

Glossary of Electric System Terms

90/10 Load—An annual forecast of the state’s peak electric *demand* (load) where there is a 10-percent chance that the actual system peak load will exceed the forecasted value in any given year or, stated another way, it is expected that on the average the forecast will be exceeded once every ten years.

affected utility—Affected utilities are those whose systems cause, contribute to or would experience an impact from a reliability issue.

angle—Used to measure the synchronism between different alternating quantities, such as voltage or current. It is often an important performance measure; it is measured in degrees.

baseload—A baseload power plant is an electric *generation* plant that is expected to operate in most hours of the year.

blackout—A total loss of power over an area; usually caused by the failure of electrical equipment on the power system.

breaker-and-a-half—A substation design that offers advantages such as ensuring that the failure of any one circuit breaker will not interrupt power for more than a brief time. The designs also allow parts of the substation to be de-energized for maintenance and repairs without causing a power interruption.

brownout—Abnormally low voltage that causes voltage-sensitive equipment such as computers, motors and certain types of lighting to have degraded or interrupted performance.

bus—Also referred to as a “node” or a “station” or a “substation.” A common connection point for two or more electrical components, such as a transformer, a generator.

capability—The capacity of a piece of equipment to perform its intended function, such as carrying current for a conductor or transformer, or interrupting current for a switch or breaker, or supplying power for a generator. Certain pieces of equipment can have different capabilities based on certain factors, such as ambient conditions (temperature, wind) and the amount of time the equipment is expected to perform the intended function. Typically, a Normal rating or capability is nearly continuous, and an Emergency capability is a higher capability utilized during infrequent events for a short duration, typically twelve hours or less.

capacitor—A device that stores an electrical charge and is typically used to address low voltage issues on a power system.

conductor—Part of a *transmission* or *distribution* line that actually carries the electricity; in other words, the wire itself. The wire or conductor is just one part of a transmission line; other parts include the poles and the insulators from which the conductor is hung. A conductor must have enough capacity to carry the highest *demand* that it will experience, or it could overheat and fail.

contingency—An unplanned event creating an outage of a critical system component such as a **transmission** line, **transformer**, or **generator**.

converge—Power flow programs use an iterative mathematical process to solve for, or converge to, the solution of unknown system parameters, such as **Voltage** and **Angle**. When the mathematics do not result in a solution, the iterative process has “failed to solve” or “failed to converge” to a solution. This result is an indication of voltage collapse or **loss of load**.

Critical Energy Infrastructure Information (CEII)—Specific engineering, vulnerability, or detailed design information about proposed or existing infrastructure (physical or virtual) that: (1) relates details about the production, generation, transmission, or distribution of energy; (2) could be useful to a person planning an attack on critical infrastructure; (3) is exempt from mandatory disclosure under the Freedom of Information Act; and (4) gives strategic information beyond the location of the critical infrastructure.

demand—The amount of electricity being used at any given moment by a single customer, or by a group of customers. The *total* demand on a given system is the sum of all of the individual demands on that system occurring at the same moment. The *peak* demand is the highest demand occurring within a given span of time, usually a season or a year. The peak demand that a **transmission** or **distribution** system must carry sets the minimum requirement for its capacity (see also the definition for **energy**).

demand-side management (DSM)—A set of measures utilized to reduce energy consumption. Energy conservation is one kind of DSM.

dispatch—As a verb: turning on or off, or setting the value or output of a generator, a **capacitor** bank, **reactor** or **transformer** setting. As a noun: the state or status of these devices.

distribution—Distribution lines and distribution **substations** operate at lower **voltage** than the **transmission** systems that feed them. They carry electricity from the transmission system to local customers. When compared to transmission, distribution lines generally use shorter poles, have shorter wire spans between poles and are usually found alongside streets and roads, or buried beneath them. A typical distribution **voltage** would be 13.8-kV.

distribution utility—A utility in the state of Vermont that is responsible for owning, operating, and maintain the distribution part of the electric system within an area.

easement—A right to use another’s land for a specific purpose, such as to cross the land with transmission lines.

failed to converge—See **converge**.

fault—The failure of a line, **transformer**, or other electrical component. Once such a component has failed (due to overheating, short-circuiting, physical breakage, or other trauma) it is automatically taken out of operation by a circuit breaker that quickly turns the component off. Once it has been “tripped

off” it no longer poses a threat to human safety, but its loss may present a difficult burden to the remaining system (see also the definition of **redundant** below).

forward capacity market—A marketplace operated by ISO-NE using an auction system with a goal of purchasing sufficient power capacity for reliable system operation for a future year at competitive prices where all resources, both new and existing, can participate.

generation or generator—A device that converts mechanical **power** from an engine, a water wheel, a windmill, or other source, into electrical power.

Inductor—See **reactor**.

kilowatt-hour (kWh)—One thousand watt-hours. A watt-hour is a measure of the amount of electric energy generated or consumed in a given period of time.

kilovolt (kV)—One thousand volts. Volts and kilovolts are measures of **voltage**. **lead distribution utility** - A utility selected by the **affected utilities** to facilitate decision-making and to lead the effort to conduct the **NTA** analysis

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load—see **demand**.

load shedding—Intentionally turning off power to a customer or group of customers, usually for reliability reasons such as to avoid a blackout or equipment damage.

loss of load—See **blackout**

megawatt (MW)—One million watts. Watts and megawatts are measures of power. To put this in perspective, the peak power demand for the New England region is approaching 30,000 MW or 30,000,000,000 (thirty billion) watts.

N-0 or N-1 or N-1-1—The term N minus zero (or one or two) refers to the failure of important equipment. Although these terms sound complex, they are actually quite simple. “N” is the total number of components that the system relies on to operate properly. The number subtracted from N is the number of components that fail in a given scenario. Therefore, N-0 means that no components have failed and the system is in a normal condition. N-1 means that only one component has failed. N-1-1 means that two components have failed, which is generally worse than having only one fail (see also the definition of **contingency** above).

non-transmission alternative (NTA)—The use of a non-transmission solution such as local generation or energy efficiency to solve a transmission reliability deficiency.

out of angle—See **phase shifter**.

per unit (pu)—The ratio of an actual or measured quantity to the base or reference value of the same quantity. For example, a 0.9 pu voltage on a 100 kV system represents a 90 kV measurement of the voltage.

phase shifter—Also referred to as a “phase shifting transformer” (PST) or “phase angle regulator” (PAR). A **transformer** that adjusts the **angle** between two **buses** in order to change the amount of power flowing between these buses. Some of these transformers are also able to adjust **voltage**. These transformers have an **angle capacity**, which states the extent to which the **transformer** can adjust the **angle** between two **buses**. When the **angle capacity** is reached before the desired flow can be achieved, it is stated that the transformer ran out of **angle** or that the **angle capacity** of the transformer is not sufficiently large.

power—The amount of electricity that is consumed (**demand**) or supplied at any given time.

power factor—A measure of the amount of reactive power (by-product of alternating current, i.e., AC) in relation to the real **power** (component of power that can heat).

pool transmission facility or facilities (PTF)—Generally speaking, any transmission facility operating at 69 kV or higher and connected to other transmission lines or transmission systems is considered a PTF. PTF falls under the authority of ISO New England and the construction of new PTF facilities is generally funded through the ISO on a load ratio share basis among its member utilities.

reactive reinforcement—Also referred to as “reactive compensation.” The act of adding a **capacitor** bank or shunt **reactor** to increase or reduce **voltage**.

reactor—A device that stores energy in the form of a magnetic field, and then uses this energy to induce current. Typically used to address high voltage issues on a power system.

reliability deficiency—An existing or projected future violation, before or after a contingency, of the applicable planning, design and/or operating criteria, with consideration given to the reliability and availability of the individual system elements.

renewable power source—Any power source that does not run on a finite fuel which will eventually run out, such as coal, oil, or natural gas. Renewable power sources include solar, wind and hydro generators, because sunlight, wind and running water will not run out. Generators that burn replaceable fuels also commonly qualify as renewable power sources. Examples include bio-diesel generators that run on crop-derived fuels and wood-burning generators.

right of way (ROW)—The long strip of property on which a **transmission** line is built. It may be owned by the utility or it may be an **easement**.

ring bus—See **breaker-and-a-half, bus, substation**.

sensitivity studies—A technique of analysis whereby different values of certain key variables such as the permanent loss of a generation or transmission resource are tested to see how sensitive study results are to possible change in assumptions.

shoulder load—A load level that is within some band width over and above 80% of the peak load level.

steady state—Refers to the period of time after all momentary network disturbances and automatic equipment adjustments have ended.

substation—A substation is a fenced-in area where several generators, *transmission* and/or *distribution* lines come together and are connected by various other equipment for purposes of switching, metering, or adjusting *voltage* by using *transformers*.

subtransmission—Subtransmission lines are power lines that typically operate at a *voltage* of 34,000 to 70,000 volts and are generally below 100 kV.

thermal—Refers to the heating effects of current flow. Often used in conjunction with capability, impact, analysis.

transformer—A device that typically adjusts high-*voltage* to a lower voltage. Different voltages are used because higher voltages are better for *moving* power over a long distance, but lower voltages are better for *using* electricity in machinery and appliances. Transformers are commonly described by the two (or more) voltages that they connect, such as “115/13.8-kV,” signifying a connection between 115-kV and 13.8-kV equipment or lines.

transmission—Transmission lines and transmission *substations* operate at high *voltage* and carry large amounts of electricity from centralized *generation* plants to lower voltage *distribution* lines and substations that supply local areas. Transmission lines use poles or structures, have long wire spans between poles and usually traverse fairly straight paths across large distances. Typical transmission *voltages* include 345-kV and 115 kV and generally all are above 100 kV.

transmission system reinforcements—Transmission line or substation equipment added to existing transmission infrastructure.

voltage—Voltage is much like water pressure in a system of pipes. If the pressure is too low, the pipes cannot carry enough water to satisfy the needs of those connected to them. If the voltage is too low, the electric system cannot carry enough electricity to satisfy the needs of those connected to it.

voltage collapse -A phenomenon whereby a series of events ultimately results in a blackout after a certain amount of time ranging from seconds to minutes.

voltage instability—A phenomenon whereby system operators cannot maintain acceptable system voltage given the tools at their disposal for a specific combination of load, generation and transmission. Voltage collapse may ensue.