Glossary

ab initio	From first principles. In science, a method is considered ab initio if it relies only on the established laws of nature and does not utilize assumptions or special models.
aberration	In optics, the failure of rays to converge at a single focus because of defects in a lens or mirror, leading to a blurring of the image produced. Similarly, in electron microscopy aberration leads to a blurring of the sample image, reducing the minimum attainable resolution.
absorption heat transformer	A device with the ability to raise the temperature of low or medium heat to higher, more useful temperature.
additive manufacturing	A class of processes that builds up objects by adding material, rather than using subtractive processes such milling and machining. This is also known as 3D printing.
advanced metering infrastructure	Integrated system of smart meters, communications networks, and data management systems that enables two-way communication between utilities and customers.
advanced ultra-supercritical	Advanced ultra-supercritical (A-USC) pulverized coal power plants use steam cycle temperatures above 650°C (1202°F) to increase overall plant efficiency. USC steam temperatures are limited to approximately 627°C (1160°F) by the use of ferritic steels.
albedo	The fraction of incident light reflected from a surface, such as from the earth back into space.
Alpha decay	A mechanism of radioactive decay in which the radioisotope emits an alpha particle, undergoing a change to another element having a mass number reduced by four and an atomic number reduced by two.
alpha emitter	A radioisotope that undergoes alpha decay.
alpha particle	A helium nucleus, which contains two protons and two neutrons. It has an electric charge of +2, and an energy of approximately five megaelectron volts.
alternating current	An electric current that oscillates between positive and negative values at a fixed frequency.
Archaea	The biological kingdom of single celled organisms called prokaryotes having no cell nucleus or other membrane bound organelles.
Atomic layer deposition	A thin film deposition technique based on the sequential use of two (or more) gas phase chemicals (precursors) that react with a surface until all exposed sites are consumed (self-limiting). Through repeated exposure to each precursor, a thin film is deposited. In contrast to chemical vapor deposition, the precursors are never present at the same time.

auxiliary loads	The power required to power ancillary equipment in a power plant, such as fans and pumps.
auxiliary power unit	A device on a vehicle (truck, airplane, etc.) that provides power to start engines, run support equipment, or serve as backup power.
B20	A fuel composed of 80% petroleum based diesel fuel and 20% bio diesel that is typically made from soybean, canola, or other vegetable oils, animal fats, or recycled grease.
balancing area	A geographic segment of the electric power system in which electrical balance is maintained between resources and loads.
base-load power plant	A plant, usually housing high-efficiency steam-electric units, which is normally operated to take all or part of the minimum load of a system, and which consequently produces electricity at an essentially constant rate and runs continuously.
beam emittance	The properties of a particle beam in an accelerator, describing the size of the source and the divergence of the beam.
biogenic	Produced by biological processes of living organisms.
biomass gasification with carbon capture and storage	A power generation plant that gasifies biomass with the resulting synthetic gas used to fire a combined-cycle unit to produce electricity with the waste carbon dioxide being stored rather than vented to the atmosphere.
biomass-to-liquids	A process that converts biomass into a syngas which is then converted into liquid hydrocarbons.
black start	The process of restoring a power station to operation without relying on the external electric power transmission network.
blowout preventer	A piece of equipment used to control the flow of oil and gas from wells and prevent an uncontrolled release from the well.
Brayton cycle	A thermodynamic cycle that describes the workings of a constant pressure heat engine.
British thermal unit	The quantity of heat required to raise the temperature of one pound of liquid water by one degree Fahrenheit.
burning plasma	A condition wherein the energy produced by nuclear fusion within a confined plasma is sufficient to maintain the plasma temperature, i.e. the energy output is greater than the energy input.
CAFE	The Corporate Average Fuel Economy standard was first enacted by the U.S. Congress in 1975 and sets average fuel economy standards across a fleet of vehicles produced by an individual manufacturer.
calutron	A mass spectrometer used to separate the isotopes of an element.
capacitor bank	A passive electrical component used to improve the quality of power delivery by sourcing reactive power.
capacity factor	The ratio of the electrical energy produced by a generating unit for the period of time considered to the electrical energy that could have been produced at continuous full power operation during the same period.
carbon capture and storage	The process of capturing waste carbon dioxide from a source, such as fossil fuel power plants, and storing it where it will not enter the atmosphere.

cascading effect	A chain of events due to an initial disturbance that propagates across the system.
catalyst	A molecule or material that accelerates the rate of a chemical reaction without undergoing a permanent change itself. Catalysts exist either in the same phase (homogeneous) or a different phase (heterogeneous) relative to the reactant.
central generators	Centrally dispatched power-generating technologies that are connected to an electricity grid.
chained dollars	A measure used to express real prices. Real prices are those that have been adjusted to remove the effect of changes in the purchasing power of the dollar; they usually reflect buying power relative to a reference year.
circuit breaker	A critical component of the electric power system used to ensure safety and protection of assets by separating and isolating segments of the electric power system.
clean energy manufacturing	The manufacture of goods in a manner that reduces the environmental impacts associated with the manufacture, use, and/or disposal of the products.
cloud condensation nuclei	Small particles upon which water condenses that serve as the precursors to cloud formation.
CO_2 equivalent	A measure used to compare the emissions from various greenhouse gases based upon their global warming potential in units that are equivalent to that of carbon dioxide (CO_2).
coal-to-liquids	A process that converts coal into a syngas which is then converted into liquid hydrocarbons.
co-design	In science and engineering, a design methodology wherein the requirements of the problem to be solved are considered when designing the system that will be used to solve the problem.
colossal magnetoresistance	A property of some materials that enables them to dramatically change their electrical resistance in the presence of an external magnetic field.
combined heat and power	A power generating unit designed to produce both electricity and heat from a fuel source, increasing system efficiency.
combined heat and power	The concurrent production of electricity or mechanical power and useful thermal energy from a single energy input.
compressed air energy storage	The storage of compressed air in a container, usually an underground cavern, for later expansion through a turbine to generate electricity.
compressed natural gas	Natural gas compressed to a pressure at or above 200–248 bar (i.e., 2,900–3,600 pounds per square inch) and stored in high-pressure containers. It is used as a fuel for natural gas-powered vehicles.
computational fluid dynamics	A branch of fluid mechanics that uses computers to solve problems of fluid flow using numerical analysis and algorithms.
computational manufacturing	The use of computational tools such as modeling, simulation, and control systems to improve and regulate manufacturing processes or develop novel materials and products.

concentrating solar power	A solar energy conversion system characterized by the optical concentration of solar rays through an arrangement of mirrors to generate a high-temperature working fluid that is then used in a steam or gas turbine to generate electricity.
conservation voltage reduction	A strategy to reduce energy consumption by reducing the voltage along distribution feeders while staying within limits needed for equipment to operate properly.
core damage frequency	An expression of the likelihood that, given the way a reactor is designed and operated, an accident could cause the fuel in the reactor to be damaged.
critical material	A material of high economic importance that is at risk of supply disruption due to challenges such as a small global market, lack of supply diversity, or geopolitical risk.
cycle life	The number of charge/discharge cycles that a battery is able to support for a given depth-of-discharge within its useful life.
day ahead markets	Forward electricity markets where participants commit to buy or sell wholesale electricity a day in advance to help avoid price volatility.
demand controlled ventilation	A system which automatically adjusts the operation of ventilation equipment, either through a timed schedule or occupancy sensors, to meet ventilation requirements.
demand-side management	Utility programs that incentivize consumers to shift electricity use away from periods of peak demand (e.g., via load shifting), and to reduce electricity use overall (e.g., via energy efficiency).
density functional theory	A computational quantum mechanical modeling method used to simulate the electronic structure of many-body systems.
depth-of-discharge	A method to indicate a battery's state of charge, where 100% is empty.
diffraction	The process by which incident particles (photons, electrons, protons, neutrons, ions) interact with a periodic structure to produce a characteristic interference pattern. This interference pattern can be used to determine structural properties of a material.
dimethyl ether	A colorless gas that can be produced from natural gas or biomass and can be used as a substitute for liquefied petroleum gas for cooking or industrial uses or as a motor fuel in diesel engines with relatively minor modifications.
direct current	An electric current that flows in one direction.
direct energy conversion	Devices or systems that convert energy from one form to another without intermediate steps.
dispatchable demand resources	Customer demand that can be reduced in response to the utility or grid operator direction to address electricity system peak demand or supply constraints in exchange for a reduction in their electricity bills.
distributed energy resources	Small, modular technologies that can provide electricity or energy services, such as distributed generation and energy storage, that can be placed throughout the grid but typically near customer loads.
distributed generation	A variety of small, modular power-generating technologies that can be placed throughout the grid, particularly on distribution systems. (Note that they do not necessarily have to be combined with storage, etc., and don't necessarily get used to improve operations.)

distribution feeder	Power lines connected to a distribution substation to deliver electricity to customers.
distribution system	The lower voltage portion of the electricity delivery system used to connect supplies, typically from transmission, and distribute it to individual customers in a more confined geographic region.
duck curve	A graphical representation of the net-load curve (total load minus the amount produced by variable generation such as solar) projected for the California Independent System Operator demonstrating the increased need for system flexibility to meet steep ramps.
E15	A fuel containing a mixture of 15 percent ethanol and 85 percent gasoline.
E85	A fuel containing a mixture of 85 percent ethanol and 15 percent gasoline.
edge localized mode	A sudden, intense burst of heat that erupts from the edge of a plasma magnetically confined in a Tokamak fusion device.
electric drive technologies	Technologies that provide propulsion for electric drive vehicles and include power electronics and electric motors.
electric vehicle supply equipment	Equipment that increases the safety and ease of charging electric vehicles by enabling two-way communication between the vehicle and charger.
electric vehicles	A vehicle powered by electricity stored in batteries.
electricity architecture	The collection of relationships, connectivity, interactions, and structures that make up the electric power system spanning the physical, cyber, and human domains.
electrolysis	A process that uses electricity to split water into hydrogen and oxygen.
electron microscopy	A type of microscope that uses a beam of electrons to create an image of a specimen. Due to the very small wavelength of the electron, electron microscopes have much higher resolving power relative to a light microscope, revealing much finer detail of objects.
electron volt	An empirically-derived unit of energy defined as the amount of energy gained or lost by an electron moved across an electrical potential of one volt. It is approximately equal to 1.6×10^{-19} joules. It is often expressed in metric multiples (e.g., milli [m], mega [M] or giga [G]).
electronic converter	A technology based on semiconductor devices that change the characteristics of electric power, altering voltage levels or converting between alternating current and direct current.
embodied energy	The energy required to build or manufacture a device or structure, including the energy used to produce the materials in that device or structure.
energy services	Services made possible by energy use such as transportation, heating, light, etc.
energy surety	A guarantee of desired energy system attributes such as safety, security, reliability, sustainability, and cost effectiveness.
enhanced geothermal systems	An enhanced geothermal system is one which creates porosity in hot rock to allow the extraction of heat to drive power generation.
enhanced oil recovery	Techniques that use water, steam, chemical, carbon dioxide flooding, etc., to produce greater amounts of the original oil in a reservoir than would be producible by conventional techniques.

enthalpy	The amount of heat content used or released in a system at constant pressure.
enzyme	A macromolecule that acts as a catalyst for complex biological reactions.
exascale	A term representing a level of computer performance equal to or greater than 1,000 petaflops.
experience curve analysis	A method of projecting the reduction in technology costs over time, usually as a function of increasing volume of production, improvement in manufacturing processes, learning by doing, etc. External factors such as policy or other technology changes can also play a role.
expert elicitation	The use of experts familiar with a technology to supply subjective probability distributions of projected economic, technical, or other characteristics at some future date. Such a method can be used to provide risk and uncertainty estimates in technology forecasts.
fair-weather bias	A potential bias in results due to examining only clear sky conditions.
Fischer-Tropsh	A process that converts a feedstock such as natural gas or coal into a syngas, which is then converted into liquid hydrocarbons.
flaring	The controlled combustion of flammable gases at a refinery or at a wellhead. Often natural gas is flared as a result of the unavailability of a method for transporting such gas to markets.
flexible AC transmission systems	An electronic-based system used to help control of key AC transmission system parameters and increase power transfer capability.
flexible decision making	An approach that considers the full uncertainty in future value, and focuses on potential value if projects or technologies are successful. It relies upon iterative follow-on investment decisions that do not require large outlays of funding at early stages, to reduce uncertainty and increase rate of success.
flexible generators	A electric power generation unit that is readily available and under the direct control of the operator with the ability to change output levels.
flux	The rate of flow of a physical property per unit area.
free-electron laser	The use of very-high speed electrons moving through a regular alternating magnetic structure (undulator) to generate lasing with high peak brilliance. The radiation emitted is widely tunable, from microwave to X-ray band, by adjusting the energy of the electrons or the magnetic field strength of the undulator.
fuel cell	A device that produces electricity through an electrochemical process, usually from hydrogen or from methane, with oxygen, etc.
fuel scheduling	The scheduling of fuel supply for individual generators.
functional annotation	The process of attaching biological information to genomic elements including biochemical function, biological function, regulation, and expression.
gamma radiography	The use of gamma ray photons to image the internal structure of an opaque object.
gas-cooled fast reactor	A next generation reactor that uses helium as a coolant and relies on high-energy "fast" neutrons.

gene expression	The process by which the information contained in a gene is used to synthesize a functional gene product (RNA or protein). Overexpression of a gene results in the synthesis of too many copies of the functional product.
Generation III+ reactor	An advanced, third-generation light water reactor that incorporate new features such as improved safety features and standardized design.
genome	The complete set of DNA, including all of its genes, necessary to build and maintain an organism.
geoengineering	The deliberate, large-scale modification of the earth's natural systems.
geothermal power	Geothermal power uses heat from underground to generate electricity, heat buildings, or for other purposes.
gigabit	A multiple (10^9) of the bit, the basic unit of digital information storage, having one of two values (zero or one).
gigaton	One billion metric tons
gigawatt	One billion watts or one thousand megawatts (also GW)
gross domestic product	The total value of goods and services produced by labor and property located in a country.
heat island	An urban area characterized by temperatures higher than those of the surrounding non-urban area. As urban areas develop, buildings, roads, and other infrastructure replace open land and vegetation. These surfaces absorb more solar energy, which can create higher temperatures in urban areas.
heat pump	Technologies that move thermal energy opposite to the direction of normal heat flow, such as by absorbing heat from a cold area and transferring it to a warmer one. During the heating season, heat pumps move heat from the cool outdoors into the warm indoors and during the cooling season, heat pumps move heat from the cool indoors into the warm outdoors.
hierarchical control	A classification of coordination and control of generators and other power system assets based on a top-down relationship.
high-temperature superconductor	A material that shows superconductivity (i.e., zero electrical resistance) at temperatures much higher than traditional superconductors.
higher heating value	The value of the heat of combustion of a fuel that takes into account the heat of vaporization of water.
high-performance computing	The practice of achieving high computing power through massive parallelization of processors to solve very complex problems.
homogeneous charge compression ignition	A type of internal combustion engine process where a well-mixed combination of fuel and air are compressed to the point of ignition without using a spark plug or fuel injector to initiate combustion.
horizontal drilling	A drilling technique where the drill is directed horizontally.
hybrid electric vehicles	A vehicle in which a power plant (e.g., internal combustion engine or fuel cell) powers an electric propulsion system, either exclusively or in parallel with a mechanical drivetrain.

hydraulic fracturing	Fracturing of rock at depth with fluid pressure to increase rock porosity. Hydraulic fracturing at depth may be accomplished by pumping water into a well at very high pressures which can then enable oil or gas production from an otherwise bound source or enable flow of water through a thermal reservoir for geothermal energy production. Under natural conditions, vapor pressure may rise high enough to cause fracturing in a process known as hydrothermal brecciation.
hydrodynamics	A field of physics that deals with the motion of fluids and the forces acting on objects immersed in fluids.
hydropower	The use of flowing water to produce electrical energy.
induced seismicity	Earthquake activity that results from human activity such as the subsurface injection of fluid at a rate or pressure such that the rock is caused to move along a pre-existing fault plane.
inductor bank	A passive electrical component used to improve the quality of power delivery by sinking reactive power.
information and communication technology network	An integrated system of telecommunications, computer networks, and software that enable users to access, store, transmit, and manipulate information.
Integrated Assessment Model	Scientific modeling most often used for environmental analysis that integrates multiple academic disciplines.
integrated gasification combined cycle	A power generation plant that gasifies coal with the resulting synthetic gas used to fire a combined-cycle unit to produce electricity.
interchange scheduling	The scheduling of energy exchange between grid control areas.
interferometer	A measurement device that superimposes electromagnetic waves in order to extract information about the waves via their interference (constructive or destructive) with one another. Typically one of the waves interacts with an object that modifies the wave, thereby providing information about the properties of the interacting object.
intermediate-load power plant	A plant that is normally operated to follow load as it changes through the day.
interval meter	An electrical meter that records power consumption over periodic intervals.
lisotope	A variant of an element differing in the number of neutrons (the atomic mass), but not the number of protons (the atomic number).
kilowatt	One thousand watts (also kW)
kilowatt-hour	A measure of electricity defined as a unit of work or energy, measured as one kilowatt (1,000 watts) of power expended for one hour. One kilowatt-hour (kWh) is equivalent to 3,412 British thermal units (also kWh).
large-eddy simulation	A mathematical model of turbulence used in computational fluid dynamics to simulate, for example, combustion, acoustics, and turbulence.
lead-cooled fast reactor	A next generation reactor that uses lead-bismuth eutectic as a coolant and relies on high energy "fast" neutrons.

levelized cost of energy	A metric of the total cost of energy (most often applied to electricity) production divided by the asset lifetime, and includes capital depreciation, fixed and variable operations and maintenance, fuel costs, and potentially other costs or credits (such as carbon offsets).
life cycle	All stages of a product's life, from raw materials extraction to manufacturing, use, and final disposal or recycling.
life-cycle assessment	A methodology that assesses the energy, materials and potentially other inputs, outputs, and impacts of a product or process. The assessment spans the entire useful life, from raw material extraction through end-of-life management (repurposing, recycling or disposal).
light-emitting diodes	A semiconductor that emits light when an electric current passes through it.
light water reactors	A nuclear reactor that uses water as the primary coolant and moderator, with slightly enriched uranium as fuel.
light-duty vehicles	Vehicles weighing less than 8,500 pounds (including automobiles, motorcycles, and light trucks).
lignocellulosic biomass	Plant dry matter (biomass) composed of carbohydrate polymers (cellulose, hemicellulose) tightly bound to an aromatic polymer (lignin).
lipid	An organic compound comprised of fatty acids that are insoluble in water.
liquefied natural gas	Methane that has been changed from gas phase to liquid phase as a result of a reduction of temperature or an increase in pressure or a combination of both.
liquefied petroleum gas	A group of hydrocarbon gases, primarily propane, normal butane, and isobutene, derived from crude oil refining or natural gas processing.
low temperature combustion	A term that covers a number of advanced combustion technologies that reduce nitrogen oxide and particulate emissions.
lower heating value	The value of the heat of combustion of a fuel that does not take into account the heat energy put into the vaporization of water (heat of vaporization).
lumen	An empirical measure of the quantity of light. It is based upon the spectral sensitivity of the photosensors in the human eye under high (daytime) light levels.
magnetic resonance spectroscopy	A measurement technique that exploits the quantized spin of an atomic nucleus (nuclear magnetic resonance spectroscopy) or electron (electron paramagnetic resonance spectroscopy) to interrogate the physical and chemical properties of a system.
marine and hydrokinetic power	Power generation using the energy of waves, tides, and river and ocean currents.
mass spectrometry	An analytical technique used to identify the amount and type of chemical species in a sample by measuring the mass-to-charge ratios.
material criticality	A designation of materials that are most important to the economy and are at risk of supply disruption.
Materials Genome Initiative	A multiagency initiative to improve the process for discovering, developing, and manufacturing advanced materials through advanced computational capabilities, data management, and integrated engineering, with a goal of developing advanced materials twice as fast and at a fraction of the cost of conventional approaches.
megawatt-hour	One thousand kilowatt-hours or one million watt-hours (also MWh)

megawatt	One million watts of electricity (also MW)
mesoscale	The length scale between the nanoscale and the macroscale (approximately 100 to 1,000 nanometers), where the properties of bulk objects, defined by classical mechanics, emerge from properties of the atomic and molecular components, defined by quantum mechanics.
metabolic pathway	A series of connected biochemical reactions occurring within a cell.
metal organic framework	Compounds consisting of metal atoms or clusters linked by organic molecules to form one-, two-, or three-dimensional structures that typically have very high internal surface area.
methanol	A light, volatile alcohol (CH_3OH) that can be blended with gasoline or used directly as a motor fuel. It is used as a fuel for many motor racing events.
metrology	The science of measurement, embracing both experimental and theoretical determinations at any level of uncertainty in any field of science and technology.
microbial dark matter	The unseen majority of microbial life that is not currently amenable to laboratory cultivation and therefore direct study by observation.
molten carbonate fuel cell	A type of fuel cell that contains a molten carbonate electrolyte. Carbonate ions (CO_3^{-2}) are transported from the cathode to the anode. Operating temperatures are typically near 650°C.
N-1 reliability criteria	A bulk power system operating and planning criteria to ensure reliability in the event of a single contingency such as the loss of a large power plant or transmission line.
nanoscale	Structures having a length scale of approximately 1–100 nanometers. One nanometer is 10^{-9} meters.
nanoscience	The multidisciplinary study of structures and materials at the nanoscale.
nanotechnology	The manipulation of matter on an atomic, molecular, and supramolecular scale.
natural gas hydrates	Cage-like lattice of ice inside of which are trapped molecules of methane, the chief constituent of natural gas; also referred to as methane hydrates.
nuclear fusion	A reaction wherein two or more atoms collide and combine to create a new, heavier element. For elements lighter than iron, this process releases energy.
ocean acidification	The ongoing decrease in ocean pH levels due to the uptake of increased levels of carbon dioxide in the earth's atmosphere.
ome	In biology, the totality of objects within a given field of study, e.g. genome (the genetic material of an organism), proteome (the collection of proteins expressed by a genome), metabolome (the complete set of small molecule chemicals found within an organism), or transcriptome (the set of RNA molecules in an organism).
omics	An informal term referring to any field of biology ending in "–omics", (e.g., genomics, proteomics, or metabolomics).
options space analysis	A method of comparing a set of technologies that contribute to a particular desired service in a specific sector (such as transportation) across a range of characteristics and trade-offs.

organic aerosol	A material comprised of a gaseous suspension of microscopic solid or liquid particles composed of organic matter. A secondary organic aerosol is particulate matter composed of compounds formed from the atmospheric transformation of organic species.
particle accelerator	A device capable of accelerating charged particles to high energies using electromagnetic fields.
peak load	The maximum electric load during a specified period of time for a given power system.
peaking power plant	A power plant, typically gas turbines, diesels, or pumped-storage hydroelectric, normally used during the peak-load periods.
petaflop	A trillion flop, or floating point operations per second, a measure of computer performance.
phase angle	The difference in timing between when the voltage peaks and when the current peaks for alternating current at a given point in the electric power system.
phasor management unit	A device which measures the voltage, current, and phase at a point on the electrical grid that uses a common time source for synchronization; also known as a synchrophasor.
phosphor	Generally, a substance that exhibits luminescence.
phosphoric acid fuel cell	A type of fuel cell in which the electrolyte consists of concentrated phosphoric acid (H_3PO_4). Protons (H^+) are transported from the anode to the cathode. The operating temperature range is generally 160°C–220°C.
photoelectrochemical water splitting	A process where hydrogen is produced from water using sunlight and specialized semiconductors called photoelectrochemical materials, which use light energy to directly dissociate water molecules into hydrogen and oxygen.
photoelectrodes	A semiconducting electrode in a photoelectrochemical cell that, when impinged by a photon, creates a negatively charged electron and a positively charged hole that are used at the surface of the cathode and anode, respectively, to perform chemical reduction and oxidation, respectively.
photoionization	Ionization of an atom or molecule produced as a result of interaction with electromagnetic radiation.
photosynthesis	The process by which plants and other organisms use light to convert water and carbon dioxide into chemical energy that fuels the activities of the organism and, most commonly, oxygen.
photovoltaic	An electronic device consisting of layers of semiconductor materials fabricated to form a junction (adjacent layers of materials with different electronic characteristics) and electrical contacts and being capable of converting incident light directly into electricity.
photovoltaic effect	The creation of a voltage or electric current in a material exposed to light.
photovoltaics	The method of converting solar energy into usable electrical energy using semiconducting materials that exhibit the photovoltaic effect.
phylum	In biology, a taxonomic rank, below kingdom and above class, wherein a group of organisms are defined as having a “certain degree” of morphological or developmental similarity, or a “certain degree” of evolutionary relatedness.

piezoelectricity	A property of certain solid materials to internally accumulate electrical charge when mechanically stressed.
plasma	An aggregate state of matter comprised of ionized atoms and their free electrons.
plasma wakefield acceleration	A method for accelerating charged particles to very high energy over relatively short distances by creating a charge wake in a plasma using high energy electrons or a laser pulse.
platinum group metals	A group of metals with similar physical and chemical properties to platinum. They are iridium, osmium, palladium, platinum, rhodium and ruthenium. Common uses in vehicles are for emissions control and fuel cell catalysts.
plug-in electric vehicles	A hybrid electric vehicle with batteries that can also be recharged by an external electricity source.
plug-in hybrid electric vehicles	A vehicle that combines a conventional internal combustion engine with an electric propulsion system with batteries that can also be recharged by an external electricity source.
plug-loads	The energy used by equipment using an electric outlet.
point sources	Any discernible, confined, and discrete source of pollutants.
polarization	A property of electromagnetic radiation that describes the constrained set of orientations of the electric or magnetic field vector. Examples include linear and elliptical. Polarization results from the fact that light behaves as a two-dimensional transverse wave.
polygeneration	A process with three or more energy outputs such as electricity, fuel, and heat.
polymer electrolyte membrane fuel cell	A type of acid-based fuel cell in which the transport of protons (H+) from the anode to the cathode is through a solid, aqueous membrane impregnated with an appropriate acid. The electrolyte is a called a polymer electrolyte membrane. The fuel cells typically run at low temperatures (<100°C).
portfolio analysis	A time-dependent system of relationships among competing and complementary energy technologies, the larger energy system, the economy, land use, water, atmospheric composition, and climate.
power use effectiveness	A measure of efficiency for computer data centers. It is calculated as the total facility power consumption divided by the power consumed by the computer equipment.
pre-mixed charge compression ignition	A technique where the fuel, air, and some exhaust gas are mixed before compression and ignition.
primary energy	Energy in the form that it is first accounted for in a statistical energy balance, before any transformation to secondary or tertiary forms of energy.
process intensification	Any technique or apparatus, especially in the chemicals sector, that reduces equipment size and complexity, energy consumption, and/or the environmental impacts of manufacturing processes.
prosumer	A consumer of electric power that can also produce it.
pumped hydro storage	A technology that uses electricity to pump water into an elevated reservoir to store energy and runs the water through a hydroelectric turbine to release energy.
pyrolysis	The decomposition of biomass at high temperatures in the absence of oxygen. It can be used to generate syngas or pyrolysis oils, etc.

quads	Quadrillion British thermal units
radial lines	A classification of the way a conventional electricity distribution system is typically connected to deliver electricity.
radiative transfer	The physical phenomenon of energy transfer via absorption, emission, and scattering as electromagnetic radiation travels through a medium.
radical	A typically highly reactive chemical species (atom, molecule, ion) having an unpaired valence electron.
ramp rates	The rate that a source of electric power can change its output.
rare earth material	A class of seventeen elements in the periodic table, specifically the fifteen lanthanides (lanthanum through lutetium) plus scandium and yttrium.
reactivity controlled compression ignition	A variant of homogeneous charge compression ignition where a higher reactivity fuel is combined with a premixed mixture of a lower reactive fuel, air and exhaust gases.
reflectometry	A non-destructive experimental technique used to probe the properties of a medium by measuring the energy reflected when the wave encounters a material interface different from the initial medium.
reliability (electric grid)	A measure of power system performance; the ability to continue meeting electricity demands.
reserve requirements	The amount of excess available capability of an electric power system over the projected peak load for a utility system that act as a back up in case of an unexpected outage of an operating generation unit.
residual oil zone	Areas of immobile crude oil below the oil-water contact zone.
resilience	The ability of the electric power system to withstand minor disturbances, mitigate the impact of major disturbances, and recover to normal operations after disturbances.
roll-to-roll processing	A class of substrate-based manufacturing processes in which additive and subtractive processes are used to build structures in a continuous manner. Typical roll-to-roll operations include casting, extrusion, coating, and printing of two-dimensional processes.
round-trip efficiencies	The percentage of energy that can be retrieved after it has been stored.
R-Value	A measure of a material's resistance to heat flow in units of Fahrenheit degrees x hours x square feet per Btu. The higher the R-value of a material, the greater its insulating capability.
scintillation	The emission of light from a material upon absorption of radiation, for example a photon, electron, ion, or neutron.
semiconductor	An elemental or compound material having electrical conductivity between that of a conductor and an insulator.
small angle neutron scattering	An experimental technique wherein incident neutrons are elastically scattered (i.e., the energy of the incident and scattered electrons are the same) at small (0.1–10°). angles from the sample, enabling structural analysis at mesoscopic length scales (1–100 nanometers).
small modular reactors	Nuclear power plants that smaller in size than conventional nuclear power plants. Typically, they are 300 MWe or less in capacity.

smart grid technologies	A category of technologies that improve the monitoring, analysis, and control of the grid, leveraging advances in information and communication technologies.
sodium-cooled fast reactor	A next generation reactor that uses liquid metallic sodium as a coolant and relies on high-energy "fast" neutrons.
solar thermochemical hydrogen	A thermochemical process for extracting hydrogen from water using concentrated sunlight as the heat source.
solid oxide fuel cell	A type of fuel cell in which the electrolyte is a solid, nonporous metal oxide with temperatures of operation typically 800°C–1000°C.
solid-state distribution transformer	A technology that combines high-powered semiconductor devices with the function of a conventional distribution transformer to provide new capabilities.
solid-state lighting	Refers to lighting using light-emitting diodes, which are semiconductors that emit light when an electric current passes through them.
spallation	A process by which neutrons and other particles are ejected from a heavy metal target due to impacts from a high-energy particle beam.
spectral lines	The discrete energies in an otherwise continuous spectrum that are absorbed or emitted by an atom or molecule and that are characteristic of that atom or molecule.
state variable	One of a set of variables used to describe the mathematical state of a dynamical system.
state-of-charge window	An indicator of the remaining charge in the batteries for hybrid electric vehicles, plug-in hybrid electric vehicles, and electric vehicles.
steam methane reforming	A method for producing hydrogen, carbon monoxide, or other useful products by reacting high-temperature steam with natural gas.
stochastic optimization	The minimization (or maximization) of a function in the presence of randomness in the optimization process.
storage ring	A circular particle accelerator capable of storing a continuous or pulsed particle beam (typically protons, electrons, or positrons) for long periods of time. Typically used to store electrons that produce synchrotron radiation for an X-ray light source or in a particle collider where two counter rotating stored particle beams are collided at discrete locations.
superconducting magnetic energy storage	A device that stores electric energy in a magnetic field generated from a direct current circulating in a superconducting coil.
superconducting radiofrequency	The science and technology of applying electrical superconductors to radiofrequency technology. When used to build an RF cavity, the negligible electrical resistance of the superconducting material leads to cavities capable of storing energy with almost no loss and very narrow bandwidth.
superconductor	A material that exhibits no electrical resistance below a characteristic temperature.
supercritical fluid	A substance at a temperature and pressure above its critical point, where distinct liquid and gas phases do not exist.
supervisory control and data acquisition systems	A technology used to monitor and control equipment and systems remotely.

sustainability analysis	A methodology that looks at the environmental, life-cycle, climate, and other impacts of different technologies.
sustainable manufacturing	The creation of manufactured products through economically-sound processes that minimize environmental impacts while conserving energy and natural resources.
synchronous generator	A classification of electric power generators that converts mechanical energy into alternating current where the frequency of the output is synchronized with the speed of the rotor.
synchrotron radiation	Electromagnetic radiation produced as a result of very high speed (relativistic) charged particles being accelerated in a curved path.
synthetic biology	An interdisciplinary branch of biology that is focused on the design and construction of new biological parts, devices, and systems, and the modification of existing, natural biological systems for useful purposes.
system congestion	A condition that occurs when there is insufficient available transfer capacity on an electric grid to implement all of the preferred schedules for electricity transmission simultaneously.
Système International	The International System of Units (Système International d'Unités), the modern form of the metric system, comprises a coherent system of units of measurement built on seven base units, used to define twenty-two named units and derive many more unnamed units.
systems biology	The study of the complex interactions between biological components, for example molecules, cells, organisms, or species.
Technology Readiness Levels	A method of estimating technology maturity and uses a scale from 1 (basic science) to 9 (mature technology).
technology roadmapping	A methodology to provide information to inform technology decision-making by identifying technologies and gaps, tracking performance of technologies, and identifying opportunities to leverage RDD&D investments.
terawatt-hour	One trillion watt-hours (also TWh)
tesla	The Système International (SI) derived unit of magnetic flux density.
thermal energy storage system	A technology where thermal energy is stored in a medium such as molten salt, that can be later used to power a turbine to produce electricity, or in ice, that can be later used to offset air conditioning needs.
thermochemical	The chemistry of heat and heat-assisted chemical reactions.
thermodynamic limit	The upper limit on conversion efficiency for turning heat energy into useful work.
thermoelectric generators	Devices that can convert heat differentials in a material directly into electricity through the Seebeck effect.
tight oil (gas)	Oil (natural gas) produced from petroleum-bearing formations with low permeability such as the Eagle Ford, the Bakken, Haynesville, and other formations that must be hydraulically fractured to produce oil (natural gas) at commercial rates. Shale oil (natural gas) is a subset of tight oil (natural gas).
Tokamak	A device capable of confining a plasma using magnetic fields in the shape of a torus. It is a type of magnetic confinement device being explored for harnessing thermonuclear fusion as a power source.
tomography	The process of imaging a 3D object by sections using a penetrating wave.

transactive energy	An advanced control and coordination concept to manage the generation, consumption, or flow of electric power within an electric power system through the use of economic or market-based constructs while considering grid reliability constraints and other objectives.
transformer	A component of the electric power system used to change the voltage of alternating current.
transmission	The high voltage portion of the electricity delivery system used to connect electric suppliers to demand centers across large geographic regions.
transmission electron microscopy	An imaging technique in which a beam of electrons passes through and interacts with an ultra-thin sample, providing atomic-scale resolution of the material structure.
transporter protein	A protein in an organism that functions to move material from one place to another.
transuranic element	An element having an atomic numbers greater than that of uranium (92). Such elements are also sometimes referred to as super-heavy elements.
tribology	The science and technology of interacting surfaces, usually considering the friction and wear between them, and the processes of lubrication.
tritium	A rare, radioactive isotope of hydrogen having one proton and two neutrons in its atomic nucleus.
troposphere	The lowest layer of the earth's atmosphere.
unconventional oil and gas	An umbrella term that refers to resources such as shale gas, shale oil, tight gas, and tight oil that cannot be produced economically through standard drilling and completion practices.
unit commitment	An optimization problem used to determine the operation schedule of individual generators to meet varying loads under different constraints and environments.
variable frequency drive	An adjustable speed motor system that uses changes in electric frequency and voltage to manage motor speed and torque based on application demand.
variable generators	An electric power generation unit whose output changes with time due to factors outside the direct control of the operator, such as wind or solar energy.
vehicle-to-building	A system that allows the electricity stored in a plug-in hybrid electric vehicle, hybrid electric vehicle, or fuel cell electric vehicle (with hydrogen as electricity precursor) to be utilized by a building during periods of high demand or power outage.
vehicle-to-grid	A system that allows the electricity stored in a plug-in hybrid electric vehicle, hybrid electric vehicle, or fuel cell electric vehicle (with hydrogen as electricity precursor) to be utilized by the power grid during periods of high demand.
volt/VAR optimization	An advanced grid application that optimizes voltage profiles and reactive power flows in distribution systems to achieve a variety of objectives.
voltage collapse	An undesirable condition of the electric power system where there is a loss in stability and a blackout occurs when system voltages decrease catastrophically.
waste heat recovery	The capture and useful application of energy that would otherwise be rejected to the environment as waste heat.

watt	The Système International (SI) unit of power, defined as one joule per second.
wedge analysis	A framework for comparing different climate change mitigation activities on the basis of their greenhouse gas reduction potential represented as "wedges."
wide bandgap semiconductors	A semiconductor that has a bandgap of typically three electron volts or more, compared to silicon with a bandgap of 1.1 electron volts. This larger bandgap enables a semiconductor device using this material to operate at much higher voltages, frequencies, and temperatures than silicon-based devices, allowing more powerful electronic devices to be built.
wind turbine	Wind energy conversion device that produces electricity; typically three blades rotating about a horizontal axis and positioned up-wind of the supporting tower.

* The definitions provided in this glossary are specifically for the context in which these terms are used within the Quadrennial Technology Review 2015. In other contexts, these terms may be used differently. A variety of sources were referenced in the development of this glossary, including: "Glossary." U.S. Energy Information Administration, 2015, http://www.eia.gov/tools/glossary/; "Glossary of Energy-Related Terms." U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, 2015, http://energy.gov/eere/energybasics/articles/glossary-energy-related-terms; and many other public sources.