control or when using a new input. These are acids that are produced by microbes in the silage from sugars and other carbohydrate sources. By definition they are volatile, which means that they will volatilise in air, depending on temperature. These are the first degradation product of anaerobic digestion prior to methane creation.
<b>Volatile solids (%VS)</b>	Parameter expressing the rate of volatile solids in a liquid sample
<b>Volatile solids (VS)</b>	Those solids in water or other liquids that are lost on ignition of the dry solids at 550°C