

1

Glossary of Key Energy Terms

1.1 Introduction

This first chapter of the book provides the definition of hundreds of terms in use throughout the energy field, particularly as they apply to hydrogen. As one might suppose, the reader is primarily introduced to energy and energy-related terms. As noted in the Preface, this book is concerned with hydrogen energy and as such, this chapter primarily addresses terms related to this topic. Thus, this chapter may be used whenever and wherever information is needed about words and/or terms in the hydrogen energy field.

Some additional points regarding this glossary that deserve mention are presented below:

- 1) Each definition is presented in nontechnical jargon.
- 2) Where necessary, common scientific and engineering units have been included.
- 3) A conscious attempt was made to only include terms that are often used in practice.
- 4) Only one spelling is used for words with multiple accepted spellings but with shared meaning.
- 5) Different terms with the same meaning are cross-referenced by using the wording “see also”.
- 6) Important acronyms are also included in the chapter.

This chapter defines many but not all of the terms that the reader will encounter in this book. The following list is therefore not exhaustive as a complete index of the book or glossary of all the terms that appear in the energy field. Finally, the purpose of this chapter is to explain the meanings of technical terms that may be unfamiliar to the reader. Definitions given here are for the purposes of this text and are not necessarily complete or exhaustive. Words or phrases included here are those for which there may be some confusion as to the meaning intended.

Section titles for this energy glossary chapter are presented below:

- 1.1 Introduction
- 1.2 Importance of Energy Literacy
- 1.3 Glossary
- 1.4 Symbols and Acronyms
- References

1.2 Importance of Energy Literacy

Why a glossary chapter? A good question. The answer? For some readers, this chapter might be the most important one in the book. Understanding energy and energy-related words and terms can motivate some individuals and prepare others to understand the roles (sustainable) energy plays in their lives. Hence, some people will refer to this chapter as “energy literature” of sorts. Informed individuals on energy topics:

- 1) Can trace energy flow and flow patterns and think in terms of energy systems and sustainability.
- 2) Know about their energy usage in terms of the amounts, for what, and where that energy originates from.
- 3) Can purposefully assess the credibility of energy information, regulations, and policies and decisions about sustainable energy futures.
- 4) Can communicate generally about energy sources and usage in meaningful ways.
- 5) Can make informed energy-related decisions based on an understanding of impacts and consequences.
- 6) Continues to learn about energy.

Thus, energy-related understanding can also help:

- 1) Lead to more informed decisions
- 2) Improve the security of a nation
- 3) Promote economic development
- 4) Lead to sustainable energy use
- 5) Reduce environmental risks and negative impacts
- 6) Help individuals and organizations save/make money

Without this information, individuals and communities will have difficulty making informed decisions on topics including sustainable or smart energy use at home, consumer choices, and national and international energy regulations and policies. Energy education should begin with basic energy literacy connected with the most frequently used terminologies.

Finally, the bulk of the material in this chapter was drawn from the earlier work of Theodore, Reynolds, and Morris (1997), as well as others (Holmes, Singh, and Theodore 1993; Theodore, Ricci and VanVlet 2007; Skipka and Theodore 2014; Dupont, Ganesan, and Theodore 2016; Theodore and Theodore 2021).

1.3 Glossary

- **Above ground tank** – any tank or other container, the volume of which is completely above the plane of the adjacent surrounding surface, and whose surface can be visually inspected.
- **Absolute humidity** – the amount of water vapor present in a unit mass of air, usually expressed in kilograms of water vapor per kilogram of dry air or pounds of water vapor per pound of dry air.
- **Absolute pressure** – the actual pressure exerted on a surface that is measured relative to zero pressure; it equals the gauge pressure plus the atmospheric pressure.
- **Absolute temperature** – the temperature expressed in Kelvin (K) or degrees Rankine (°R).
- **Absolute temperature scale** – a scale (e.g., K, °R) in which temperatures are measured relative to absolute zero.

- **Absolute vacuum** – a void that is completely empty of matter.
- **Absolute zero** – the temperature of zero on either the Kelvin or Rankine scale at which molecular motion is thought to cease.
- **Absorbate** – a substance that is taken up and retained by an absorbent.
- **Absorbent** – any substance that takes in or absorbs other substances.
- **Absorber** – a device in which a gas is absorbed by contact with a liquid.
- **Absorption** – the process in which one material (the absorbent) takes up and retains another (the absorbate) to form a homogenous solution; it often involves the use of a liquid to remove certain gas components from a gaseous mixture.
- **Absorption tower** – a vertical tube in which a rising gas is partially absorbed by a liquid in the form of falling droplets.
- **Acceleration** – the rate of change of velocity with time, ft/s².
- **Acceleration due to gravity** – the acceleration of a free-falling body in a vacuum under the influence of gravity; on Earth, this value is taken as 32.2 ft/s² or 9.8 m/s².
- **Accident** – an unexpected, undesirable event that is caused by the presence of a hazard and adversely affects humans and/or the environment.
- **Accuracy** – the measure of agreement between a measured value and an accepted or true value; it is expressed as the percentage difference between the true and measured values relative to the true value.
- **Acetogen** – a microorganism involved in the anaerobic transformation of organic matter to methane during biogas production.
- **ACFM** – see actual cubic feet per minute.
- **Acid** – a material containing hydrogen that produces at least one hydrogen ion when dissolved in a water solution; it can react with and be neutralized by a base to form a salt.
- **Acid dew point** – the dew point of flue gases that contain any significant quantity of sulfur trioxide, SO₃; this temperature is generally 300°F.
- **Activated alumina** – a highly porous, granular form of aluminum oxide with absorptivity for moisture and odor contained in gases and some liquids.
- **Activated carbon** – a highly adsorbent, amorphous form of carbon employed to remove odors, gaseous pollutants, and toxic substances from gaseous emissions or to remove dissolved organic material from wastewater.
- **Activated sludge** – a suspension of aerobic microorganisms with the ability to remove polluting material from a stream of wastewater.
- **Activation energy** – the minimum amount of energy that a molecule must require before it can be regarded as being activated (i.e., able to undergo a reaction).
- **Actual cubic feet per minute (acfm)** – a unit of flow rate measured under actual pressure and temperature conditions.
- **Additives** – specialty chemicals incorporated into fuels and lubricants that enhance the performance of the finished product.
- **Adiabatic** – a term used to describe a system in which no gain or loss of heat is allowed to occur.
- **Adiabatic flame temperature** – the maximum temperature that a combustion system can reach.
- **Adiabatic process** – a process in which there is no transfer of heat across the system boundary.
- **Adiabatic temperature** – the temperature attained by a reaction undergoing a volume or pressure change in which no heat enters or leaves the system.
- **Adsorbent** – a substance (e.g., activated carbon, activated alumina and silica gel) that can condense or hold molecules of other substances on its surface.
- **Adsorber** – an apparatus in which molecules of gas or liquid are captured by a solid.

- **Adsorption** – the physical or chemical bonding of molecules of gas, liquid, or dissolved solid to the external or internal (if porous) surface of a solid; it is an advanced method of treating waste that is employed to remove odor, color, or organic matter from a system.
- **Advanced wastewater treatment** – any process that is employed for the treatment of wastewater that follows other physical, chemical, or biological treatment and serves to improve the quality of effluent prior to reuse or discharge; this includes charged helium nucleus
- nutrients, suspended solids, nonbiodegradable organics, etc.
- **Aerobic digestion** – the breakdown of suspended and dissolved organic matter in the presence of oxygen.
- **Afterburner** – a secondary burner, located so that combustion gases from the primary incinerator are further burned to remove smoke, odors, and other pollutants.
- **Agent** – a biological, physical, or chemical entity capable of causing disease.
- **Agglomeration** – the process by which smaller particles grow larger by collision or contact with other particles.
- **Air heater** – a heater exchanger through which air passes and is heated or cooled by a medium at a different temperature.
- **Air preheater** – an air heater that increases the temperature of an air stream entering a process.
- **Air quality** – the degree of cleanness of the air with regard to lack of pollution.
- **Aliphatic** – one of the major groups of organic compounds characterized by straight or branched chain arrangement of constituent carbon atoms; they are divided into alkanes, alkenes, or branched compounds.
- **Alkali** – any basic substance that is bitter in water solution and irritating or caustic to the skin and mucous membranes; it turns litmus blue, has a pH value greater than 7.0, and is typically employed in wastewater treatment processes.
- **Alkaline electrolyzer** – the oldest technology for creating hydrogen from water and electricity.
- **Alkaline fuel cell** – one of the oldest and cheapest fuel cell technologies that is highly conductive of electrolyte and highly reactive to electrodes.
- **Alkalinity** – a measure of the degree of reaction by a compound with hydrogen ions (e.g., the capacity of water to neutralize acids).
- **Alkane** – a member of a series of saturated, aliphatic hydrocarbons.
- **Alkene** – a member of a series of unsaturated, aliphatic hydrocarbons that are characterized by double bonds between carbon atoms.
- **Alkyl** – a paraffinic hydrocarbon group that may be derived from an alkane by removing one hydrogen from the molecule.
- **Alkylation** – a process in which a high-octane blending component for gasoline is derived from catalytic combination of an isoparaffin and an olefin.
- **Alpha (α) particle** – a positively charged helium nucleus (i.e., two protons and two neutrons) that is emitted spontaneously from radioactive elements.
- **Ambient temperature** – the temperature of the surrounding air.
- **Amine** – a class of organic compounds of nitrogen that may be derived from ammonia (NH_3) by replacing one or more of the hydrogen atoms with an alkyl group.
- **Ammonia (NH_3)** – the different directions fifth highest volume of chemical produced in the United States that exists as a colorless gas or liquid with a sharp, intensely irritating odor; the inhalation of concentrated fumes may be fatal, and it has a TLV of 25 ppm in air and explosive limits of 16–25% in air.
- **Ampere** – a unit of electrical current, equal to 1 C/s.
- **Amplitude** – the peak, or maximum value, in wave-type transmissions.

- **Anaerobe** – an organism that carries out microbial reactions in the absence of oxygen.
- **Anaerobic digestion** – the degradation of organic matter by anaerobic organisms in the absence of oxygen to produce primarily carbon dioxide and methane.
- **Ancillary equipment** – any secondary equipment or device including piping, fittings, valves, pumps, etc.
- **Anhydrous** – an inorganic compound that does not contain water, either adsorbed on its surface or combined as water of crystallization.
- **Anion** – a negatively charged ion.
- **Anisotropic** – a term used to describe a material with different optical or other physical properties in different directions (e.g., quartz and graphite).
- **Annual energy production (AEP)** – the energy generated by turbine(s) over the course of 1 year.
- **Anode** – the positive electrode of an electrolytic cell to which negatively charged ions travel when an electric current passed through the cell.
- **Anticipated transient without scram (ATWS)** – for a nuclear reactor, an accident for which the initiating event is an anticipated operational occurrence and in which the system for fast shutdown of the reactor fails to function.
- **Applicant** – any person or organization applying to a regulatory body for authorization (or approval) to undertake specified activities.
- **Approval** – the granting of consent usually by a regulatory body.
- **Aqua** – a term used to designate water such as in a stream, a lake, or other sources.
- **Aqueous solution** – any solution dissolved in water.
- **Archimedes' principle** – the principle that the buoyant force on an object immersed in a fluid is equal to the weight of fluid displaced by it.
- **Aromatic** – a term used to describe a major group of unsaturated cyclic hydrocarbons containing one or more rings, typified by benzene which has a six-carbon ring containing three double bonds.
- **Arrangements (for operations)** – the integrated set of infrastructural elements necessary to provide the capability for performing a specified function or task required to carry out a specified operation.
- **Assessment** – the process, and the result, of analyzing systematically and evaluating the hazards and problems associated with sources and practices, and associated protection and safety measures for the purposes of protecting the public and environment against risks.
- **Atmosphere** – the gaseous envelope of fluid surrounding the Earth that comprises the troposphere, stratosphere, mesosphere, and thermosphere; the Earth's atmosphere consists of 79.1% nitrogen, 20.9% oxygen, about 0.03% carbon dioxide, a trace of the noble gases, water vapor, and traces of ammonia, organic matter, ozone, various salts, and suspended solid particles.
- **Atmospheric dispersion** – the mechanism of dilution of smoke or gaseous pollution in which the concentration is progressively decreased.
- **Atmospheric pressure** – the pressure exerted by the atmosphere at any given point.
- **Atmospheric stagnation** – the condition of very little or no air movement.
- **Atom** – the smallest unit of an element that retains all the properties of the element; it is composed of electrons, neutrons, and protons.
- **Atomic energy** – the energy, in the form of heat and radiation, that is derived in a controlled fashion from nuclear fission or fusion.
- **Atomic fission** – the breaking down of large atoms into smaller atoms or elements, involving the liberation of heat, gamma rays, alpha particles, and beta particles.

- **Atomic mass unit (amu)** – a unit equal to one-twelfth the mass of one neutral C^{12} atom.
- **Atomic weight** – the average weight or mass of all the isotopes of an element as determined by the proportion in which they are present in a given element; it is based on the mass of isotopes of carbon which is assigned a reference value of 12.000.
- **Attenuation** – the reduction in intensity of radiation passing through matter due to processes such as absorption and scattering.
- **Authorization** – the granting by a regulatory body or other governmental body of written permission for a person or organization to conduct specified activities. Authorization could include licensing (issuing a license), certification (issuing a certificate), or registration.
- **Autogenous combustion** – any burning without the addition of supplementary fuel.
- **Autoignition** – the starting of a fire without the addition of an external source such as a flame, spark, or heat.
- **Autoignition temperature (AIT)** – the temperature to which a closed or nearly closed container must be heated so that a flammable liquid, when introduced into the container, will ignite spontaneously or burn without the presence of a spark or flame.
- **Automatic control** – the maintenance of desired process conditions by means of sensing devices.
- **Available hydrogen** – naturally occurring liquid, gaseous, or solid hydrogen (or deuterium or tritium) on Earth often in combination with oxygen, carbon, or other elements.
- **Available oxygen** – the quantity of dissolved oxygen available for oxidation of organic matter.
- **Avogadro's number** – the number of molecules in 1 mol of a substance, 6.23×10^{23} .
- **Baffle** – a flow-regulating device consisting of a perforated metal plate placed horizontally to restrict or divert the passage of a fluid, usually used for the purpose of providing a uniformly dispersed flow.
- **Ball joint** – a flexible pipe joint formed in the shape of a ball or sphere.
- **Ball valve** – a nonreturn valve consisting of a ball resting on a cylindrical seat within a fluid passageway or pipe.
- **Barometric pressure** – the pressure of the ambient air in the atmosphere at a particular point or above the surface of the Earth.
- **Barrels of oil equivalent** – a unit of measure to quantify crude oil, natural gas liquids, and natural gas amounts using the same basis.
- **Base** – any compound that dissociates in an aqueous solution to yield hydroxyl ions; it is employed to neutralize acids.
- **Baseload** – the minimum level of demand on an electrical grid over a given period of time (usually over the year, or over a season or day); base load power sources are power stations that are capable of consistently generating the electrical power needed to cover this demand.
- **Baseload generation** – electric generation units that typically run all 24 hours a day.
- **Basic** – a term used to describe a compound that is alkaline, i.e., has a pH greater than 7.0.
- **Batch process** – a process that is not continuous; its operations are carried out with discrete quantities of material.
- **Battery** – a device consisting of one or more electrically connected electrochemical cells that is designed to receive, store, and deliver electric energy; it converts chemical energy to electrical energy.
- **Bernoulli's theorem** – a physical law of hydraulics that states that the energy per mass is constant at any point in a conduit; this energy comprises a velocity head, a pressure head, and a static head.
- **Beta (β) particle** – a charged particle emitted from a radioactive atomic nucleus; it has moderate penetrative power and can damage living tissue.

- **Bias** – a measure of the systematic error between an actual or true value and a prediction by a model or a measured mean value; the bias of a model represents the tendency of a model to overpredict or to underpredict.
- **Binary fission** – a process by which bacteria reproduce by splitting into equal parts.
- **Binary power plant** – a power plant that transfers heat from hot water to a working fluid that vaporizes at lower temperatures than water.
- **Biofuel** – a fuel produced from biomass or biomass used directly as a fuel.
- **Biomass fuel** – fuels derived from recently living organisms; sometimes also includes fuels derived from municipal solid waste (containing methane and carbon dioxide).
- **Biosphere** – that part of the environment normally inhabited by living organisms. In practice, the biosphere is not usually defined with great precision but is generally taken to include the atmosphere and the Earth's surface, including the soil and surface water bodies, seas and oceans, and their sediments.
- **Biotechnology** – the application of scientific and engineering principles to the processing of any organic or inorganic substance by biological agents to provide goods and services including energy.
- **Bituminous coal** – a coal between lignite and anthracite in rank, burning with a smoky, luminous flame.
- **Black hydrogen** – hydrogen produced from coal via coal gasification and extraction.
- **Blade** – the long fiberglass pieces designed to catch the wind at the top of the wind turbine, causing the turbine to turn. Three blades connect to the hub to create the rotor.
- **Blast-furnace gas** – a by-product gas from smelting iron ore obtained by the passage of hot air over the coke in blast furnaces.
- **Bleeding** – the gradual release of material and/or reduction of pressure from a system or process (e.g., by a valve).
- **Blowdown** – the cyclic or constant removal of a portion of any process flow to maintain the constituents of the flow at a desired level.
- **Blower** – a fan employed to force or move air or gas under pressure.
- **Blue hydrogen** – this term is used for hydrogen produced using low-carbon processes.
- **Boiler** – a pressure vessel designed to produce vapor from liquid, usually water, by the applications of heat.
- **Boiler scale** – a covering, varying from a porous, friable crust to a dense, hard coating, that is deposited on boiler heating surfaces by precipitation of minerals from the water used.
- **Boiling point** – the temperature of a liquid at which its vapor pressure is equal to or varies slightly above that of the atmospheric pressure of the environment; it is 212°F for water at sea level.
- **Bond energy** – the amount of energy required to disrupt the bonds in 1 mol of a chemical compound.
- **Boyle's law** – a law that states that the volume of a gas is inversely proportional to the pressure if the temperature remains constant; this relation holds true for ideal gases.
- **Brine** – a concentrated solution of salt and water that remains after the removal of a distilled product.
- **British Thermal Unit (Btu)** – the quantity of heat required to raise the temperature of 1 lb of water by 1°F at the temperature at which water has its greatest density (approximately 39°F).
- **Brown hydrogen** – hydrogen produced from lignite (see black hydrogen).
- **Brownian movement** – the constant, random movement of small, suspended particles due to collisions with other molecules.

- **Bubble point** – the temperature at which the first bubbles of gas appear in a vapor–liquid equilibrium system with two or more components.
- **Bubble tower** – a plate tower employed in distillation (primarily) and absorption; it contains plates with bubble caps to promote intimate vapor–liquid contact.
- **Buffer** – (1) a solution containing both a weak acid and its conjugate weak base, which is employed to stabilize the pH value in a solution, and (2) anything that acts to diminish and/or regulate change in a system or process.
- **Bulk density** – the mass per unit volume of the solid in a solid–gas mixture such as a packed bed or soil mass; unlike the real density, the pore space is included in the volume.
- **Bulk sample** – a small portion of material that is collected and sent to a laboratory for analysis.
- **By-product** – a material that is not one of the primary products of a production process and is not solely or separately produced by the production process.
- **Bypass** – a device to inhibit, deliberately but temporarily, the functioning of a circuit or system by, for example, short circuiting the contacts of a relay.
- **Calcination** – the heating of a solid waste material to a temperature below its melting point to bring about a state of thermal decomposition or a phase transition other than melting.
- **Calibration** – the determination, checking, or adjustment of the accuracy of any instrument that gives quantitative measurements.
- **Calorimeter** – a device for determining the amount of heat evolved or absorbed in a chemical reaction.
- **Capacitance** – the property of a capacitor that determines how much charge can be stored in it for a given potential difference between its terminals; it is measured by the ratio of the charge stored to the potential difference.
- **Capacitor** – a device for accumulating and holding a charge of electricity, usually consisting of conducting surfaces separated by a dielectric.
- **Capacity** – the maximum electric power capability of a generating unit or transmission line measured in MW.
- **Capacity factor (aka load factor)** – the actual output of a generating unit over a specific period of time divided by the unit's total capacity multiplied by the total number of hours in the period.
- **Capital costs** – initial, one-time costs of planning, designing, and constructing a facility; it also refers to additional costs of long-term investment in facilities maintenance or upgrades.
- **Carbon neutral** – a process that has no net emissions of greenhouse gases into the atmosphere.
- **Carbon-free hydrogen** – hydrogen produced from renewable feedstock with emissions below 36.4 g CO₂eq/MJ H₂ e.g., by electrolysis using renewable electricity as feedstock.
- **Carnot cycle** – an ideal, closed heat cycle of reversible changes with which the performance of heat engines may be compared; it assumes no frictional losses.
- **Carryover** – the entrainment of liquid or solid particles in the vapor evolved by a boiling liquid or from a processing unit.
- **Catalysis** – a process in which the rate of a reaction is altered by the presence of an added substance that remains unchanged at the end of the reaction.
- **Catalytic combustion** – a process in which a catalyst is introduced into an exhaust gas stream to encourage the reaction of gaseous hydrocarbons at a lower temperature than would otherwise be possible.
- **Catalytic cracking** – the breaking of carbon–carbon bonds with the aid of a catalyst; it is an essential process in the refining of petroleum.

- **Cathode** – the negative electrode of an electrolytic cell to which positively charged ions travel when an electric current is passed through the cell.
- **Cation** – a positively charged ion.
- **Cavitation** – the formation of vapor bubbles in a liquid when subjected to localized low-pressure regions causing severe mechanical damage to the surface of the metal exposed to it.
- **Centrifugal fan** – a device for moving gases.
- **Centrifugal pump** – a device that increases the pressure of a liquid by using centrifugal force.
- **Certificate** – a legal document issued by the regulatory body stating the applicable conditions to be met for certification and certifying compliance with regulatory requirements if the conditions are met.
- **Certification** – the issuance of a certificate.
- **Channel** – an arrangement of interconnected components within a system that initiates a single output.
- **Charles' law** – the law which states that the volume of a confined gas at a constant pressure is proportional to its absolute temperature.
- **Check valve** – a one-way valve that prevents flow through a pipe in an undesired direction; it opens in the direction of the normal flow and closes with a reversal of flow.
- **Chemical agent** – an element, compound, or mixture that coagulates, dissolves, neutralizes, solubilizes, oxidizes, concentrates, makes a pollutant mass more rigid, or otherwise facilitates the lessening of harmful effects or the removal of a pollutant from a fluid.
- **Chemical bond** – an attractive force between atoms strong enough to permit the combined aggregate to function as a unit.
- **Chemical oxygen demand (COD)** – a measure of the oxygen that is needed for the decomposition of inorganic and organic waste matter present in wastewater.
- **Chemical reaction** – a process that involves changes in the structure and energy content of atoms, molecules, or ions but not their nuclei; a chemical change that may occur in several ways, including combination, replacement, decomposition, or some modification of these.
- **Chemical thermodynamics** – the aspects of thermodynamics concerned with the relationship of heat, work, and other forms of energy to equilibrium in chemical reactions and phase changes within a system.
- **Chemisorption** – the adsorption that occurs by the formation of bonds between the surface molecules of a metal and another substance in contact with it.
- **CHP** – an abbreviation that stands for combined heat and power. A term used to describe a technology that produces both heat and power for commercial uses.
- **Closed-loop** – a term used to describe an enclosed process.
- **Closure** – administrative and technical actions directed at a disposal facility at the end of its operating lifetime.
- **Co-firing** – the simultaneous use of multiple fuels to create thermal energy.
- **Coal** – a natural, solid, combustible material that is utilized as a fuel; it is formed from prehistoric plant life that occurs in layers or veins in sedimentary rock.
- **Coal gasification** – a process through which coal is deconstructed into a gas via a combination of high-pressure and high-temperature steam, and by external heat; this process transforms the complex hydrocarbons from a solid slate into a gaseous one.
- **Co-current** – a term condition used to describe a situation in which two or more controls or systems exist in an operated condition at the same time.
- **Coefficient of performance (COP)** – the ratio of the refrigeration effect to the work input.

- **Coke** – the porous, brittle, carbonaceous, solid residue of the destructive distillation of bituminous coal, petroleum, and coal-tar pitch; it can be utilized as a fuel.
- **Coke oven gas** – the mixture of permanent gases produced by the carbonization of coal in a coke oven at temperatures in excess of 1,000°C.
- **Combined-cycle turbine** – a device that uses both a gas turbine and a steam turbine to convert thermal energy to kinetic energy.
- **Combustible** – a material that can be ignited at a specific temperature in the presence of air or oxygen to release heat.
- **Combustion** – a reaction at a high temperature with oxygen that produces carbon dioxide, water, and energy in the form of light and heat; it is a basic cause of air pollution. **Combustion air** – the air required in an incinerator or furnace for combustion.
- **Combustor** – the component of a power plant where fuel is burned.
- **Compaction** – the process of reducing the bulk of solid waste by rolling and packing down or compressing and crushing.
- **Composting** – an aerobic, microbial decomposition of solid organic wastes, both agricultural and municipal/industrial.
- **Compound** – a substance composed of atoms or ions of two or more elements in chemical combination where the constituents are united by bonds or valence forces; it is a homogeneous entity where the elements have definite proportions by mass and are represented by a chemical formula.
- **Compressed natural gas (CNG)** – natural gas, which is comprised primarily of methane, compressed to a pressure at or above 2,400 lb/in.² and stored in special high-pressure containers; it is used as a fuel for natural gas-powered vehicles.
- **Compressor** – any device employed to increase the pressure of gas.
- **Concentration** – the relative amount of a component in a given substance.
- **Condensate** – any liquid resulting from the cooling of a gas or vapor.
- **Condenser** – any device that cools gases or vapors to liquid.
- **Conditional probability value (CPV)** – the upper bound for the conditional probability that a particular type of event will cause unacceptable consequences. The term is used in the detailed event screening process for site evaluation.
- **Conduction** – (1) the transfer of heat from one substance to another when the two substances are in physical contact, and (2) the transfer of an electric current through a solid or liquid in a metal.
- **Conductive heat transfer** – a transfer of heat from one point to another within a body, or from one body to another if the bodies are in physical contact.
- **Conductivity** – the property of a substance or mixture that describes its ability to transfer heat or electricity.
- **Confidence interval** – an interval estimate with a specified level of confidence for a given set of data.
- **Confinement** – prevention or control of releases of radioactive material to the environment in operation or in accidents.
- **Congestion** – occurs when the level of electrical power that needs to be transported across a transmission line exceeds its transmission capacity.
- **Consequence assessment** – assessment of the radiological consequences (e.g., doses, activity concentrations) of normal operation and possible accidents associated with an authorized facility or part thereof.
- **Conservation of energy** – the principle that states that energy can never be created or destroyed, but only changed in form; this is also known as the First Law of Thermodynamics.

- **Conservation of mass** – the principle which states that mass can neither be created nor destroyed.
- **Conservation of momentum** – the law which states that the total momentum in a steady state flow process must remain constant.
- **Continuity equation** – a conservation of mass equation in fluid flow relating fluid density and flow velocity.
- **Convection** – the transfer of heat through a fluid by the movement of the fluid, and the vertical movement of air leading to cooling.
- **Conveyor** – any device for the transport of raw materials (usually solids), assembly units, or finished products.
- **Cooling tower** – a hollow, vertical structure with internal baffles to disperse water so it is cooled by flowing air and by evaporation at ambient temperature.
- **Corona** – an electrical discharge effect that causes ionization of oxygen and the formation of ozone; it is found in electrostatic precipitators.
- **Corrosion** – the deterioration or destruction of a material by chemical action.
- **Cost-effective** – said of an energy efficiency measure (such as a compact fluorescent light bulb, a refrigerator, insulation, or any other measure that makes a home more energy efficient) or of a program that delivers energy efficiency measures, including weatherization.
- **Coulomb** – a unit of electrical charge, equal to 6.281×10^{18} electronic charges.
- **Countercurrent** – a term used to describe the flow pattern in a piece of equipment in which two streams travel in opposite directions.
- **Countermeasure** – an action aimed at alleviating the consequences usually of an accident.
- **Cracking** – a refining process involving decomposition and molecular recombination of organic compounds to form molecules of smaller sizes that are suitable for fuels.
- **“Cradle-to-grave”** – an approach in which all the stages in the lifetime of a facility, activity, or product are taken into consideration.
- **Cradle-to-grave** – a waste producer’s responsibility for the proper management and disposal of the material from the time of generation to the time of destruction.
- **Critical mass** – the minimum mass of a fissionable material needed to start and maintain a chain reaction.
- **Critical point** – (1) the transition point between the liquid and gaseous states of a substance; (2) the temperature above which a gas cannot be liquefied however high the pressure; and (3) the temperature at which internal changes take place within a metal.
- **Critical Reynolds number** – the value of the Reynolds number at which the flow makes a transition from laminar to turbulent flow as the velocity is increased.
- **Critical temperature** – the temperature above which a gas or vapor cannot be liquefied by an increase in pressure alone.
- **Cryogenics** – the production and utilization of extremely low temperatures.
- **Crystallization** – the change of state of a substance from a liquid to a solid by the phenomenon of crystal formation by nucleation and accretion (e.g., the freezing of water into ice).
- **Curie** – a quantitative measure of radioactivity equal to 3.7×10^{10} disintegrations per second.
- **Current** – the rate of motion of electricity through a substance.
- **Curtailment (of generation)** – curtailment is the reduction of electrical generation, used as a last resort to balance a system or solve congestion.
- **Dalton’s law** – in a mixture of non-reacting gases, the total pressure exerted by the mixture is equal to the sum of the partial pressures of the individual gases in the mixture.
- **Damper** – a manual or automatically controlled valve or plate in a duct or stack that is employed to regulate the flow of air or other gases.

- **Decarbonized hydrogen** – hydrogen produced from nonrenewable feedstock with emissions below 36.4 g CO₂ eq/MJH₂. See carbon-free hydrogen.
- **Decarbonized power sector** – the reduction of the carbon intensity of the power sector by increased use of technologies that result in a lower concentration of fossil fuels released into the atmosphere during power generation.
- **Decommissioning** – administrative and technical actions taken to allow the removal of some or all regulatory controls from a facility. Decommissioning can entail activities that are similar to remediation (also an authorized process).
- **Decomposition** – a fundamental type of chemical change where one substance breaks down into simpler substances.
- **Deep well injection** – a method of ultimate (EPA’s definition) disposal that involves depositing liquid waste into a deep well beneath the surface of the Earth for permanent storage.
- **Deflagration** – a surface phenomenon that involves the very rapid burning of the particles of an explosive; it is usually initiated by impact or friction.
- **Degrade** (as in energy) – the transformation of energy into a form in which it is less available for doing useful work.
- **Dehydration** – the chemical process where water in a chemical or material is removed.
- **Deionization** – a method for purifying water that involves converting the soluble salts into acids by passing them through a hydrogen exchanger, and their removal by an acid adsorbent or synthetic resin.
- **Demand-side management (DSM)** – controlling the use of energy on the customer’s side of the meter; sometimes used interchangeably with “energy conservation” and “energy efficiency.”
- **Demonstration power plant** – a pre-commercial project used to demonstrate the viability of a new technology.
- **Depletion** – the exhaustion of natural resources because of their removal.
- **Depressurization** – a reduction in pressure.
- **Desalination** – the extraction of freshwater from sea or other saltwater bodies by the removal of salts, usually by evaporation, distillation, or membrane separation.
- **Design basis** – the range of conditions and events taken explicitly into account in the design of structures, systems and components, and equipment of a facility, according to established criteria, such that the facility can withstand them without exceeding authorized limits.
- **Desorption** – a process of removing an adsorbed material from the solid on which it is adsorbed by increasing the temperature or reducing the pressure, or both.
- **Destructive distillation** – an operation in which a highly carbonaceous material is subjected to high temperature in the absence of air or oxygen resulting in the decomposition of solids, liquids, and gases.
- **Desulfurization** – the removal of sulfur from fossil fuels to reduce pollution.
- **Detention time (detention period)** – the average time that a unit volume of a fluid is retained in a unit during a flow process.
- **Deterministic analysis** – analysis using, for key parameters, single numerical values (taken to have a probability of 1), leading to a single value for the result.
- **Deuterium** – an isotope of hydrogen with an atomic weight of 2.0; unlike normal hydrogen, it has neutrons in the nucleus.
- **Deviation** – a departure, usually from specified conditions or requirements.
- **Dew point** – the temperature at which the first droplet of water forms on the progressive cooling of a mixture of air and water vapor; at the dew point, the air becomes saturated with water.
- **Diatomic** – a term used to describe a single molecule consisting of two atoms (e.g., O₂ H₂).

- **Dielectric** – a term used to describe a substance with very low electrical conductivity (i.e., an insulator).
- **Dielectric constant** – an index of the ability of a substance to impair the transmission of an electrostatic force from one charged body to another.
- **Diffuser** – a tube or plate that separates a gas stream into bubbles suitable for diffusion.
- **Digestion** – The process of breaking down a substance into smaller molecules.
- **Dipole** – a pair of equal and opposite electric charges separated by a small distance.
- **Direct combustion** – combustion of a material without first converting the material to another form.
- **Direct conversion** – the conversion of one form of energy directly into electrical energy, such as the conversion of sunlight into electricity.
- **Direct radiation** – the unscattered radiation that strikes a surface.
- **Distillate** – any overhead product of distillation, especially of petroleum.
- **Distillate oil** – the fuel oils that contain 0.05% nitrogen by weight or less and comply with the specifications for fuel oil numbers 1 and 2, as defined in the Standard Specifications for Fuel Oils.
- **Distillation** – a process of separating the constituents of a liquid mixture by means of vaporization of the mixture and separate recovery of vapor and residue.
- **Distributed energy resources (DERS)** – decentralized electrical generation and storage technologies that are located close to the load served.
- **Distributed generation (embedded generation)** – energy produced near the point of consumption rather than at a distance, usually small plants that provide power onsite.
- **Distribution grid** – the distribution grid is the group of power lines and associated equipment for the transport of electric energy at a lower voltage to most customers.
- **Distribution system** – a powerline system that comprises the parts of an electric power system between the sub-transmission system and the consumers' service switches.
- **Distribution** – the delivery of electricity to homes and businesses through low-voltage power lines.
- **Donor** – an atom that furnishes a pair of electrons to form a bond or linkage with another atom called the acceptor.
- **Dose assessment** – assessment of the dose(s) of hazardous compounds or radiation to an individual or group of people.
- **Dose rate** – the dose per unit time of a hazardous compound or radiation.
- **Downcomer** – a pipe or flue that conveys gases, vapors, or condensate downward in blast furnaces, distillation towers, and refineries.
- **Downtime** – the lost production time during which a piece of equipment is not operating correctly due to a breakdown, maintenance, or power failure.
- **Draft** – the difference between the pressure within a unit and that in the atmosphere.
- **Dry bulb** – thermometer bulb maintained dry; it is used with a wet bulb to provide a measure of air humidity.
- **Dry-bulb temperature** – the air temperature where the thermometer is shielded from direct radiation and moisture; it is a measure of the heat content of the air.
- **Dry ice** – the solid form of carbon dioxide, subliming at temperatures of -72°C and above; it is used as a convenient portable refrigerant.
- **Dry injection** – the injection of a dry reagent to control acid emissions from incinerators.
- **Dry rock formation** – an underground location where rocks are heated to high temperatures by the heat of the Earth but where little or no water exists within the rock.
- **Dry steam** – steam that does not contain much, if any, liquid.

- **Duct** – a round or rectangular conduit, usually metal or fiberglass, employed to transport fluids.
- **Dynamic pressure** – the pressure exerted by a fluid in motion against a surface or body.
- **Earth's crust** – the outermost solid layer of the Earth.
- **Earth's mantle** – a solid layer of the Earth, approximately 2,300 km thick, located between the Earth's crust and the Earth's core.
- **Economic conservation** – the management of natural resources, or the environment, to sustain a regular yield of a commodity at the highest feasible level.
- **Economic growth** – the annual rate of change in the Gross National Product, usually expressed as the percentage difference from the previous year.
- **Economizer** – a device that uses the heat of combustion of a gas to raise the temperature of boiler feedwater prior to entry into the boiler.
- **Efficient energy** – the use of a relatively small amount of energy for a given task, purpose, or service; achieving a specific output with less energy input.
- **Effluent** – any fluid emerging from a pipe or similar outlet that enters the environment.
- **Ejector** – a device for moving a fluid or solid by entraining it in a high-velocity stream of air or water jet.
- **Elbow** – a pipe fitting that connects two pipes at a 90° angle.
- **Electric dipole moment** – the condition in which one part of a molecule has a positive electrical charge while the other part has a negative electrical charge.
- **Electrochemistry** – the branch of chemistry concerned with the relationship between electrical forces and chemical reactions.
- **Electrode** – a conductor that establishes electrical contact with an electrolyte; a pair of electrodes is a necessary component of an electrolytic cell.
- **Electrolysis** – the splitting of an electrolyte by the application of electric current; this process can be employed to remove ions from a waste stream.
- **Electrolyte** – a substance that dissociates into two or more ions when it is dissolved in water.
- **Electrolyzer** – a technology that converts water and electricity into hydrogen, oxygen, and heat.
- **Electromotive force** – the force that causes a flow of electric current.
- **Electron** – a negatively charged fundamental unit of matter with a negligible mass that circles the positively charged nucleus of an atom.
- **Electron valence** – the number of electrons needed to be gained or lost by a material for it to gain stability.
- **Electronegative** – a term used to describe a substance that attracts electrons to bond to another substance.
- **Electrostatic field** – a region in which a stationary electrically-charged particle is subjected to a force of attraction or repulsion because of another stationary electric charge.
- **Electrostatic precipitator (ESP)** – a device that separates particles from a gas stream by passing the carrier gas between two electrodes across which a high voltage is applied.
- **Element** – any substance that cannot be broken down into smaller substances while still keeping all its properties; it is one of the presently known types of substances that comprise all matter.
- **Emergency plan** – a description of the objectives, policy, and concept of operations for the response to an emergency and of the structure, authorities, and responsibilities for a systematic, coordinated, and effective response; the emergency plan serves as the basis for the development of other plans, procedures, and checklists.
- **Emergency preparedness** – the capability to take actions that will effectively mitigate the consequences of an emergency to human life, health, property, and the environment.

- **Emergency procedures** – a set of instructions describing in detail the actions to be taken by emergency workers in an emergency.
- **Emergency response** – performance of actions to mitigate the consequences of an emergency to human life, health, property, and the environment; also provides the basis for the resumption of normal social and economic activity after the emergency.
- **Emissivity** – the ratio of the radiating power of a real surface to a blackbody surface.
- **Empirical** – anything derived from experimentation or observation and not from theory.
- **Endothermic** – a term used to describe a process or change that occurs with an absorption of heat.
- **Energy** – a quantity of electricity; often measured in MWh. It is the capacity to do work.
- **Energy balance** – an inventory of the energy of a process system; it includes energy crossing the system boundary and energy generated, consumed, or accumulated within the system.
- **Energy carrier** – a source of energy that has been subject to human-induced energy transfers or transformations; examples include hydrogen fuel and electricity.
- **Energy conversion** – the conversion of one form of energy to another form, usually for convenience of use.
- **Energy converter** – a device that transforms one energy carrier into another or into an energy service.
- **Energy resource** – a form of energy that can be extracted from the environment and placed into useful services in the economy; fossil fuels, sunlight, wind currents, and uranium represent energy resources, while electricity and hydrogen are energy carriers, not resources.
- **Energy service** – the forms of energy demanded by consumers and industry. These generally include (but are not limited to) heating, cooling, lighting, mechanical power, and information.
- **Energy transition** – a particularly significant set of changes to the patterns of energy use in a society, potentially affecting resources, carriers, converters, and services.
- **Enforcement** – the application by a regulatory body of sanctions against an operator, intended to correct and, as appropriate, penalize noncompliance with conditions of an authorization.
- **Engineering notation** – a method of representing very large or small numbers by factoring the number into two parts, one, a number between 1 and 10, the other, the number 10 raised to an integer power, e.g., 0.0000089 may be represented by 8.9×10^{-6} .
- **Enhanced Geothermal Systems (EGS)** – geothermal power plants that use dry rock as the heat source.
- **Enthalpy** – a measure of the heat content of a body or system.
- **Entrainment** – the carryover of drops of liquid during a process such as distillation, absorption, scrubbing, or evaporation.
- **Entropy** – a measure of the randomness of a system; it is also a measure of the ability of a system to perform useful work.
- **Environmental impact assessment (EIA)** – a procedure evaluating the effects on the environment of an infrastructure project.
- **Environmental justice** – a term that is used to describe environmental crimes and offenses committed against minorities and low-income individuals; although industry has received the brunt of these allegations, it almost always can be attributed to politicians and the political process.
- **Epicenter** – the point on the Earth's surface directly above the focus (i.e., hypocenter) of an earthquake.
- **Equation of state** – an equation relating the pressure, temperature, and volume of a system.
- **Equilibrium** – a state in which there is no tendency toward spontaneous change.

- **Essential services** – the supply of resources, including electricity, gas, water, compressed air, fuel, and lubricants, necessary to maintain systems operational at all times.
- **Estuary** – a region of interaction between rivers and near-shore ocean water where tidal action and river flow create a mixing of fresh and salt water.
- **Evacuation** – the rapid, temporary removal of people from an area to avoid or reduce emergency; evacuation may be taken as a precautionary urgent protective action based on observable conditions or plant conditions.
- **Evaporation** – the conversion of a liquid to vapor.
- **Evaporator** – a process unit in which a solution is converted to a vapor and a more concentrated solution.
- **Event tree analysis** – an inductive technique that starts by hypothesizing the occurrence of basic postulated initiating events and proceeds through their logical propagation to system failure events.
- **Excursion** – an unintentional occurrence, such as a discharge of pollutants above the permitted amount, due to reasons beyond human control.
- **Exhaust** – a duct for the escape of gases, fumes, and odors from an enclosure.
- **Exothermic** – a term used to describe a reaction or process during which heat is released.
- **Expansion joint** – a joint installed in a structure to provide for changes (often in length) during expansion or contraction resulting from changes in temperature, without distortion of the structure.
- **Explosive** – a term used to describe a substance that undergoes a rapid chemical change on heating or detonation, with the evolution of significant heat and a large volume of gas.
- **External combustion engine** – an engine that converts thermal energy to kinetic energy with combustion occurring outside the chamber (cylinder or turbine).
- **Extract** – the solvent phase stream leaving a liquid–liquid extraction process.
- **Extraction** – the dissolving and separating out of specific chemical constituents.
- **Fabric collector** – a dust collector that operates by removing particles from airstreams through straining, interception, diffusion, filtration, or electrostatic charge.
- **Fahrenheit** – a relative temperature scale on which the boiling and freezing points of water at atmospheric pressure are 212 and 32°F, respectively.
- **Failure** – loss of the ability of an energy structure, system, or component to function within acceptance criteria.
- **Fallout** – the radioactive debris or material that settles to the Earth after a nuclear explosion.
- **Fatigue** – the incremental weakening of a material because of repeated cycles of stresses that are far lower than its breaking load; the end result is failure.
- **Fault tree analysis** – a deductive technique that starts by hypothesizing and defining failure events and systematically deduces the events or combinations of events that caused the failure events to occur. The fault tree is the diagrammatic illustration of the event sequence.
- **Feedstock** – raw material to supply or fuel a power plant, machine, or industrial process.
- **Federal Energy Regulatory Commission (FERC)** – the federal agency charged with regulating rates, terms, and conditions of interstate and wholesale power sales and transmission services.
- **Fermentation** – a biochemical reaction accompanied by microorganisms that are supplied with nutrients and organic substrates and carried out at critical conditions of heat, pressure, and light that are specific to the reaction at hand; the reaction leads to reduced organic compounds rather than complete oxidized end products.
- **Fiberglass** – a fiber created from the spinning of glass, possessing high resistance to chemical reactions and heat.

- **Fill** – any material deposited by an agent to fill a channel, valley, sink, or other depression.
- **Filter** – a porous material through which a gas or liquid is passed to remove suspended particles of dust.
- **Filter cake** – a concentrated solid or semisolid material that is separated from a liquid and remains on the filter after pressure filtration.
- **First Law of Thermodynamics** – the law which states that energy can be neither created nor destroyed, only transformed.
- **First-order reaction** – a reaction in which the rate of disappearance of a chemical is directly proportional to the concentration of the chemical and is not a function of the concentration of any other chemicals present in the reaction mixture.
- **First responders** – the first members of an emergency service to respond at the site of an emergency.
- **Fission** – the splitting of atomic nuclei into smaller nuclei, accompanied by the release of significant quantities of energy; it is induced by bombardment with neutrons from an external source and continued by the neutrons that are released.
- **Fixation** – the process of causing an unreactive element to combine into a chemical compound, as in ammonia synthesis.
- **Fixed carbon** – the ash-free, carbonaceous material that remains after volatile matter is driven off a dry waste sample.
- **Fixed-bed operation** – an operation in which the additive material (e.g., catalyst, absorbent, and filter media) remains stationary in a chemical reactor.
- **Flammability** – the ease with which a material (gas, liquid, or solid) will ignite spontaneously (autoignition) from exposure to a high-temperature environment, or from a spark or open flame.
- **Flammable** – any solid, liquid, vapor, or gas that will ignite easily and burn rapidly.
- **Flared** – gas disposed of by burning in flares usually at the production sites or at gas processing plants.
- **Flash distillation** – a separation process in which an appreciable portion of a liquid is quickly converted to vapor by changing the temperature and/or pressure; this method is widely employed for the desalination of seawater.
- **Flash point** – the minimum temperature at which a liquid or solid gives off enough vapor to form an ignitable mixture with the air near the surface of the liquid or solid.
- **Flashing** – the conversion of a portion of a hot fluid under pressure into vapor by the release of the pressure.
- **Flocculant** – a substance (e.g., lime, and alum, ferric chloride) that induces flocculation, or the agglomeration of colloidal particles suspended in water through charge neutralization for improved separation of particles during water treatment.
- **Flotation** – a treatment process using air, injected into a stream, that adheres to the solids and causes them to rise, allowing for their removal.
- **Flow diagram** – a chart or line drawing employed by engineers to indicate successive steps in a process; it generally includes materials input and output, by-products, wastes, and other relevant data.
- **Flue gas** – the air and pollutants emitted into the atmosphere after a production process or after combustion occurs.
- **Fluidization** – a technique in which a finely divided solid is caused to behave like a fluid by suspending it in a moving gas or liquid.
- **Flux** – the rate of flow of a fluid across an area.
- **Fly ash** – the noncombustible residual particles from the combustion process that are carried by the flue gas.

- **Foot-pound (force)** – the standard unit of work (energy) in the American Engineering (AE) system.
- **Force** – the push or pull that tends to impart motion to a body at rest, to increase or diminish speed, or to change the direction of the body already in motion.
- **Forced draft** – the positive pressure created by the action of a fan or blower.
- **Formula** – a written, symbolic representation of a chemical entity or mathematical relationship.
- **Fossil** – any material that results from an animal or vegetable source from past geologic ages that has been buried and naturally compressed in the Earth.
- **Fossil fuel power** – electricity generated (produced) by coal, oil, or natural gas.
- **Fossil fuels** – fuel formed from biomass by a process taking millions of years or longer to occur; major fossil fuels include coal, petroleum, and natural gas, minor ones include peat and shale.
- **Free convection** – the motion and mixing of a fluid caused solely by density differences within a fluid.
- **Free electron** – an electron that is not associated with any one atom.
- **Free energy** – a thermodynamic quantity employed to predict the maximum work obtainable from the spontaneous transformation of a given reaction.
- **Free radical** – a molecular fragment with one or more unpaired electrons; it is usually short-lived and highly reactive.
- **Friction head** – the pressure differential required to overcome the resistance to flow.
- **Fuel cell** – an electrochemical device that employs continuous oxidation–reduction reactions to produce electricity.
- **Fusion** – the process in which the nuclei of two light elements (chiefly the hydrogen isotopes) combine to form the nucleus of a heavier element resulting in the release of substantial amounts of energy.
- **Fusion point** – the temperature at which a particular substance can flow.
- **Fusion reactor** – a nuclear reactor that devices energy from the fusion of two atoms (deuterium, tritium, or lithium) to one helium atom, with the release of energy.
- **Galvanization** – the coating of steel or iron with zinc, either by immersion in a bath of molten zinc or by electrolytic deposition from a solution of zinc sulfate, to give protection against corrosion.
- **Gamma decay** – a nuclear reaction in which the nucleus of an atom emits a pulse of energy in the form of gamma radiation.
- **Gas turbine** – a device that converts the thermal energy of hot air and hot fuel to kinetic energy of a spinning shaft.
- **Gasification** – the conversion of solid or liquid fuels into gas for use as a convenient and clean source of energy.
- **Gate valve** – a valve in which the closing element consists of a disk that slides over an opening or cross-sectional area through which a fluid passes; it is suitable for on-off control but not for throttling.
- **Gauge** – an instrument for measuring and indicating process variables such as pressure, liquid level, thickness.
- **Gaussian distribution (normal distribution)** – a distribution that represents the maximum number of occurrences at or near a center or mean point, a progressive decrease in occurrences with increasing distance from the center, and symmetrical distribution of occurrences on both sides of the center.
- **Generation** – the amount of electricity a generator has produced over a specific period of time.
- **Generator** – any machine that produces electrical power.

- **Geopressure** – an unusually high underground pressure caused by a subsurface formation.
- **Geothermal energy** – energy stored in the form of heat below the Earth's surface.
- **Glacier** – a large body of ice formed on land by the compaction and recrystallization of snow and showing evidence of present or past movement.
- **Global warming** – the warming of the Earth's atmosphere due to the greenhouse effect.
- **Grab sample** – a single sample that is collected at a time and place to be most representative of a total discharge.
- **Gradient** – the rate of change of a quantity or variable.
- **Gravimetric** – any measurement by weight.
- **Gray hydrogen** – hydrogen produced with emissions of more than 36.4 g CO₂eq/MJ H₂, e.g., by methane gas reformation without carbon capture technology, using natural gas as feedstock.
- **Gray water** – domestic wastewater composed of water from sinks, washing machines and tubs not containing liquid or solid human waste.
- **Green hydrogen** – hydrogen produced from 100% renewable sources.
- **Greenhouse effect** – the rise in the average global temperature due to the absorption of infra-red radiation by increasing amounts of carbon dioxide, methane, nitrous oxide, and other greenhouse gases in the air which retard the dissipation of heat from the Earth's surface.
- **Grid** – a system of interconnected high-power transmission lines.
- **Gross national product (GNP)** – the total monetary value of all goods and services produced within a country during a period of time (usually a year), making no allowance for depreciation of stock or other consumption of capital, but including investments.
- **Guide vane** – a fixed or adjustable device intended to direct fluid flow in a conduit or channel.
- **Half-life** – (1) the time required for the concentration of a material to be reduced to one-half its initial value, and (2) the time required for an unstable element or nuclide to lose one-half of its radioactive intensity in the form of alpha, beta, or gamma radiation.
- **Hard water** – an alkaline water containing dissolved salts (divalent cations) that interfere with some industrial processes and prevent soap from lathering.
- **Hazard** – the potential for harm or other detriment; a factor or condition that might operate against safety.
- **Head** – the height of the free surface of fluid above any point in a hydraulic system; it is a measure of the pressure or force exerted by a fluid.
- **Head loss** – the drop in the sum of pressure head and static head between two points along the path of a flowing fluid due to energy loss such as fluid friction.
- **Heat** – a form of energy (thermal) associated with and proportional to molecular motion.
- **Heat capacity** – the amount of thermal energy or heat a substance can store, expressed as the heat required to raise the temperature of a certain amount of substance by 1°.
- **Heat engine** – a device that converts thermal energy to kinetic energy.
- **Heat exchanger** – a unit or vessel in which a hot fluid stream transfers part of its energy to a cooler fluid stream.
- **Heat of combustion** – the heat released by the oxidation of all carbon and hydrogen (usually in a fuel) to carbon dioxide and water.
- **Heat of fusion** – the heat necessary to convert a solid to its liquid form.
- **Heat of neutralization** – the heat liberated in the reaction of acidic solutions with basic solutions.
- **Heat of reaction** – the heat absorbed or evolved by a chemical reaction.
- **Heat of vaporization** – the heat required to convert a liquid or solid to a vapor.

- **Heat recovery** – the transfer of heat from a substance that has been heated during a process to the substance about to be treated to conserve energy.
- **Heat recovery steam generator** – a device employed in cogeneration to recover the heat from a flue gas and transfer it to water to produce steam and/or a hot water heat sink, i.e., a unit designed to absorb heat.
- **Heat transfer** – the transfer of energy between two materials as heat through conduction, convection, or radiation.
- **Heavy hydrogen** – see deuterium.
- **Heavy water** – water consisting of deuterium oxide, or water in which the hydrogen has been replaced by deuterium.
- **Helium (He)** – the first element in the noble gas group with atomic number 2 and atomic weight 4.0; its nuclei are alpha particles.
- **Helper in an emergency** – member of the public who willingly and voluntarily helps in the response to an emergency.
- **Hertz (Hz)** – an electrical unit of frequency equal to one cycle per second.
- **Heterogeneous** – a term used to describe a mixture of different phases (e.g., liquid–vapor, liquid–vapor–solid).
- **High-level radioactive waste** – the waste that is generated from the fuel of a nuclear reactor or found at nuclear reactors or nuclear fuel reprocessing plants.
- **Holdup** – a volume of material held or contained in a process vessel or line.
- **Holocene** – the most recent epoch of the geological Quaternary period, defined as the interval from 10,000 years before the present to the present.
- **Homogeneity** – the even distribution of species or characteristics so that a sample taken at any one point resembles one taken at any other.
- **Homogeneous reaction** – a chemical reaction in which the reacting substances are in the same state, i.e., solid, liquid, or gas.
- **Horsepower** – a unit of power (rate of work) in the AE system, equal to 550 ft-lb (force) per second.
- **Hot well** – reservoir of a condensing unit receiving condensate from a barometric condenser.
- **Humidification** – a process for increasing the water content of air or other gases.
- **Humidity** – the measure of the amount of water vapor in the air at any given time.
- **Hybrid** – (1) an offspring of two organisms that differ in at least one gene, and (2) any equipment that differs from another in at least one respect or accomplishes two or more objectives in a process.
- **Hydrate** – a compound formed by the joining of water with another molecule.
- **Hydrides** – a hydrogen storage technology that can absorb hydrogen into differing solids, including certain metallic compounds and porous nanoparticles. The hydrogen stored in this form can then be released back via changes in pressure, decomposition over a catalyst, or an increase in heat.
- **Hydrocarbon** – a chemical compound composed of only hydrogen and carbon.
- **Hydrocarbon cracking** – the decomposition of petroleum or other hydrocarbons by heat to give materials employed as gasoline, kerosene, other motor fuels, domestic fuel oil, and other products.
- **Hydroelectric power** – the electricity produced from converting the elevation head of water to kinetic energy of moving water to drive a turbine.
- **Hydrogen bond** – an attractive force, or bridge, occurring in highly polar compounds (e.g., covalent compounds containing fluorine, oxygen, nitrogen, or chlorine atoms, such as water) in which a hydrogen atom of one molecule is attracted to an unshared electron pair of another molecule.

- **Hydrogen** – a nonmetallic element with atomic number 1 and atomic weight 1.0 that is highly flammable and explosive; it is used in the production of ammonia, ethanol, and aniline. The lightest element in the periodic table and the most common in the universe.
- **Hydrogenation** – any reaction of hydrogen with an organic compound.
- **Hydrogenolysis (destructive hydrogenation)** – a type of hydrogenation reaction in which molecular cleavage of an organic compound occurs with the addition of hydrogen to each portion.
- **Hydrogeology** – the geology of groundwater with particular emphasis on the chemistry and movement of water.
- **Hydrologic cycle** – the constant cycling of water by evaporation, condensation, and precipitation.
- **Hydrology** – the science and engineering disciplines dealing with the physical properties, distribution, and circulation of water.
- **Hydrolysis** – the reaction of a salt with water to form an acid and a base.
- **Hydrometer** – a device for measuring the density of liquids.
- **Hydrometry** – the measurement and analysis of the flow of water.
- **Hydrophilic** – a substance with an affinity for or high solubility in water.
- **Hydrophobic** – a substance that has low solubility in water and an affinity for organic compounds.
- **Hydropower** – a process to use moving water (kinetic energy) to produce electricity. See hydroelectric power.
- **Hydrostatic level** – the elevation to which the top of a column of water would rise from a conduit under pressure.
- **Hydrothermal** – a geological process involving heated or superheated water.
- **Hydroxide** – an inorganic compound that contains an OH group.
- **Hygrometer** – a device used to measure the water vapor content of the atmosphere.
- **Ideal flow** – fluid flow that is incompressible, two-dimensional, irrotational, steady, and nonviscous.
- **Ideal fluid** – a hypothetical gas or liquid that offers no resistance to external forces and therefore has zero viscosity (i.e., a perfect fluid).
- **Ideal gas** – a hypothetical gas in which there is a complete absence of cohesive forces between the component molecules; the behavior of such a gas can be predicted accurately by the Ideal Gas Law.
- **Ideal Gas law** – the equation of state of an ideal gas which is a good approximation to real gases at ambient to high temperature and low pressure. It states that $PV = nRT$, where P is the absolute pressure, V is the volume, n is the number of moles of gas, R is the universal gas constant, and T is absolute temperature.
- **Igneous rock** – rock that has formed from volcanic magma.
- **Ignition temperature** – the lowest temperature of a fuel at which combustion becomes self-sustaining.
- **Impactor** – a sampling device that employs impingement for the measurement of particles in a gas.
- **Impoundment** – a stored body of water behind a dam, also called a reservoir.
- **Inches of water** – a unit of pressure, equal to 0.0361 lb (force) per square inch.
- **Incident** – any unintended event, including operating errors, equipment failures, initiating events, accident precursors, near misses or other mishaps, or unauthorized act, malicious or non-malicious, the consequences or potential consequences of which are not negligible from the point of view of protection and safety.

- **Independent system operator (ISO)** – the entity that dispatches electricity (directs it from where it is generated to where it is needed) within a grid.
- **Induced draft** – the negative pressure created by the action of a fan, blower, or other gas-moving device.
- **Industrial hygiene** – the art and science of anticipating, recognizing, evaluating, and controlling occupational and environmental health hazards in a work area and the surrounding community.
- **Inertia** – the force exerted by a body in opposition to a change in its motion.
- **Inertial separator** – a device that employs centrifugal force to separate particles from a gas or liquid stream.
- **Initiating event** – an identified event that leads to anticipated operational occurrences or accident conditions.
- **In situ** – (1) a term used to describe any reaction or analysis occurring in place; and (2) a term used to describe a fossil, mineral, or rock found in its original place of deposition, growth, or formation.
- **Insolation** – the rate at which heat is delivered to any place on the surface of the Earth directly from the sun.
- **Inspection** – an examination, observation, surveillance, measurement, or test undertaken to assess structures, systems, components, and materials, as well as operational activities, technical processes, organizational processes, procedures, and personnel competence.
- **Insulating brick** – a firebrick with a low thermal conductivity that is suitable for insulating industrial incinerators.
- **Interacting event** – an event or a sequence of associated events that, interacting with a facility, affect site personnel or items important to safety in a manner that could adversely influence safety.
- **Interconnector** – transmission lines that allow the transfer of electricity across international borders.
- **Interested party** – a person, company, etc., with a concern or interest in the activities and performance of an organization, business, system, etc.
- **Interlock** – a device designed to ensure that operations (or motions) occur in proper sequence.
- **Internal energy** – the energy contained within a body due to the motion of its constituent atoms and molecules.
- **Internal work** – the work done by a system against internal forces, or between its parts, or on the system by these forces.
- **Inversion** – an atmospheric condition in which the air temperature increases, rather than decreases, with an increase in altitude, due to a layer of warm air that prevents the rise of cooler air trapped beneath it; this prevents the dispersion of pollutants within the lower atmosphere.
- **Investor-owned utility (IOU)** – the type of utility that delivers most of the power in the United States; other types are municipally owned, cooperatives (often rural), and federal power companies.
- **Ion** – a charged atom or molecule that has gained or lost one or more electrons; the migration of an ion affects the transport of electricity through an electrolyte or, to a certain extent, through a gas.
- **Ion electrode** – an electrode that develops and measures an electrical potential in response to the activity of an ion in solution.
- **Isentropic process** – a process that occurs without any increase or decrease in entropy.
- **Isobar** – (1) a line drawn on a map connecting points of equal surface atmospheric pressure, and (2) a line of constant pressure on a graph.
- **Isobaric** – a process that occurs at constant pressure.

- **Isokinetic sampling** – a technique for collecting air particles so that the gas entering a sampling nozzle is at the same speed as the surrounding air.
- **Isopleth** – a line drawn on a map through points of equal value for a given meteorological variable.
- **Isotherm** – a line connecting points of equal temperature that is employed on climatic maps or graphs of thermodynamic relations.
- **Isothermal** – a process that exhibits no change in temperature.
- **Isotropic** – anything that exhibits uniform properties throughout and in all directions.
- **Iterative process** – a process for calculating a desired result by means of a repeated cycle of operations in which each result becomes closer and closer to the desired result.
- **Joule Thompson effect** – the cooling that is achieved when a highly pressured gas is allowed to expand without performing work.
- **Kiln** – a large, cylindrical mechanized type of furnace or incinerator.
- **Kilowatt (kW)** – A unit of power equivalent to 1,000 W.
- **Kilowatt-hour (kWh)** – one thousand Watt-hours, which is the basic measure of electricity usage.
- **Kinetic energy** – the energy possessed by a body or material stream because of its motion.
- **Laminar flow** – one of the two types of flow that occur in fluids (the other being turbulent) in which a fluid follows a smooth well-defined path; this type of flow occurs at low Reynolds numbers.
- **Lapse rate** – the rate at which temperature decreases in the atmosphere as height above the surface increases; the average adiabatic lapse rate is approximately -6 to $-8^{\circ}\text{C}/\text{km}$ rise.
- **Latent heat** – the heat released or absorbed by a change of state.
- **Latent heat of vaporization** – the amount of heat required to convert a unit mass of a substance from a liquid to a gas at its melting point.
- **Leaching** – the process by which soluble material dissolves and is carried through a solid in a solution.
- **Leakage** – an undesired and gradual escape or entry of a material from a system or reactor.
- **License** – a legal document issued by a regulatory body granting authorization to perform specified activities relating to a facility.
- **Life-cycle** – the phases, changes, or stages that an organism, process, system, facility, or asset passes through during its lifetime.
- **Life-cycle analysis (LCA)** – (also called Life Cycle Assessment) a technique to assess environmental impacts associated with all the stages of an asset's life, from cradle-to-grave, from raw material extraction, materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling.
- **Life-cycle management** – lifetime management in which due recognition is given to the fact that at all stages in a lifetime, there may be effects that need to be taken into consideration and may be altered to extend the useful life of the product or asset.
- **Life, lifetime** – the period of time during which a component, facility, or asset is expected to perform according to the technical specifications to which it was produced.
- **Light water** – common water, as opposed to heavy water.
- **Liquefied natural gas (LNG)** – natural gas that has been liquefied for easier shipment and use. Natural gas, primarily methane, has been liquefied by reducing its temperature to -260°F at atmospheric pressure.
- **Liquefied petroleum gas (LPG)** – light gases, such as butane and propane, that can be maintained as liquids while under pressure.
- **Liquid trap** – the sumps, well cellars, and other traps employed in association with oil and gas production, gathering, and extraction operations for the purpose of collecting oil, water, and other liquids.

- **Liquid–liquid extraction** – the removal of a solute from one liquid by bringing the first liquid into intimate contact with a second liquid with which it is immiscible and in which the solute has higher solubility.
- **Load (also demand)** – (1) the level of electricity consumption by a consumer, and (2) a unit that consumes electrical power as opposed to a generator that provides it.
- **Load curve** – a chart illustrating the variation in demand/electrical load over a specific time.
- **Load factor** – the ratio of the average power supplied during a designated period to the peak or maximum load occurring in that period.
- **Local distribution company (LDC)** – A legal entity engaged in the retail sale and/or delivery of natural gas through a distribution system that includes mainlines and laterals.
- **Local exhaust system** – a system for capturing and exhausting contaminants from the air at the point where the contaminant is produced.
- **Low NO_x burner** – one of several combustion technologies employed to reduce emissions of NO_x (oxides of nitrogen).
- **Lower explosive limit (LEL)** – the lowest concentration (usually on a mole or volume percent or fraction basis) of a compound in a mixture that will propagate a flame in the air at 25°C and atmospheric pressure.
- **Maintenance** – the organized activity, both administrative and technical, of keeping structures, systems, and components in good operating condition, including both preventive and corrective (or repair) aspects.
- **Make-up solvent** – the solvent introduced into a process that compensates for solvent loss during a process.
- **Malfunction** – a failure in the normal operation of a system or process.
- **Management system** – a set of interrelated or interacting elements (a system) for establishing policies and objectives and enabling the objectives to be achieved in an efficient and effective manner.
- **Manifest** – the document employed for identifying the quantity, composition, origin, routing, and destination of hazardous wastes during disposal, treatment, or storage.
- **Manifold** – a pipe fitting with numerous branches to convey fluids among a large pipe and several smaller pipes or to permit the choice of diverting flow from one of several sources to one of the many discharge points.
- **Manometer** – an instrument for measuring pressure that consists of a U-shaped tube containing a liquid.
- **Manufactured gas** – a gas obtained by destructive distillation of coal, or by the thermal decomposition of oil, or by the reaction of steam passing through a bed of heated coal or coke.
- **Market barrier** – anything that interferes with people being able to participate in a market; usually used to explain why energy efficiency is not the standard for energy usage.
- **Mass** – the fundamental measure of the quantity of matter; it differs from weight in that it does not depend on gravitational force.
- **Mass balance** – an inventory of the mass of a chemical in a process or system; it includes mass crossing the system boundary and mass generated, consumed, or accumulated within the system.
- **Mass velocity** – the mass flow rate divided by the cross-sectional area through which the mass is flowing.
- **Material recovery** – the separating and processing of waste materials for beneficial use or reuse.
- **Mathematical model** – a mathematical representation of a real process, expressed as a set of equations or algorithms.
- **Matter** – anything that has a mass or occupies space; it can be solid, liquid, or gas.

- **Maxwell's rule** – a changing magnetic field produces a changing electric field, and this changing electric field produces another changing magnetic field. Thus, the cycle continues, and an electromagnetic wave is made and propagates through space.
- **Mechanical draft tower** – a tower through which the airflow is maintained by fans.
- **Mechanical power** – energy service provided by motors and engines for transportation and other physical manipulation of materials.
- **Megawatt (MW)** – a unit of power equal to 1 million Watts.
- **megawatt-hour (MWh)** – a unit of power equal to 1,000 kilowatt-hours (kWh). It is equal to 1,000 kW of electricity used for 1 hour.
- **Metastable** – an intermediate state in between stability and instability.
- **Metric system** – a system of measurement, exclusively using multiples of 10, that is based on the meter as its unit of length.
- **Metric ton** – a unit of mass equal to 1,000 kg = 2,204 lb (mass).
- **Minimization** – a decision criterion that selects the alternative that has the lowest value to the decision-maker.
- **Miscibility** – the ability of a liquid or gas to dissolve uniformly in another liquid or gas.
- **Mist eliminator** – a control device employed to remove water/liquid droplets entrained in a gas stream.
- **Model** – an analytical or physical representation or quantification of a real system and the ways in which phenomena occur within that system, used to predict or assess the behavior of the real system under specified (often hypothetical) conditions.
- **Modeling** – refers to the development and use of a computer model that represents a physical system by means of mathematical equations.
- **Model validation** – the process of determining whether a model is an adequate representation of a real system being modeled by comparing the predictions of the model with observations of the real system.
- **Molar volume at STP** – the volume that is occupied by 1 mol of an ideal gas at standard temperature and pressure.
- **Mole (mol)** – a measure of the amount of a substance; 1 mol of a compound has a mass equal to its molecular weight.
- **Mole fraction** – a ratio expressing concentrations of solutions and mixtures; defined as the number of moles of that component divided by the total number of moles in a system.
- **Molecular distillation** – distillation at low pressure on the order of 0.001 mmHg.
- **Molecular weight (MW)** – the sum of the atomic weights of the atoms in a molecule.
- **Molecule** – a chemical unit composed of one or more atoms combined to form a single unit; it is the smallest unit of a substance that still possesses the properties of that substance.
- **Momentum** – the product of a body's mass and its velocity.
- **Monomer** – a molecule that is capable of conversion to polymers, synthetic resins, or elastomers by combination with itself or other similar molecules; it usually contains carbon and is of relatively low molecular weight.
- **Monte Carlo method** – a method that constructs a stochastic model of a process on which sampling experiments are performed; it usually involves the use of random numbers in its calculations.
- **Multicyclone collector** – a dust collector consisting of several cyclone collectors that operate in parallel.
- **Multiple-effect evaporator** – a series of single-effect evaporators connected so that the vapor from one effect is the heating medium for the next.

- **Nano** – a prefix for units in the SI system indicating 10^{-9} .
- **Natural draft** – the negative pressure created by the height of a stack or chimney and/or the difference in temperature between flue gases and the atmosphere.
- **Natural gas** – a natural fuel that exists as a mixture of gases, containing primarily methane and some ethane; it is found in certain geological formations.
- **Natural gas liquids (NGLs)** – separated from natural gas, these include ethane, propane, butane, and natural gasoline.
- **Negative pressure** – a pressure difference that is negative.
- **Neutral** – (1) a particle without an electric charge, and (2) a solution that is neither acidic nor basic but with $\text{pH} \approx 7.0$.
- **Neutron** – the fundamental unit of matter with no electric charge and about the same mass as a proton; it is present in all atomic nuclei except that of ordinary hydrogen.
- **Node** – a significant point in a grid where several elements, such as loads, generation, storage, transmission lines, or external grids are connected.
- **Nonconservative** – a substance that can react.
- **Nonferrous** – any metal that contains no iron.
- **Normal boiling point** – the boiling point of a liquid when the ambient pressure is 1 atm.
- **Normal operation** – operations carried out within specified operational limits and conditions.
- **Notification** – a document submitted to the regulatory body by a person or organization to notify an intention to carry out a practice or other use of a source.
- **Nuclear energy** – the energy obtained from the fission of uranium or other heavy elements, or the fusion of lighter elements.
- **Nuclear power plant** – a facility that converts nuclear energy into usable power.
- **Nuclear reaction** – a reaction that involves a change in the nucleus of an atom, as opposed to a chemical reaction in which only the electrons take part; a reaction, as in fission, fusion, or radioactive decay that alters the energy, composition, or structure of an atomic nucleus.
- **Nuclear reactor** – a device for generating energy by the controlled fission of atoms or by the fusion of light atoms.
- **Nucleate boiling** – a method of vaporization where high rates of heat transfer are obtained because of bubble formation at a liquid–solid interface.
- **Nucleus** – (1) the small, positively charged central mass of an atom that contains essentially the entire mass of the atom in the form of protons and neutrons, (2) the central portion of a living cell that controls its functions, and (3) any small particle that can serve as the basis for crystal growth.
- **Nuclide** – a particular species of atom that is characterized by the mass, charge, and energy content of its nucleus.
- **Octane number** – a parameter defining the quality of petroleum; a fuel with a high-octane number has better antiknock properties than one with a lower octane number.
- **Off-gas** – a gaseous product from the chemical decomposition of a material.
- **Oil sands** – a naturally occurring mixture of *bitumen* (a heavy, viscous form of crude oil), water, sand, and clay. Using hydro-processing technology, bitumen can be refined to yield synthetic oil.
- **Oil shale** – a black, brown, or green shale impregnated with kerogen, and from which gaseous and liquid petroleum can be obtained by destructive distillation at 300–400°C.
- **Oil-equivalent gas** – the volume of natural gas needed to generate the equivalent amount of heat as a barrel of crude oil. Approximately 6,000 ft³ of natural gas is equivalent to 1 barrel of crude oil.
- **Operations and maintenance (O&M)** – (1) the actions taken after a facility is constructed to ensure the proper operation, maintenance, and management to achieve intended efficiency and

production levels in an ongoing and optimum manner, and (2) activities required to properly and efficiently operate a system or process.

- **Operating personnel** – individual workers engaged in the operation of facility or the conduct of an activity.
- **Operating pressure** – the system pressure at which a process is operating.
- **Operation** – all activities performed to achieve the purpose for which a facility was constructed.
- **Operational states** – states defined under normal operation and anticipated operational occurrences.
- **Organic** – a term used to describe anything that contains carbon and is thus derived from living organisms.
- **Orifice** – an opening with a closed perimeter in a plate, wall, or partition, through which fluid flows; it is generally employed for the purpose of measuring or controlling a fluid.
- **Orifice meter** – an instrument that measures fluid flow by recording the differential pressure across an orifice plate placed in the flow stream.
- **Orsat method** – a portable mechanism for the analysis of mixtures of carbon dioxide, carbon monoxide, and oxygen in a gas stream.
- **Outflow** – the flow of a product stream out of a process facility.
- **Overfire** – the high-velocity jets of air employed to promote combustion in a furnace.
- **Overload** – the operation of equipment in excess of normal or full capacity.
- **Oxidation** – (1) the addition of oxygen, accompanied by a transfer of electrons, that breaks down organic waste or chemicals such as cyanides, phenols, and organic sulfur compounds in sewage by bacterial and chemical means; and (2) a general term describing a reaction with oxygen.
- **Oxygen (O)** – a colorless odorless, tasteless, nonmetallic, diatomic gaseous element with atomic number 8 and atomic weight 16.0; it is an oxidizing agent and a moderate fire risk as a gas, explosive as a liquid when in contact with heat and oxidizable materials, and an irritant to skin and tissue.
- **Oxygen demand** – the quantity of oxygen utilized in the biochemical or chemical oxidation of organic material in a specified time, at a specified temperature and under other specified conditions.
- **Packing** – (1) a collar or gasket employed to seal mechanical devices to prevent leakage of liquid, and (2) the inert material employed in absorption towers and distillation columns.
- **Parameter** – a quantitative or characteristic property that describes the physical, chemical, or biological conditions of a system.
- **Partial condensation** – the cooling of a saturated vapor until part of it is condensed as liquid.
- **Partial pressure** – the pressure exerted by one of the several components of a gaseous or vapor mixture (see also Dalton's law).
- **Partial vacuum** – a condition in which the pressure is less than atmospheric.
- **Partial volume (pure component volume)** – the volume that would be occupied by one component of a gaseous mixture if it were alone and under the total pressure and temperature of a mixture.
- **Particle-size distribution** – an equation, graph, or table that quantifies, usually by mass percent, the various sizes of particulates found in a sample.
- **Parts per billion (ppb)** – the fraction (ppb_m for mass fraction and ppb_v for volume fraction) multiplied by 10^{-9} ; it is a unit used to measure extremely small quantities of a substance.
- **Parts per million (ppm)** – the fraction (ppm_m for mass fraction and ppm_v for volume fraction) multiplied by 10^{-6} ; it is a unit used to measure extremely small quantities of a substance.

- **Peak load** – the highest demand placed on a grid by a load or group of loads over a specified period of time.
- **Peaking unit** – a unit that runs only during hours when loads are at their highest point in the day or year.
- **Periodic** – phenomena that repeat after regular intervals of time.
- **Periodic law** – the law which states that elements in the periodic table exhibit regular and predictable changes in their properties with increasing atomic numbers.
- **Persistence** – the length of time a compound or material, once introduced into the environment, remains there.
- **Petrochemicals** – compounds derived from petroleum.
- **Phase** – a physically homogenous component of a system.
- **Phase transition** – an abrupt change in physical properties as temperature and/or pressure are changed continuously.
- **Photochemical air pollution** – brownish-gray haze caused by the photochemical oxidation by solar ultraviolet radiation of an atmosphere containing hydrocarbons and oxides of nitrogen.
- **Photovoltaic** – the means to convert solar radiation directly to electricity using solar cells that are made up of semiconducting materials that are similar to computer and television chips.
- **Photovoltaic cell** – a solid-state electronic device that converts light directly into electricity.
- **Physical model** – the simulation of a real process by a physical experiment that models the important features of the original process that are the object of study.
- **Physical property** – a property of a substance that can change without involving a change in chemical composition, e.g., density, heat capacity.
- **Physical treatment** – a treatment process that alters physical structure or that uses physical processes (sedimentation, filtration and screening) to treat a waste stream.
- **Pilot plant** – a trial assembly of small-scale reactions and processing equipment used to test new processes or reactions.
- **Pilot scale testing** – a small-scale study designed to provide information about a process before it is scaled up to full production size.
- **Pipeline** – continuous pipe conduit, complete with such equipment as valves, compressor stations, communications systems, and meters, for transporting natural and/or supplemental fluids from one point to another, usually from a point in or beyond the producing field or processing plant to another pipeline or to points of utilization.
- **Pitot tube** – a device that is inserted into a pipe to measure the velocity of a flowing fluid.
- **Planned maintenance** – a form of preventive maintenance consisting of refurbishment or replacement that is scheduled and performed prior to unacceptable degradation of a structure, system, or component.
- **Plate column** – a mass transfer (e.g., distillation) column consisting of a number of perforated, equally spaced, horizontal plates on which a layer of liquid is maintained and through which gas flows.
- **Plugging** – the act or process of stopping the flow of water (e.g., the stopping of a leak and sealing off a pipe or hose).
- **Plume** – a visible or measurable discharge of a contaminant from a given point of origin, or the shape it takes.
- **Plutonium (Pu)** – a radioactive element with atomic number 94 and atomic weight 239.1; it is one of the most toxic substances known to humans.
- **Pneumatic** – a term used to describe anything of or containing air, or gases.

- **Political** – of, relating to, or dealing with the structure or affairs of government, politics, or the state.
- **Polymerization** – a chemical reaction, usually carried out with a catalyst, heat, and often under high pressure, in which a large number of relatively simple molecules combine to form chain-like macromolecules.
- **Pore** – any interstice or open space, generally one that allows the passage or adsorption of liquid or gas in a material.
- **Porosity** – the ratio of the volume of open space in a bed to the total bed volume.
- **Porous** – any material with small passages that are permeable to fluids.
- **Positive head** – the energy possessed per unit mass of fluid due to its elevation above some datum point.
- **Potential energy** – the energy possessed by a body due to its position in a force field (e.g., under gravitational influence).
- **Potential head** – the height above a specified datum point or position.
- **Power** – (1) the rate at which work is performed, and (2) a source of physical or mechanical force or energy expressed in watts, kilowatts, or megawatts.
- **Power plant** – a unit constructed for the conversion of stored energy (usually in fossil fuels) into another desired form of energy (usually electrical).
- **Precipitate** – a solid that separates out from a liquid due to some physical or chemical change in the liquid.
- **Preheater** – a unit employed to heat air needed for combustion by absorbing heat from the hot flue gases.
- **Pressure disk** – a thin piece of metal between flanges that breaks at a certain pressure as a safety pressure relief device.
- **Pressure drop** – a measure of the difference in pressures measured immediately upstream and downstream of a unit or process.
- **Pressure relief valve** – a valve that opens automatically to a sufficient area when the pressure reaches an assigned limit in order to relieve the stress on a pipeline or vessel.
- **Pretreatment** – any or all of the operations prior to treatment, such as collection, segregation, chemical neutralization, and decontamination.
- **Preventive maintenance** – actions that detect, preclude, or mitigate degradation of a functional structure, system, or component to sustain or extend its useful life by controlling deterioration and failures to an acceptable level.
- **Proton exchange membrane (PEM)** – a chemical solution used for the electrolyte in either a fuel cell or an electrolyzer that shares the name.
- **Primary air** – admitted to a reactor or incinerator during the first stage of a combustion process (i.e., with the fuel).
- **Primary energy source** – a source of energy found in nature that has not been subject to any human-induced energy transfers or transformations. Examples include fossil fuels, solar, wind, and hydropower.
- **Primary pollutant** – a pollutant emitted directly from a process stack.
- **Prime mover** – a component that converts energy into action when commanded by an actuation device.
- **Probe** – (1) a tube employed to measure pressure at a distance from the actual measuring equipment, and (2) a general term to describe a sampling device.
- **Procedure** – a series of specified actions conducted in a certain order or manner; the set of actions to be taken to conduct an activity or to perform a process is typically specified in a set of instructions.

- **Process** – a manufacturing procedure or the equipment employed in the chemical, pharmaceutical, food, metalworking, or other industry.
- **Process control** – the manipulation of the condition of a process to effect a desired change in the output of the process.
- **Process vent** – any open-ended pipe in a process or stack that is vented to the atmosphere.
- **Processing** – any method, system, or other treatment designed to change the physical form or chemical content of a substance.
- **Product** – the end result of a process reaction.
- **protocol** – the plan and procedures that are to be followed in conducting a test or project.
- **Proton** – the positively charged fundamental unit of matter with about the same mass as a neutron; it is present in all atomic nuclei.
- **Proximate analysis** – analysis, on a mass basis, of a fuel to determine how much moisture, volatile matter, and ash the sample contains, in addition to its heating value.
- **Psychrometer** – an instrument employed to calculate dew points and relative humidity through the use of dry-bulb and a wet-bulb thermometer.
- **Psychrometric chart** – a chart employed to determine the properties of moist air and humidity.
- **Pump** – any mechanical device designed to cause an entering fluid to have an increased velocity and/or pressure at its exit.
- **Purging** – a cleansing or removal of impurities, foreign matter, or undesirable elements.
- **p-value** – exceedance probabilities for a given variable, i.e., a p_{90} energy production value denotes the production level predicted to be exceeded 90% of the time.
- **Pyrolysis** – the chemical decomposition of organic matter through the application of heat in the absence of oxygen.
- **qualified expert** – an individual who, by virtue of certification by appropriate boards or societies, professional license, or academic qualifications and experience, is duly recognized as having expertise in a relevant field of specialization.
- **qualitative analysis** – the analysis of a gas, liquid, or solid sample or mixture to identify the elements or compounds present in a sample.
- **quality assurance/quality control (QA/QC)** – a system of procedures, checks, audits, and corrective actions to ensure that all research, design and performance, environmental monitoring and sampling, and other technical and reporting activities are of the highest achievable quality.
- **quantitative analysis** – measurement of the presence and quantities of particular elements or compounds present in a sample.
- **quantum** – (1) any quantity with its magnitude restricted to a discrete set of values and a multiple of a definite unit, and (2) the smallest indivisible quantity of energy.
- **Quark** – the smallest known quantity of matter.
- **Quenching** – a rapid cooling of metals or alloys by immersion in cold water or oil.
- **Quiescent** – a system at rest.
- **Radiant energy** – energy traveling in the form of electromagnetic waves, e.g., light, heat, or electricity.
- **Radiation source** – a radiation generator or a radioactive source or other radioactive material outside the nuclear fuel cycles of research and power reactors.
- **Radiation** – the emission or transmission of energy in the form of waves or particles through space or through a material medium.
- **Radioactive** – (1) the release of energy from the decay of the nuclei of certain kinds of atoms and isotopes either naturally or as a result of intentional manipulation, and (2) exhibiting radioactivity; emitting or relating to the emission of ionizing radiation or particles (adjective).

- **Radioactive half-life** – the time required for the radioactivity to decrease, by a radioactive decay process, by half.
- **Radioactive material** – material designated in national law or by a regulatory body as being subject to regulatory control because of its radioactivity.
- **Radioactive nuclide** – any atom that disintegrates by emitting radiation.
- **Radioactive waste** – for legal and regulatory purposes, material for which no further use is foreseen that contains, or is contaminated with, radionuclides at activity concentrations greater than clearance levels as established by the regulatory body.
- **Radioactive waste management** – all administrative and operational activities involved in the handling, pretreatment, treatment, conditioning, transport, storage, and disposal of radioactive waste.
- **Radioactivity** – the phenomenon whereby atoms undergo spontaneous random disintegration, usually accompanied by the emission of radiation.
- **Radium (Ra)** – a radioactive element with atomic number 88 and atomic weight 226.0 that exists as a brilliant-white solid; it is highly toxic, radioactive, and destructive to living tissue.
- **Radon daughter** – a radioactive decay product of radon.
- **Rankine** – an absolute temperature scale on which the freezing and boiling points of water at atmospheric pressure are 459.7°R and 639.7°R, respectively.
- **Raoult's law** – the law that states that in a vapor–liquid equilibrium mixture, the partial pressure of any component in the vapor is equal to the product of the vapor pressure of the pure component and the liquid mole fraction of that component.
- **Rapping** – a process to remove dust off the plates in an electrostatic precipitator.
- **Rare Earth element** – one of the groups of 15 chemically related elements in group IIIB of the periodic table with atomic numbers from 58 to 71; this group is referred to as the lanthanide series.
- **Raschig ring** – a short section of a metal tube that is employed in mass transfer operations; it is similar in shape to the pasta called ziti.
- **Reaction** – a chemical change in which a substance decomposes or combines with other substances to form a new substance.
- **Reaction order** – the sum of all the numerical orders for each reactant as given by the rate equation (e.g., a first-order reactant plus a second-order reactant gives a third-order reaction).
- **Reaction velocity** – the rate at which a chemical reaction occurs as measured by the rate of formation of the products or the rate of disappearance of reactants.
- **Reactor** – a vessel in which a reaction is carried out.
- **Real gas** – a gas that deviates from the ideal gas law as a result of the interaction of gas molecules.
- **Reboiler** – an auxiliary heating unit for a distillation column designed to supply additional heat to the lower portion of the column.
- **Recirculation** – the repeated flow of a fluid around a closed system.
- **Rectification** – the enrichment or purification of vapor during the distillation process by contact or interaction with a countercurrent stream of liquid condensed from the vapor.
- **Recycled** – any used, reused, or reclaimed material that is employed to produce a new material.
- **Recycling** – (1) an operation in which a substance is passed through the same series of processes more than once, and (2) processes used to separate waste components and concentrate them for return to the raw materials market.
- **Reducing agent** – any material that adds hydrogen or electrons to an element or compound.
- **Reduction** – a chemical reaction in which an atom or ion gains an electron.
- **Refinery gas** – noncondensate gas collected in petroleum refineries.

- **Refining** – a separation process in which undesirable components are removed from various types of mixtures to yield a more purified product.
- **Reflux** – the liquid that has condensed from a rising vapor and is allowed to flow back down a column in a distillation process.
- **Reflux ratio** – the quantity of liquid reflux (return) per unit quantity of product removed from a processing unit.
- **Refractory** – an inert, ceramic material with the ability to retain its physical shape and chemical identity when subjected to extremely high temperatures.
- **Refrigerant** – a substance that is suitable as the working medium of a cycle of operations producing refrigeration (e.g., liquid ammonia, and Freon).
- **Regulatory body** – an authority or a system of authorities designated by the government as having legal authority for conducting the regulatory process, including issuing authorizations.
- **Reinforced plastic** – a composite structure strengthened by glass fibers or other materials.
- **Relative humidity** – the ratio of the amount of water vapor in air to the maximum amount of water vapor the air could hold at a specific temperature.
- **Relief valve** – a pressure relief device such as pressure valves, rupture disks, and other pressure relief systems employed to protect process components from possible explosions or other damage due to overpressure.
- **Rem** – the unit dose of ionizing radiation that gives the same biological effect as that due to 1 Roentgen of X-rays.
- **Renewable energy** – energy obtained from sources that are virtually inexhaustible (defined in terms of comparison to the lifetime of the Sun) and replenish naturally over small-time scales relative to the human life span.
- **Renewable energy resource** or **renewables** – electricity generated (produced) by sources that are sustainable, like the sun (solar or photovoltaic power), wind, geothermal (uses the heat beneath the ground), biomass (trees or other crops grown to be burned in a power plant), wave, or tidal power.
- **Reproducibility** – the ability to repeat an experiment, reaction, or process and produce the same results.
- **Research** – a systematic investigation, including the development, testing, and evaluation that is designed to develop or contribute to knowledge.
- **Reservoir** – a place where a supply or store of something is kept or located.
- **Residual** – the portion of a pollutant remaining in the environment after a natural or technological process has taken place.
- **Residue** – the solid or semisolid material (e.g., ash, ceramics, glass, and metal) that remains after completion of a chemical or physical process such as combustion, distillation, evaporation, or filtration.
- **Retrofit** – the addition or removal of a piece of equipment, or a required adjustment, connection, or disconnection of an existing piece of equipment for the purpose of reducing emissions or updating the process associated with it.
- **Reverse flow** – a flow in a direction opposite to normal flow.
- **Reversible process** – an ideal thermodynamic process that can be exactly reversed.
- **Reversible reaction** – a chemical reaction that can proceed in either direction.
- **Reynolds number** – a dimensionless number used in fluid flow calculations to describe the state of flow in the system, i.e., turbulent or laminar.
- **Risk assessment** – the qualitative and quantitative evaluation of the risk posed to human health and the environment by the presence of specific pollutants, potential natural, or man-made risks associated with normal operation or possible accidents involving facilities and activities.

- **Risk characterization** – the final step of a risk assessment that describes the nature and often the magnitude of human risk, including attendant uncertainty.
- **Rotameter** – a device composed of a float inside a tapered glass tube employed for measuring fluid flow.
- **Rotary dryer** – a long steel cylinder, slowly revolving, with a slightly inclined axis, through which a material passes to be dried by hot air.
- **Rotary valve** – a valve consisting of a casing, more or less spherical in shape, and a gate that turns through 90° when opening or closing; they have a cylindrical opening of the same diameter as that of the pipe it serves.
- **Rotor** – the blades and the hub together on a wind turbine.
- **Safety assessment (safety analysis)** – evaluation of the potential hazards associated with the activities of a facility or the conduct of an activity.
- **Safety data sheet (SDS)** – a compilation of information required under the OSHA communication standard on the identity of hazardous chemicals, health and physical hazards, exposure limits, and precautions for safe handling and spill clean-up.
- **Safety valve** – a valve that automatically opens when prescribed conditions, usually of pressure, are executed in a pipeline or other closed receptacle containing liquids and/or gases.
- **Salinity** – the amount of salt in water.
- **Saturated hydrocarbon** – a hydrocarbon molecule that contains only single bonds and hence cannot bond with more atoms.
- **Saturated steam** – steam that is in equilibrium with liquid water at a given temperature and pressure.
- **Saturation temperature** – the minimum temperature at which condensation will occur.
- **Scalar** – a quantity that possesses only a magnitude, but not direction.
- **Scale-up** – the calculation and planning involved in increasing operations from the pilot plant stage to the large-scale production stage.
- **Scheduled maintenance** – any periodic activity that is necessary to maintain the integrity or reliability of a system, which can be anticipated and scheduled in advance.
- **Scope of work** – a document detailing program requirements.
- **Scrubber** – a device that uses a liquid spray to remove particulates and gaseous pollutants from an air stream; the gases are removed by absorption, or a chemical reaction, and the particulates are removed through contact and capture by the liquid droplets.
- **Sealed source** – radioactive (or other energy) source in which the dangerous or radioactive material is permanently sealed in a capsule or closely bonded and in a solid form.
- **Second law of thermodynamics** – the law which states that heat will flow from a warmer body to a cooler body when brought into contact with each other.
- **Second-order reaction** – a chemical reaction in which the rate of reaction is proportional to a concentration term raised to the second power.
- **Seepage** – the passage of fluids through porous media, i.e., water through soil.
- **Semiconductor** – a substance that can conduct electricity under some conditions but not others.
- **Sensible heat** – the heat that, when added or removed, results in a change of temperature.
- **Sensitivity analysis** – the study of how the uncertainty in the output of a mathematical model or system can be apportioned to different sources of uncertainty in its inputs.
- **Serendipity** – an unexpected scientific discovery that turns out to be more important than the project being researched.
- **Service life** – the period of time during which a component of a system will be capable of performing its desired function.

- **Settling chamber** – any chamber designed to reduce the velocity of a gas stream in order to promote the settling of particulates from the gas stream before it is discharged into the environment.
- **Shield** – a wall that protects individuals and/or workers from harmful radiation.
- **Shielding** – the protection of personnel from the harmful effects of ionizing radiation and/or neutrons by enclosure of the radiating equipment.
- **Shutdown** – the cessation of operation of an affected facility for any purpose.
- **Side reaction** – a secondary reaction accompanying or following a primary reaction.
- **Significant figures** – the number of digits that reflect the accuracy with which a quantity is measured or known.
- **Simple distillation** – a distillation process in which no appreciable rectification of a vapor occurs.
- **Single-effect evaporator** – an evaporator in which the liquid is subjected to only one evaporation step.
- **Sink** – a receptacle for material moved through a system.
- **Site area** – area of a site over which the management of an authorized facility can be given some degree of authority.
- **Site boundary** – boundary of the site area.
- **Site inspection** – an on-site investigation to determine whether there is a release or potential release and the extent and severity of hazards posed by the release from the site.
- **Site personnel** – all persons working in the site area, either permanently or temporarily.
- **Site survey** – process of identifying candidate sites for a facility installation after the investigation of a large region and the rejection of unsuitable sites.
- **Siting** – process of selecting a suitable site for a facility, including appropriate assessment and definition of the related design basis.
- **Slurry** – a mixture of particulate matter and liquid.
- **Small hydro** – a hydro plant with a capacity between 100 kW and 30 MW.
- **Smelter** – a facility that melts or fuses ore.
- **Soft water** – a water with a low concentration of calcium and magnesium ions, as opposed to hard water.
- **Solar cell** – a battery-like device in which the radiant energy of the sun is converted to electrical energy by means of a semiconductor that is sensitive to the photovoltaic effect.
- **Solar farm** – a power utility, covering a considerable area, where large amounts of electrical energy would be generated from solar energy.
- **Solar heated system** – a system that uses focused solar radiation for the development of energy.
- **Solar radiation** – the electromagnetic waves emitted by the sun.
- **Solid oxide fuel cells (SOFCs)** – among the most efficient and longest-duration fuel cells commercially available.
- **Solubility** – the amount at which one substance can mix or blend uniformly with another.
- **Soluble** – a substance that is able to be dissolved in a liquid.
- **Solute** – the substance that is dissolved in a solvent to form a solution.
- **Solution** – a homogeneous mixture of two or more substances constituting a single phase.
- **Solvent** – the substance (usually liquid) in which a solute is dissolved to form a solution.
- **Sorption** – the action of adsorption. The interaction of an atom, molecule, or particle with a solid surface at a solid–solution or a solid–gas interface.
- **Source** – anything that may cause radiation exposure, such as by emitting ionizing radiation or by releasing radioactive substances or radioactive material and can be treated as a single entity for purposes of protection and safety.
- **Space velocity** – the volume of gas or liquid, measured at a specified temperature and pressure, passing through a unit volume per unit time.

- **Specific gravity** – (1) the ratio of the density of a liquid or solid at a particular temperature to the density of water at 4°C, and (2) the density of a gas to that of air at the same temperature and pressure.
- **Specific heat** – the ratio of the heat capacity of a substance to the heat capacity of water at a particular temperature.
- **Specific volume** – the volume of a unit mass of a substance; it is the reciprocal of density.
- **Spectrum** – the radiant energy emitted by a substance as a characteristic band of wavelengths by which it can be identified.
- **Spent** – any material that has been used and, because of contamination, can no longer serve the purpose for which it was produced without additional processing.
- **Spent source** – a source that is no longer suitable for its intended purpose.
- **Stability** – a measure of the degree of atmospheric turbulence commonly defined in terms of the vertical temperature gradient referenced to the adiabatic lapse rate. See lapse rate, inversion.
- **Stable** – a term used to describe a chemical with the ability to resist changes in its composition despite exposure to water, air, pressure, heat, or shock; see also stable air; stable isotope.
- **Stable isotope** – an isotope of an element that is not radioactive.
- **Stack** – a chimney or any vertical conduit through which gaseous products are released into the atmosphere.
- **Stack sampling** – the collecting of representative samples of gaseous and particulate matter that flows through a duct or stack.
- **Stage** – (1) a part of a series of operations in a piece of equipment, and (2) a subdivision of a series, which is a subdivision of a system, as applied to geological strata.
- **Stakeholder** – an individual, a group of individuals, a company, or an institution that has a stake in a plan, project, or any other planning-related matter.
- **Stand-alone system** – an independent system or process.
- **Standard condition** – any reference temperature and pressure (e.g., a temperature of 70°F and a pressure of 14.7 psia).
- **Standard cubic feet per minute (scfm)** – a flow rate corrected to standard pressure and temperature.
- **Standard enthalpy of reaction** – the change in enthalpy of a given chemical reaction with all reactants and products in their reference states; the reference state is usually 25°C and 1 atm.
- **Standard heat of formation** – the heat of formation of a compound from its elements at 1 atm and 25°C.
- **Standard temperature and pressure (STP)** – standard conditions, typically 0°C, 25°C or 60°F and 1 atm.
- **State** – one of the three forms that matter can take; these are solid, liquid, and gas.
- **Static electricity** – electricity that is at rest, not flowing.
- **Static head** – the pressure in a fluid due to the height of fluid above a given datum point.
- **Steady flow** – flow that does not vary with time; the mass flow rate is constant and all other quantities (e.g., temperature, pressure, and velocity) are independent of time.
- **Steam** – the gaseous form of water.
- **Steam drum** – a vessel in a boiler in which saturated steam is separated from the steam-water mixture and into which feedwater is introduced.
- **Steam methane reforming (SMR)** – a process by which hydrogen is extracted from natural gas or methane.
- **Steam plume** – a dense white cloud that results from the rapid cooling of moisture-carrying air below its saturation temperature.

- **Steam quality** – a measure of the amount of liquid water in steam.
- **Steam turbine** – a device that converts the thermal energy of steam to the kinetic energy of a spinning shaft.
- **Still** – an apparatus for distilling that is employed to purify liquids (e.g., to prepare alcoholic beverages, distilled water.)
- **Stoichiometric** – (1) the elements of a compound in exactly the proportion represented by the compound's chemical formula, and (2) the minimum amount of a chemical necessary to completely react with another reactant.
- **Stoichiometric combustion** – a combustion condition that is characterized by the exact amount of oxygen required for complete combustion of the chemicals in the influent gas stream.
- **Stoichiometry** – the branch of chemistry and chemical engineering that deals with the quantities of substances that enter into and are produced by chemical reactions.
- **Stoker** – a mechanical device employed to feed solid fuel or solid waste to a furnace.
- **Stoker boilers** – a mechanical system that feeds solid fuel into the furnace of a steam boiler.
- **Stop valve** – a large valve installed in a pipeline to shut off flow for the purpose of inspection or repair.
- **Storage** – an element or system that stores energy; it allows the capture of electrical energy produced at one time for use at a later time by converting it to a different form of energy, e.g., chemical energy in batteries or potential energy in pumped storage systems.
- **Strip mining** – a process that uses machines to scrape soil or rock away from mineral deposits just under the Earth's surface.
- **Stripper** – a column in which one or more components of a liquid stream are removed by being transferred into a gas stream.
- **Strontium (Sr)** – a pale-yellow, soft, metallic element with atomic number 38 and atomic weight 87.6; it is spontaneously flammable in powdered form, ignites when heated above its melting point, and reacts with water to evolve hydrogen.
- **Subatomic particle** – any particle smaller than an atom.
- **Subterranean stream** – a stream flowing through large interstices or openings in rock, such as caves and caverns.
- **Suction pump** – a pump set above the surface of the liquid that is supplied to the pump.
- **Sump** – a pit or tank that catches liquid runoff for drainage or disposal.
- **Supercooled liquid** – a liquid cooled below its normal freezing point without solidification; it is at nonequilibrium, and therefore is a temporary, condition.
- **Superficial mass velocity** – the quantity obtained when the mass rate of flow is divided by the total cross-sectional area, regardless of the presence of any obstruction to flow.
- **Superheated steam** – steam at a temperature above its boiling point.
- **Supersaturation** – an unstable condition in which a solvent contains more dissolved matter than is present in a saturated solution of the same components at an equivalent temperature.
- **Surface tension** – the attractive force exerted by molecules below the surface on those at the surface of a liquid.
- **Surge** – a momentary increase in flow or pressure that passes along the length of a conduit due to sudden changes in velocity.
- **Surveillance** – a type of inspection to verify the integrity of a facility or structure.
- **Sustainable** – able to be maintained at a steady level without exhausting natural resources or causing severe ecological damage, as in a behavior or practice.
- **Synergism** – the cooperative interaction of two or more chemicals or processes producing a greater total effect than the sum of their individual effects.

- **Synthesis** – (1) the combination of parts to form a whole, and (2) creation of a substance that either duplicates a natural product or is a unique material not found in nature.
- **Synthetic gas** – a gas consisting of hydrogen, carbon monoxide, and often carbon dioxide that is produced through a human-controlled process. Also called synthesis gas.
- **Synthetic natural gas (SNG)** – a manufactured product, chemically similar in most respects to natural gas, resulting from the conversion or reforming of hydrocarbons that may easily be substituted for or interchanged with pipeline-quality natural gas.
- **System** – a set of connected components or parts forming a complex whole.
- **Systemic** – something that affects the entire system or body.
- **Systems-based approach** – emphasizes the interdependence and interactive nature of elements within and external to events, processes, and phenomena.
- **Tariff** – the document approved by a public utility commission that lists a utility's rates, terms, and conditions of service.
- **Temperature** – a measure of the average kinetic energy of the molecules of a substance; it is generally measured by the change of volume it causes in a liquid, as in a thermometer.
- **Temperature gradient** – the change in temperature with location or position.
- **Temperature inversion** – an increase in temperature with altitude that is caused by a warm air mass covering a colder one. See inversion, lapse rate.
- **Theoretical air** – the quantity of air, calculated from the chemical composition of a waste that is required to combust a waste/feedstock completely so that no oxygen remains.
- **Thermal conductivity** – a property that quantifies the heat transfer ability of a material as the specific rate of heat flow per unit area per unit temperature gradient.
- **Thermal decomposition** – the decomposition of a material by heat.
- **thermal energy** – also known as heat energy; the energy associated with atomic and molecular vibration within a substance.
- **Thermal pollution** – the discharge of heated water from industrial processes and power plants that can adversely affect the life processes of aquatic plants and animals.
- **Thermal storage** – technology that stores thermal (heat) energy in a reservoir.
- **Thermodynamics** – a rigorously mathematical analysis of energy relationships.
- **Third Law of Thermodynamics** – the law which states that absolute zero can never be attained; it also sets the entropy of all pure crystalline substances to be zero at absolute zero temperature.
- **Three-phase equilibrium** – the state of equilibrium among the vapor, liquid, and solid phases of a pure substance; it occurs at a definite pressure and temperature known as the “triple point.”
- **Throat velocity** – the gas velocity through the throat of a venturi.
- **Throttle valve** – a valve designed to control the rate of fluid flow.
- **Throttling** – the control of the rate of fluid flow using a throttle valve.
- **Tidal power** – the mechanical power that is generated by the rise and fall of ocean tides which may be converted to electrical power.
- **Ton (U.S., short)** – a unit of mass equal to 2,000 lb (mass).
- **Total head** – the sum of the static head, velocity head, and pressure head.
- **Total pressure** – the pressure given by the sum of static pressure and velocity pressure.
- **Trace element** – an element present in extremely small amounts.
- **Transformer** – a piece of electrical equipment used to step up or step-down voltage; a device used to change voltage on an AC electrical system.
- **Transient** – a term used to describe anything that changes with time.
- **Transmission** – the electric grid that connects electricity generators to distribution substations.

- **transmission bottlenecks** – transmission lines that are frequently subject to congestion.
- **Transmission system** – set of devices that deliver electricity over high-voltage lines from generators to the interconnection with the distribution system.
- **Transmission** – the movement of electricity from a generator to local distribution lines over high-powered lines; regulated by the FERC.
- **Triple bond** – a highly unsaturated linkage between two atoms; it occurs between two carbon atoms of acetylenic compounds.
- **Triple point** – the temperature and pressure at which all three states (i.e., solid, liquid, and gas) of a substance exist together.
- **Tsunami** – a sea wave caused by an underwater seismic disturbance such as sudden faulting, landslides, or volcanic activity.
- **Turbine** – a device for converting the flow of a fluid (air, steam, water, or hot gases) into mechanical motion by passing the fluid through fan-like blades, causing them to rotate and turning the rotation into mechanical energy that can be used to produce electricity.
- **Turbulence** – the fluid property that is characterized by irregular variations in the speed and direction of the movement of individual particles or elements of flow.
- **Ultimate analysis** – chemical analysis on a mass basis of a solid, liquid, or gaseous fuel in terms of its elemental composition and concentration.
- **Ultra-low-carbon hydrogen** – hydrogen produced with emissions below 36.4 g CO₂eq/MJ H₂ and encompasses both decarbonized hydrogen as well as and carbon-free hydrogen.
- **Ultraviolet (UV)** – the invisible, electromagnetic radiation with a very short wavelength in the range between visible light waves and X-rays.
- **Uncertainty** – anything that is unknown and uncontrollable or not perfectly known or controllable.
- **Uncertainty analysis** – an analysis of uncertainty and error bounds of the estimates involved in, and results from, the solution of a problem.
- **Unit operation** – one of the many physical operations employed in chemical engineering in the industrial production of various chemicals that do not involve a chemical reaction.
- **Unit process** – one of many chemical, thermal, or biological processes in which a chemical reaction takes place between two or more chemicals which results in another chemical or chemicals being formed.
- **Unsealed source** – a radioactive source in which the radioactive material is neither permanently sealed in a capsule nor closely bonded and in a solid form.
- **Unstable** – a chemical that tends to move toward decomposition or other unwanted chemical changes during normal handling or storage.
- **Unsteady flow** – a flow that is characterized by a mass flow rate and/or other quantities that vary with time.
- **Upper explosive limit (UEL)** – the concentration of a combustible substance above which combustion will not occur in the presence of a flame or spark.
- **Upper flammable limit (UFL)** – see upper explosive limit (UEL).
- **Upset** – a disturbance in the functioning, fulfillment, or completion of a process or material.
- **Upstream** – the direction from which a stream is flowing.
- **Uptake** – the act of taking up, drawing up, or absorbing.
- **Uranium-235 (U-235)** – a heavy, radioactive, metal element employed in nuclear reactors and in the production of nuclear weapons.
- **Uranium-238 (U-238)** – a heavy, radioactive, metal element employed in nuclear reactors and in the production of nuclear weapons; it is the most abundant uranium isotope on Earth.

- **Useful life** – the period of time during which a piece of equipment or a process operates at its design performance level.
- **Vacuum distillation** – the distillation at a pressure below atmospheric but not so low that it would be classified as molecular distillation.
- **Valence** – a whole number that is a measure of an element's capacity for combining with other elements as defined in balanced chemical equations.
- **Valence electrons** – the electrons in the outer shell of an atom; they determine the chemical properties of the atom.
- **Validation** – the process of determining whether a product or service is adequate to perform its intended function satisfactorily.
- **Valve** – a device for controlling the flow of a fluid through a pipe or tube.
- **Valve stem** – the rod employed to open or close a valve.
- **Vane** – a device that pivots on a rooftop or other elevated location for the purpose of determining the wind direction.
- **Vapor** – the gaseous state of a substance that is below its critical pressure.
- **Vapor pressure** – the pressure exerted by a vapor in equilibrium with a liquid at a given temperature.
- **Vaporization** – the process by which a substance changes from the liquid state to the gaseous state.
- **Velocity** – the speed and direction of a moving body.
- **Velocity head** – the head equivalent of the kinetic energy per unit mass of a flowing stream.
- **Velocity pressure** – the kinetic pressure in the direction of flow necessary to cause a fluid at rest to flow at a given velocity; it is always positive.
- **Vena contracta** – the most contracted surface area of a stream passing through or over an orifice or weir.
- **Vendor** – a design, contracting, or manufacturing organization supplying a service, component, or facility.
- **Vent** – an opening through which a fluid is ejected from a system.
- **Vented gas** – gas released into the atmosphere on a production site or at processing plants.
- **Ventilation** – the act of admitting fresh air into a space to replace stale or contaminated air.
- **Venturi meter** – a device for measuring the flow of water or other fluid through a closed conduit or pipe; it consists of a venturi tube and a flow registering device.
- **Venturi scrubber** – a unit using a liquid, usually water, to remove pollutants from an air stream.
- **Verification** – the process of determining whether the quality or performance of a product or service is as stated, as intended, or as required.
- **Violet rays** – the shortest rays of the visible spectrum of electromagnetic radiation.
- **Virgin material** – a raw, unused material.
- **Viscometer** – a device for measuring the viscosity of a liquid.
- **Viscosity** – the internal resistance of a fluid (liquid or gas) to a change in shape, or movement of neighboring portions of fluid relative to one another.
- **Volatility** – the tendency of a solid or liquid material to pass into the vapor state at a given temperature.
- **Voltage** – a quantitative expression of the potential difference in charge between two points in an electrical field; the greater the voltage, the greater the flow of electrical current.
- **Volume reduction** – a treatment method that decreases physical volume of a waste stream.
- **Wash solvent** – a liquid added to a liquid–liquid extraction process to wash or enrich the purity of the solute used in the extraction.
- **Waste energy** – energy that is not usefully transferred or transformed.

- **Waste minimization** – the prevention or restriction of waste generation at its source by redesigned products or process modification.
- **Water** – a colorless, odorless, tasteless liquid composed of the elements, hydrogen and oxygen.
- **Water softening** – a treatment process designed to remove hardness-producing ions completely or partially from water.
- **Watershed** – the area surrounding a stream that supplies it with runoff.
- **Watt** – a unit of power (rate of work) in the SI system, equal to 1 J/s.
- **Weir box** – a fabricated channel into which a weir plate has been installed to direct open channel flow for measurement purposes.
- **Wet bulb** – a thermometer bulb maintained wet with distilled water; it is employed with a dry bulb to allow the determination of humidity in an air sample.
- **Wet-bulb temperature** – the temperature of a parcel of air cooled to saturation (100% relative humidity) by the evaporation of water into it, with the latent heat of evaporation supplied by the parcel or air.
- **Wholesale competition** – sales to utility distribution companies and other retailers, not to end-use customers, and regulated by the FERC.
- **Wind power** – mechanical or electrical power generated by a windmill using the kinetic energy of the wind as the primary energy source.
- **Wind speed** – the speed of the wind usually denoted in meters per second (m/s) or miles per hour (mph).
- **Wind vane** – an instrument employed to determine wind direction.
- **Working capacity** – see working charge.
- **Working charge** – the net amount of pollutant that is adsorbed during a complete cycle in an adsorber.
- **X-ray** – electromagnetic radiation of extremely short wavelength; overexposure can permanently damage cells and tissue structures, and its effect is cumulative.
- **Zeolite** – any of the hydrated aluminum complex silicates, either natural or synthetic, which possesses cation exchange properties; used in water and wastewater treatment.
- **Zero-order reaction** – a reaction in which the rate of disappearance of a chemical is independent of the concentration of the chemical or the concentration of any other chemical present in the reaction mixture.
- **Zeroth Law of Thermodynamics** – this law states that two objects are in thermal equilibrium when no heat transfers occur between them when they are placed in contact with each other.

1.4 Symbols and Acronyms

A short list of symbols and acronyms employed in the energy industry is provided below.

°	degree
Δ	change
ΔG	Gibbs free energy of reaction
ΔH	enthalpy of reaction
ΔH_f°	standard heat of formation
Å	Angstrom

abs	absolute
acfm	actual cubic feet per minute
AE	alkaline electrolyzer
AFC	alkaline fuel cell
AFV	alternate fuel vehicle
ALK	alkaline electrolysis
amb	ambient
ANL	Argonne National Lab
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials, ASTM International
atm	atmosphere, atmospheric
bbl	barrel
BEV	battery-electric vehicle
BF	blast furnace
BOF	basic oxygen furnace
b.p.	boiling point
Btu	British thermal unit
°C	degree Celsius
CAA	Clean Air Act
CAD	computer-aided design
cal	calorie
CARB	California Air Resource Board
CBP	Customs and Border Patrol
CCS	carbon capture and storage
CCUS	carbon capture, utilization, and storage
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	cubic feet per minute
cfs	cubic feet per second
cgs	cm-g-sec
CH₄	methane
CHP	combined heat and power
CHHP	combined heat, hydrogen, and power
cf	cubic foot
cm	centimeter
cm³	cubic cm
CNG	compressed natural gas
CO₂	carbon dioxide
cP	centipoise
Cp	heat capacity
CWA	Clean Water Act
d	day
D₂	deuterium
DC	direct current
DoD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior

DOT	Department of Transportation
DP	dew point
EA	environmental assessment
EIA	US Energy Information Administration
EMF	electromagnetic field
EPA	US Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ES	energy storage
ETA	event tree analysis
EU	European Union
EV	electric vehicle
°F	degree Fahrenheit
FAA	Federal Aviation Administration
FC	fuel cell
FCEB	fuel cell electric bus
FCEV	fuel cell electric vehicle
FE	DOE's Office of Fossil Energy
FERC	Federal Energy Regulatory Commission
f.p.	freezing point
fpm	foot per minutes
fps	foot per seconds
ft	foot
ft-lb	foot pound
FY	fiscal year
g	gram
g/kW	gram per kilowatt
g/L	gram per liter
GHG	greenhouse gas
GJ	gigajoules
gr	grain
GW	gigawatt
H₂	hydrogen
He	helium
HEV	hybrid electric vehicles
H₂O	water
H₂O₂	hydrogen peroxide
hp	horsepower
HVAC	heating, ventilation, and cooling
ICE	internal combustion engine
IEA	International Energy Agency
IEEE	Institute of Electrical and Electronics Engineers
I-O	input-output
IRENA	International Renewable Energy Agency
ISO	International Organization for Standardization
hr	hour
in	inch
K	Kelvin

kcal	kilocalorie
kcal/mol	kilocalories per mole
kg	kilogram
km	kilometer
kW	kilowatt
kWh	kilowatt-hour
kWh/L	kilowatt-hour per liter
L	liter
lb	pound
L/D	length to diameter ratio
LEL	lower explosive limit
LFG	landfill gas
LH₂	liquid hydrogen
LHV	lower heating value
ln	natural logarithm
LNG	liquified natural gas
log	logarithm Base 10
LOHC	liquid organic hydrogen carrier
m	meter
m³	cubic meter
Mcf	million cubic feet
meq	milliequivalents
mg	milligram
MHz	megahertz
mi	mile
min	minute
MJ	megajoule
mL	milliliter
mm	millimeter
mol	mole
mol wt.	molecular weight
m.p.	melting point
mpg	miles per gallon
mph	miles per hour
Mt	megaton
MW	megawatt
MWh	megawatt-hour
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
ng	nanogram
NH₃	ammonia
NO_x	nitrogen oxide
μm	micrometer, micron
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
oz	ounce

PFD	process flow diagram
pH	log concentration of the hydrogen ion
PHA	process hazard analysis
PM	particulate matter
ppb	parts per billion
ppm	parts per million
ppm_v	parts per million by volume
ppm_w	parts per million by weight
PSA	pressure swing adsorption
PSD	particle size distribution, pore size distribution
psi	pounds per square in
psia	pounds per square in absolute
psig	pounds per square in gauge
PV	photovoltaic
°R	degrees Rankine
RCRA	Resource Conservation and Recovery Act
RFP	Request for Proposals
R&D	research and development
R&I	research and innovation
RMP	EPA's CAA Risk Management Plan
RMS	root mean square
ROI	return on investment
rpm	revolution per min
s	second
scf	standard cubic feet
scfh	standard cubic feet per hour
scfm	standard cubic feet per min
SDWA	Safe Drinking Water Act
SMR	steam methane reforming
SNR	synthetic natural gas
SOE	solid oxide electrolysis
SOFC	solid oxide fuel cell
SO_x	sulfur oxide
sp.gr.	specific gravity
sp.ht.	specific heat
STP	standard temperature and pressure
Tcf	trillion cubic foot
temp	temperature
TWh	terawatt-hour
UEL	upper explosive limit
UFL	upper flammability limit
UV	ultraviolet
Wh	waat-hour
WHO	World Health Organization
yr	year

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