UTAH OFFICE OF
ENERGY DEVELOPMENT

ENERGY TERMS DICTIONARY

This dictionary serves as a valuable reference for employees, students, policymakers, professionals new to the field of energy and anyone interested in understanding the multifaceted world of energy. By familiarizing yourself with these terms, you'll be better equipped to engage in discussions about energy policy, technology, security and sustainability.

Capacity Terms

Capacity
Capacity refers to the maximum electric output a generator can produce. It is typically measured in megawatts (MW) or kilowatts (kW), and is also commonly called "Installed Capacity," "Rated Capacity," or "Nameplate Capacity (see below)"

Capacity Factor
The capacity factor is the ratio between what a generation unit is capable of generating at maximum output versus its actual generation over a period of time. The ratio describes how often a resource is running at maximum power, with 100% meaning the plant is running at maximum power all of the time.

Nameplate Capacity
Utah code defines "Nameplate Capacity" as the sum of the maximum rated outputs of all electrical generating equipment within a facility under specific conditions designated by the manufacturer, as indicated on individual nameplates physically attached to the equipment.

Net Summer Generation Capacity
Plant maximal capacity during the summer. Determined by performance tests during peak demand between June 1 – September 30.

Net Winter Generation Capacity
Plant maximal capacity during the winter. Determined by performance tests during peak demand between December 1 – February 28.

Peak Load
The highest level of electricity demand on an electrical grid over a specified time period. This is referenced at different scales, from single consumers to entire regions, and commonly appears as daily, weekly, monthly, and annual peak load.

Plant Factor
Utah code defines "Plant Factor" as the ratio of the actual annual electrical energy output of an electrical generation facility compared to the potential annual electrical energy output if the electrical generation facility operated at full capacity continuously for the entire year.

Generation Terms

Base load
The minimum amount of electric power delivered or required over a given period of time at a steady rate. It is typically measured in megawatts (MW), kilowatts (kW), or gigawatts (GW).

Black Start Resources
Backup plans that utilities and grid operators use to restart the electrical grid after a blackout or other catastrophic events. Typically consists of starting individual, isolated plant restarts that gradually reconnect to bring the grid back online.

Capacity
The capability to generate electrical power, usually measured in megawatts (MW) or kilowatts (kW).

Demand
The rate at which energy is being used, typically reported in kilowatts (kW) or megawatts (MW). Measuring demand allows local utility companies to anticipate and plan for the maximum electrical needs of all users in the area, ensuring facilities are properly sized to handle customer energy needs.

Electricity
The most common form of energy that powers most of the things we use on a daily basis—including lights, heat and air conditioning, computers and TVs, most major appliances and anything else that plugs into an energy outlet. Electricity is a result of the existence of charged particles (such as electrons or protons), either statically as an accumulation of charge or dynamically as a current.

Energy
The ability to generate heat, light, or power through various sources like fossil fuels, renewable sources (wind, solar), or nuclear power, which can be harnessed and converted to produce electricity or other usable forms of energy for societal needs.

Energy Efficiency
The goal of using less energy to provide the same level of service, usually measured as a percentage improvement over the baseline service. This can be achieved through a wide range of methods, from advances in materials or technology, to operational improvements or decreases in waste from processes.

Energy Production
The process of generating energy, typically in the form of electricity or mechanical power, using various resources and technologies.

Generator
A machine or device that converts one form of energy into another, primarily transforming mechanical energy into electrical energy. This conversion is typically achieved through electromagnetic induction, where the movement of a conductor within a magnetic field generates an electric current.

Transmission

AC Lines
The electrical conductors that carry alternating current (AC) power from generation sources to end-users. These lines are a crucial component of the electrical grid, facilitating the transmission and distribution of electrical energy.

DC Lines
Electrical conductors that carry direct current (DC) power. Unlike the more common alternating current (AC) lines, DC lines maintain a constant polarity and direction of current flow, and are most commonly used when vast amounts of energy need to be transferred long distances.

Grid
An interconnected system of electric cables and power stations that distributes electricity over a large area. In the US this can include the entire country, specific regions, states, or cities. The concept of a “Micro-grid” is becoming more common, which would be an even smaller area such as a single facility.

Line Loss
The electrical power that is lost during the transmission and distribution of electricity through transmission lines. Unavoidable due to the laws of physics, but can be mitigated with different materials and operational conditions.

Load
The amount of electric power drawn at a specific time from an electric power system, or the total power drawn from the system.

Loop Feed
A method of distributing electrical power where multiple power sources or substations are interconnected in a loop configuration. This increases grid resiliency by providing an additional route for electrical transmission.

Radio Feed
The components and methods used to transfer radio frequency (RF) energy between a transmitter or receiver and an antenna.

Substation
An installation that transforms voltage levels, facilitates power transmission and distribution, and provides switching and protection capabilities for the electrical grid.

Supplier / Energy Supplier
Buys the energy from the producer and competes for your business. The supplier prepares offers with different price and contract options.

Underbuild
The practice of installing multiple sets of power lines at different voltage levels on the same transmission structure or pole.

Distribution Lines
Low voltage power lines (typically <46 kV) that connect from substations to residential or other customers that do not require high amounts of power. Distribution lines are more expensive to utilities because they must "step-down" the speed at which power moves to a customer.

Economic and Regulatory Concepts

Important terms for understanding the business and regulation of energy.

Adequate
Utah code defines "Adequate" as the amount of energy sufficient to continuously meet demand from under normal conditions, not including planned outages and temporary service disruptions.

Affordable
Utah code defines "Affordable" as priced to be accessible to the population without causing financial strain or compromising basic needs, quality of life, or well-being.

Aggregation
A practice that allows marketers and local governments to pool the electric or natural gas consumption of multiple customers, or residents as in the case of local governments, in order to purchase the electricity or natural gas at a bulk rate.

Demand Side Management
A strategic approach used by electric utilities to actively monitor, manage, and control electricity consumer demand by shifting their consumption patterns. This strategy aims to achieve energy conservation, reduce peak demand, and ultimately lower electricity costs for both utilities and consumers.

Early Retirement
Utah code defines "Early retirement" as the closure of an electrical generation facility

before reaching the end of a normal operational lifespan when significant upgrades and renovations to prolong the electrical generation facility's service are still financially reasonable investments.

Energy Markets
Commodity markets that deal specifically with the trade and supply of energy. Energy markets typically include the trading of electricity, natural gas, oil, coal, carbon emissions, nuclear power, solar energy and wind energy.

Deregulated Energy Markets:

- Allow competitors to buy and sell electricity
- Generation owners sell wholesale electricity to retail suppliers
- Consumers can choose between different retail electricity suppliers
- Offer more renewable energy options and green pricing programs
- Provide different contract structures (fixed, indexed, hybrid)

Regulated Energy Markets:

- Utilities own and operate all electricity generation, transmission, and distribution
- Utilities have complete control from generation to the meter
- Electricity rates are set by state public utility commissions
- Utah is a “non-retail,” or regulated, energy market

UtilityTariff

A utility tariff governs how an energy provider (electric or natural gas) charges a customer for their energy and natural gas usage. Each tariff is approved by a State Public Service Commission. It is to the discretion of the utility to determine which tariff is best for the customer of the utility. A tariff determines when and how much a customer will pay, based on the needs of the customer. A tariff varies depending on the customer’s load profile and power requirements (if the customer is industrial or residential, and whether the customer needs to pay system upgrades).

Energy Return on Investment (EROI)
The EROI is the ratio of the amount of usable energy delivered by an energy source compared to how much energy it took to obtain the resource.

Forced Retirement
Utah code defines “Forced Retirement” as the closure of an electrical generation facility as a result of a federal regulation that either directly mandates the closure of an electrical generation facility, or where the costs of compliance are so high as to effectively force the closure of an electrical generation facility.

Greenwashing
Deceptive practices where companies or utilities falsely portray their products, services, or operations as more environmentally friendly than they actually are. This has become a significant issue as the demand for clean and renewable energy grows.

Governmental Entity
Utah code defines “Governmental Entity” as

(a) any department, agency, board, commission, or other instrumentality of the state
(b) a political subdivision of the state.

Market Purchases
The acquisition of electricity by utilities or other load-serving entities from the wholesale electricity market to meet their customers' demand.

Nonattainment Area
A geographic region that fails to meet the National Ambient Air Quality Standards (NAAQS) set by the U.S. Environmental Protection Agency (EPA) for one or more criteria air pollutants, including ozone, particulate matter, lead, carbon monoxide, sulfur oxides and nitrogen oxides.

Power Purchase Agreement (PPA)
A long-term contract between an electricity generator (seller) and a power buyer (typically a utility, corporation, or government entity).

Replacement Plan
Utah code defines “Replacement Plan” as a plan by a qualified utility to replace the energy supply of an existing electrical generation facility.

Right of Way
A legal right granted to utility companies or energy providers to access, use, or pass through a specific portion of land for the purpose of constructing, operating, and maintaining energy infrastructure.

Energy Sources

Energy sources can be broadly categorized into renewable (continuously replenished by nature) and non-renewable (finite resources) types. Solar, wind, hydropower, geothermal, biomass, and tidal/wave energy are considered renewable, while coal, oil, natural gas, and nuclear are non-renewable.

Clean
Utah code defines “Clean” as minimizing adverse environmental impact and meeting state standards for environmental quality.

Dispatchable
Utah code defines “Dispatchable” as available for use on demand and generally available to be delivered at a time and quantity of the operator's choosing.

Fossil Fuels
Fuels formed from the natural anaerobic decomposition of dead organisms, including coal, oil and natural gas.

Fuel
Material such as coal, gas, or oil that is burned to produce heat or power.

Hydrogen
An energy carrier that can be produced from various sources and used in fuel cells or combustion.

Intermittent
Utah code defines “Intermittent” as a generating energy resource available for use on a variable basis that is dependent on elements outside of the control of the operator.

Nuclear Plant
A nuclear facility that includes one or more nuclear reactors, along with infrastructure such as turbines, generators, cooling systems, and waste storage units. The plant integrates these components to convert the reactor’s heat into usable electricity and manage operations safely.

Nuclear Reactor
The core component of a nuclear power plant where nuclear fission occurs. It houses and controls the chain reaction that splits uranium atoms to release energy in the form of heat. This heat is used to produce steam, which drives turbines connected to generators, creating electricity.

Micro Nuclear Reactor
A very small nuclear fission reactor with the following key characteristics:

- Power output: Typically generates up to 20 megawatts thermal energy.
- Size: 100 to 1,000 times smaller than conventional nuclear reactors.
- Portability: Designed to be easily transported by road, rail, or air due to compact size.
- Flexibility: Can operate as part of the electric grid, independently, or in a microgrid.
- Deployment: Intended for remote locations, military bases, disaster-affected areas, or places with limited access to traditional power sources.
- Extended operation: Expected to run for years without refueling.
- Modular design: Often factory-assembled for rapid deployment and installation

Particulate Matter
A mixture of solid particles and liquid droplets suspended in the air, often resulting from energy production and consumption processes.

Renewable Energy
Energy derived from natural processes that are continuously replenished such that they are inexhaustible on human time-scales. This includes sources such as sunlight, wind, rain, tides, geothermal heat, and biomass. Utah focuses on “clean” energy as opposed to renewable within its code.

Small Modular Reactors (SMRs)
An advanced nuclear reactor with the following key characteristics:

- Size: Typically generate up to 300 MWe (megawatts electric) per unit, about 1/3 the capacity of traditional nuclear reactors.
- Modular design: Components are factory-assembled and transported to the site for installation, allowing for easier and faster deployment.
- Flexibility: Can operate as part of the electric grid, independently, or in a microgrid.
- Scalability: Additional modules can be added as power demand increases.
- Safety features: Many designs incorporate passive safety systems that don't require human intervention.
- Compact size: SMRs have a smaller footprint compared to traditional nuclear plants. For example, a 920-MW NuScale SMR would require only 35 acres, while a traditional plant of similar capacity would need nearly 500 acres.
- Versatility: Can be used for power generation, process heat, desalination, or other industrial applications.
- Reduced construction time and costs: Factory assembly and modular design aim to decrease on-site construction time and potentially lower costs.
- Complementary to renewables: Can be paired with intermittent energy sources like wind and solar to ensure consistent power availability.

Spent Fuel
Nuclear fuel that has been used in a nuclear reactor and can no longer efficiently sustain a nuclear chain reaction. While it is highly radioactive and often treated as waste, up to 96% of spent fuel can be recycled to recover valuable materials like uranium and plutonium, which can be processed into new fuel for reactors, reducing both waste volume and the need for new raw materials.

Types of Energy Sources

Biomass
Energy produced by burning organic matter, such as plants, wood, or waste materials.

Coal
A fossil fuel formed from ancient plant matter, burned to generate heat and electricity.

Geothermal Energy
Heat energy extracted from beneath the Earth's surface, used for heating or electricity generation.

Hydropower
Energy derived from flowing water, typically using dams to generate electricity.

Molten Salt Reactor
A class of nuclear fission reactor in which the primary reactor coolant is molten salt.

Natural Gas
A fossil fuel composed primarily of methane, used for heating and electricity generation.

Nuclear Energy
Energy released from splitting atoms (usually uranium) in a process called fission.

Oil (Petroleum)
A liquid fossil fuel extracted from the Earth, refined into various products like gasoline.

Solar Energy
Energy harnessed from the sun's radiation, converted into electricity or heat.

Tidal/Wave Energy
Energy captured from the movement of ocean waves or tides.

Wind Energy
Kinetic energy from moving air masses, captured by wind turbines to generate electricity.

Fuels vs. Batteries

Fuels and batteries represent two distinct approaches to energy storage and utilization. Fuels, such as petroleum, natural gas, coal, uranium, and biofuels, are substances that store chemical or atomic energy, which is released through burning or other reactions to produce heat or mechanical work. They are typically used in engines, power plants, and heating systems. Batteries, on the other hand, are electrochemical devices that store electrical energy through chemical reactions and can release it as electricity on demand.

While fuels generally offer higher energy density and are suitable for large-scale energy needs, batteries excel in instant power delivery and storage, and are increasingly used in electric vehicles and grid storage applications.

Fuels

Materials that release energy when they undergo a chemical reaction, typically combustion. They serve as dense repositories of energy used for various applications such as heating, transportation, and electricity generation.

Coal
A solid fossil fuel formed from ancient plant matter, used primarily for electricity generation and industrial processes.

Biomass
Organic material (e.g., wood, agricultural residues) that can be burned or converted into biofuels for energy production.

Biofuels
Fuels produced from biological materials, such as ethanol from corn or biodiesel from vegetable oils.

Diesel
A heavier liquid fuel derived from crude oil and requiring less refinement, used in diesel engines for vehicles and machinery.

Gasoline
A volatile liquid fuel derived from petroleum, commonly used in internal combustion engines.

Hydrogen
A clean-burning fuel that can be produced from various sources; when used in fuel cells, it emits only water vapor.

Kerosene
A liquid hydrocarbon fuel used in jet engines and for heating; derived from crude oil.

Natural Gas
A fossil fuel primarily consisting of methane, used for heating, electricity generation, and as a vehicle fuel.

Nuclear Fuel
Any material which releases energy from a sustained nuclear chain reaction. Commonly used elements include Uranium-235 and Plutonium-239.

Petroleum (Crude Oil)
A thick liquid composed mainly of hydrocarbons, extracted from the earth and refined into various fuels like gasoline and diesel.

Propane
A gaseous hydrocarbon used as a fuel for heating, cooking, and vehicles, often stored as a liquid under pressure.

Batteries

Devices that store electrical energy through chemical reactions and release it as electricity when needed. They are essential for balancing supply and demand in power systems, especially with the increasing use of renewable energy sources like solar and wind.

Alkaline Battery
A common disposable battery type used in household devices; known for its long shelf life and availability.

Flow Battery
A type of rechargeable battery where energy is stored in liquid electrolytes; suitable for large-scale energy storage applications.

Lead-Acid Battery
A rechargeable battery commonly used in vehicles; known for its low cost and reliability but has a lower energy density compared to newer technologies.

Lithium-Ion Battery
A rechargeable battery widely used in portable electronics and electric vehicles due to its high energy density and efficiency.

Nickel-Cadmium (NiCd) Battery
An older type of rechargeable battery known for its durability but has been largely replaced by lithium-ion batteries due to environmental concerns.

Nickel-Metal Hydride (NiMH) Battery
A rechargeable battery that offers higher capacity than NiCd batteries; commonly used in hybrid vehicles.

Solid-State Battery
An emerging technology that uses solid electrolytes instead of liquid ones, promising higher energy density and safety.

Zinc-Air Battery
A type of battery that uses oxygen from the air to produce electricity; often used in hearing aids and other small devices

Infrastructure and Technology

Terms related to energy production and distribution systems.

Baseload Power
The minimum amount of electric power needed to be supplied to the electrical grid. It is the constant, steady level of electricity demand that must be met 24 hours a day, 7 days a week.

Behind-the-meter
Energy systems and equipment located on the customer's side of the utility meter.

Self-generation
A consumer of power that supplies electricity to itself with energy that it generates.

Black Start Resources
Backup plans that utilities and grid operators use to restart the electrical grid after a blackout or other catastrophic events.

Brayton Power Cycle
A thermodynamic cycle that describes the operation of gas turbine engines.

Clean
Utah code defines “Clean” as minimizing adverse environmental impact and being able to meet state standards for environmental quality.

Combined Cycle Power Plant (CCPP)
A sophisticated energy generation facility that integrates both gas and steam turbines to produce electricity. This system utilizes the waste heat from a gas turbine, which is generated during the combustion of fuel, to create steam in a heat recovery steam generator (HRSG). The steam then drives a steam turbine, enhancing overall efficiency.

Demand Side Management
A strategic approach to energy conservation that focuses on managing consumer demand for energy rather than simply supplying it.

Dispatchable Power
Utah code defines “Dispatchable” as available for use on demand and generally available to be delivered at a time and quantity of the operator's choosing.

Distribution System
The poles, wires, and transformers used to deliver electric energy from a bulk power supplier to the consumer.

Electrical Generation Facility
Utah code defines “Electrical Generation Facility” as a facility that generates electricity for provision to customers**.**

Electrical Utility
A company which generates, distributes, and sells electricity to the public. Utah code defines “Qualified Utility” as an electric corporation that serves more than 200,000 retail customers in the state.

Energy Carrier
A substance or phenomenon that holds energy and can be converted into other forms of energy, such as heat or mechanical work.

Energy Infrastructure
The physical systems, facilities, and equipment used for the production, transmission, distribution, and storage of energy.

Energy Storage
The capture of energy produced at one time for use at a later time to reduce imbalances between energy demand and energy production.

Generator
A machine or device that converts one form of energy into another, primarily transforming mechanical energy into electrical energy. This conversion is typically achieved through electromagnetic induction, where the movement of a conductor within a magnetic field generates an electric current.

Grid
An interconnected system of electric cables and power stations that distributes electricity over a large area.

Grid Inertia
The inherent ability of an electrical power system to resist changes in its frequency. It comes from the heavy spinning parts inside traditional power plants, such as those that burn coal, gas, or use water turbines. When something unexpected happens, like a power plant suddenly shutting down or a big surge in electricity use, this spinning energy helps keep the electricity supply steady for a few seconds, giving operators time to react and prevent blackouts.

Permits
The official approvals and authorizations required from various governmental bodies before constructing, operating, or modifying energy infrastructure.

Pumped Hydro Storage
Also known as pumped-storage hydroelectricity, pumped hydrostorage is a type of energy storage system that uses water and gravity to store and generate electricity.

Rakine Power Cycle
A thermodynamic cycle that converts thermal energy into mechanical work, primarily used in steam-powered engines and power plants.

Reclamation
The process of restoring land that has been disturbed by energy development activities back to its original state or a functionally equivalent condition.

Reliable
Utah code defines “Reliable” as:
(a) supporting a system generally able to provide a continuous supply and the resiliency to withstand sudden or unexpected disturbances.
(b) for systems delivering electricity, the ability to provide electricity at the proper voltage and frequency.

Secure
Utah code defines “Secure” as protected against disruption, tampering, and external interference.

Transformers
Electrical devices that use electromagnetic induction to transfer electrical energy between circuits, typically changing the voltage and current levels while maintaining the same frequency. Transformers play a crucial role in energy systems, particularly in the electrical grid and power distribution.

Transmission
The bulk transfer of electrical power from generating facilities to electrical substations located near population centers.

Regulatory Bodies
Organizations that oversee the energy sector. These regulatory bodies work together to oversee various aspects of the energy sector, from production and transmission to distribution and environmental impact. Their roles often overlap and complement each other to ensure a comprehensive regulatory framework for the energy industry.

Department of Energy (DOE)

- Encourages energy security and technological innovation
- Regulates export of liquefied natural gas
- Ensures reliability of nuclear capabilities
- Provides financing support for innovative energy technologies
- Authorizes export and import of natural gas and electric energy

Environmental Protection Agency (EPA)

- Sets and enforces environmental regulations related to energy production and use
- Regulates emissions from power plants and other energy facilities
- Implements programs like the Clean Power Plan

Federal Energy Regulatory Commission (FERC)

- Regulates interstate transmission of electricity, natural gas, and oil
- Reviews proposals for LNG terminals and interstate natural gas pipelines
- Licenses hydropower projects
- Oversees electricity wholesale markets and transmission reliability
- Enforces regulatory requirements through civil penalties

Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs)

- Manage regional electricity grids and wholesale electricity markets
- Ensure non-discriminatory access to transmission
- Coordinate grid operations and planning

North American Electric Reliability Corporation (NERC)

- Develops and enforces reliability standards for the bulk power system
- Assesses and reports on the reliability and adequacy of the grid
- Operates under FERC oversight

Nuclear Regulatory Commission (NRC)

- Regulates commercial nuclear power plants and other uses of nuclear materials
- Licenses and inspects nuclear facilities
- Establishes safety standards for nuclear operations

Public Service Commission (PSC)

- Regulatory Oversight: Supervises public utilities in Utah, ensuring compliance with state laws.
- Rate-making Authority: Reviews and approves utility rates to ensure they are fair for consumers and companies.

- Consumer Protection: Investigates complaints and enforces regulations to protect consumer interests.

State Public Utility Commissions (PUCs)

- Regulate retail electricity and natural gas sales to consumers
- Oversee the construction of electric generation facilities
- Regulate activities of municipal power systems and rural electric cooperatives

Units and Measurements

Energy is quantified using various units, each serving a specific purpose

Barrel of oil equivalent (BOE)
A unit of energy based on the energy released by burning one barrel of crude oil.

British Thermal Unit (BTU)
The energy needed to raise the temperature of 1 pound of water by 1°F (1 BTU ≈ 1055.06 joules).

Calorie
The energy needed to raise the temperature of 1 gram of water by 1°C (1 calorie ≈ 4.18 joules).

Electronvolt (eV)
A very small unit of energy used in particle physics and atomic physics.

Gigawatt (J)
1,000 megawatts, typically used for grid-scale power measurements.

Joule (J)
The basic unit of energy in the International System of Units (SI).

Kilowatt (kW)
1,000 watts, often used to measure electrical power output.

Kilowatt-hour (kWh)
A common measure of electrical energy consumption. Consuming a kilowatt of electricity for 1 hour

Megawatt (MW)
1,000 kilowatts, typically used for large-scale power generation.

Therm
A unit of heat energy equal to 100,000 BTU, often used for natural gas billing.

Ton of oil equivalent (TOE)
The amount of energy released by burning one ton of crude oil.

Watt (W)
The standard unit of electrical power, equal to one joule per second.

Utah Utilities

Utah is home to a variety of public utilities that include electric and gas utilities. Public utilities establish their service territory through the Utah Public Service Commission, who determines where their service area begins and ends.