

## **Glossary of Terms**

Note: Underlined items are defined elsewhere in this glossary.

**248 application process** - The 248 application process is a regulatory process based on the Vermont law known as Section 248 (30 V.S.A. 248). It is administered by the Vermont PSB to consider proposed projects by utilities serving Vermont, and to determine whether they are in the public interest. Successful applicants are granted a CPG (Certificate of Public Good) which is essentially a license to build and operate the proposed project. The 248 process permits interested parties that qualify by statute and by procedure, to have a say in the hearing process and to influence the decision by the PSB to issue a CPG, a conditional CPG or a notice of denial.

**ANR (Agency of Natural Resources)** - ANR is Vermont state's agency in charge of protecting air, water, and soil quality, as well as wildlife.

**ASC (Area Specific Collaborative)** - The ASC is a provisional association of interested parties organized under PSB Docket No. 6805 to jointly develop an integrated, least-cost solution to the Southern Loop's problems. It includes representatives from Vermont's DPS, the Stratton and Bromley ski resorts, and CVPS.

**Breaker** - See the definition of *circuit breaker* below.

**Capacitor** - A capacitor is a device located in a substation that supports voltage within a local area. It has no moving parts and is relatively inexpensive. Capacitors are often added to transmission and distribution systems to keep the voltage acceptably high as electric demand grows over time. Over-reliance on this strategy may lead to a system that has high enough voltage, but with poor stability, meaning that its voltage is too easily changed by the daily cycle of demand ramping up and down. This forces utility personnel to constantly re-adjust which capacitors are on and which are off, and makes the system vulnerable to a blackout.

**Capacity or capability** - Capacity is the maximum demand that an electrical component or system can carry without overheating.

**Circuit breaker** - A circuit breaker is a large switch that turns utility equipment on or off. It may be operated manually in order to safely perform preventative maintenance on equipment, or it may operate automatically to turn off equipment that is malfunctioning (see also the definition of *fault* below).

**Conductor** - The conductor is the part of a transmission 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** - A contingency is an unplanned outage of a critical system component such as a transmission line, transformer, or generator. The time prior to the contingency is referred to as *pre-contingency* and the time after it has begun is referred to as *post-contingency*.

**Controlled blackout** - A controlled blackout is simply the same thing as a rolling blackout.

**CPG (Certificate of Public Good)** - A CPG is a document that may be granted by the Vermont PSB at the conclusion of a Section 248 application process. It is essentially a license to build a proposed project that has been applied for (such as a new transmission line or substation) and signifies the PSB's conclusion that the project is in the best interests of the public.

**CVPS (Central Vermont Public Service)** - CVPS is an investor-owned and state-regulated electric company responsible for the purchase or generation of electricity and its delivery to customers within its Vermont franchise area.

**Demand** - Demand is 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 total peak demand that a transmission or distribution system must carry sets the minimum requirement for its capacity (see also the definition for *energy*).

**Demand factor** - Demand factor is the *average demand* of a customer or system, divided by the *highest* (i.e. *peak*) demand of that same customer or system. The peak demand determines how much infrastructure is needed; the demand factor determines how fully that infrastructure is being utilized over time.

**DG (Distributed Generation)** - Distributed generators are relatively small, dispersed electric generators that are intended to serve local electrical demand. They have come into greater use in recent years to satisfy gradual growth in demand, without the need to periodically build expensive, obtrusive, transmission lines. They may be owned and operated by the local utility or by individual customers. Typically, they are driven by gasoline or diesel engines, or by renewable power sources such as solar, wind, and running water. Depending on their size, they may be connected to a transmission system or to a distribution system.

**Dispatch** - Dispatch is the act of turning on or turning off system resources that are needed in varying amounts over time, such as generators and capacitors. Such resources are said to be “dispatchable”.

**Distribution** - Distribution lines and distribution substations operate at lower voltage than the transmission systems that feed them. They carry relatively small amounts of electricity to local customers. Distribution lines use shorter poles, have shorter wire spans between poles, and are usually found alongside streets and roads, or buried beneath them. Typical distribution voltages include 12.5 kV and 4 kV.

**DPS (Department of Public Service)** - The DPS is Vermont state's public advocate in legal proceedings and other forums that involve utility regulation, statutes, and related issues. DPS staff often specialize in specific areas such as engineering, economics, or law.

**DSM (Demand Side Management)** - Demand side management, like DG (distributed generation), is intended to satisfy local growth in electrical demand without the need to build new transmission lines. However, it differs from DG in that it strives to *reduce the demand itself* rather than to *increase the supply*. DSM generally falls into one of four categories:

1. **Conservation** measures such as replacing standard light bulbs with high-efficiency light bulbs, or adding extra insulation to buildings.
2. **Special utility rates and contracts** that encourage customers to conserve energy and/or to move their electrical use to those hours when overall electrical demand tends to be low, in order to avoid overburdening the transmission system that supplies that demand. An example of this is an *interruptible rate* that provides the customer with a discount in exchange for the utility's right to interrupt the associated demand when system reliability or economic considerations necessitate it.
3. **Load control** systems, also known as **demand response** systems, that disable non-essential customer appliances (e.g. hot water heaters) during high-demand hours.
4. **Fuel switching** measures that replace electricity-powered heating, cooking, and drying equipment with fuel-powered equipment, such as the replacement of electric ovens with gas ovens.

**DUP (Distributed Utility Planning)** - Planning method that seeks to find the lowest cost of providing reliable energy delivery through traditional means such as transmission, as well as newer approaches such as DG and DSM. Often, these strategies are used in combination.

**Efficiency Vermont** - Efficiency Vermont is Vermont's energy efficiency utility and administers programs under contract with the PSB that conserve energy by utilizing it more efficiently (see also the definition of *DSM* above).

**Energy** - Energy is the ability to do work. Energy comes in many forms (electrical, chemical, thermal, mechanical, etc). It is measurable in common units, regardless of which form it is in. The *rate* at which energy is made, used, transformed, or transferred is called power or demand. Energy is expensive to produce and therefore should not be wasted.

**Fault** - A fault is 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" (in the parlance of engineers) 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).

**Generation or Generator** - A generator is a device that converts mechanical power from an engine, a water wheel, a windmill, or other source, into electrical power. Generators have internal parts that spin as they make electricity, similar to an electric motor.

**Hydro** - Hydro is electric generation driven by running water such as streams or rivers.

**Island or Islanding** - An *island* in utility parlance, means an area of the electrical system that is electrically cut off from the main system by switches or by disabled equipment, but that is able to serve its own demand by means of generation located within its own boundaries. This requires that the generation have special controls to match its output to the island's ever-changing demand, and also requires that there be enough generation to satisfy the island's total demand. *Islanding* is the process of disconnecting from the main system and re-establishing service using these specialized generators.

**ISO New England Inc.** - ISO New England Inc. is the "Independent System Operator" for all of New England, and is responsible for the coordinated planning, PTF funding, and operation of the transmission system, as well as reliability oversight of generators and other electrical facilities. ISO-NE is also responsible for the administration of New England's power supply markets (in which utilities make bids or exercise contracts for other companies' generation to meet their own customers' demand).

**kV (kilovolt)** - A kilovolt is a thousand volts. Volts and kilovolts are measures of voltage. As an example, the "Southern Loop" subtransmission line that runs from Bennington to Brattleboro operates at 46 kV or 46,000 volts.

**Load** - Load is simply the same thing as demand.

**Load Duration Curve** - A load duration curve is a mathematically-based graph depicting the magnitude of load (i.e., demand) over a long period of time, usually one year. The graph does not show the constant up and down movements of daily or weekly demand cycles. Instead, it is a continuous function that transitions smoothly from peak demand to minimum demand over the given duration. This is because the individual data points, adjacent to one another along the curve, are *sequential in their demand value but are not sequential in their time value*. The flatter the slope of the curve in a given vicinity, the greater the duration of the associated demand value. The demand near the middle of the load duration curve is commonly referred to as "shoulder load" because of its resemblance to a human shoulder. Appendices E and H provide example load duration curves.

**Load factor** - Load factor is simply the same thing as demand factor.

**Losses** - Losses are wasted electrical energy. All components and systems that carry electricity waste a small amount of its energy. This wasted energy is given off as heat to the surrounding air. Losses cost money, but can be minimized by sound engineering practices.

**Mw (Megawatt)** - A megawatt is a million watts. Watts and megawatts are measures of demand. To put this in perspective, the peak demand for the state of Vermont is approximately 1,100 Mw or 1,100,000,000 watts.

**N-0 or N-1 or N-2** - 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. Only rarely does anyone try to calculate its actual value; it is simply a generic term to describe all the components of a given system. The number subtracted from N is the number of components that may fail in a given scenario, although more information is needed to denote just what component or components are assumed to have failed. 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-2 means that two components have failed at the same time, which is generally worse than having only one fail (see also the definition of *contingency* above).

**Network** - A network line is one that is capable of carrying power in either direction, similar to a two-way street. Most transmission lines are network lines, while most distribution lines are not (see also the definition of *radial* below).

**Peaking Generation** - Peaking generation is generation that is designed to run only a limited number of hours per year, during periods of high demand.

**Power** - Power is simply the same thing as demand.

**PSB (Public Service Board)** - The PSB is Vermont state's quasi-judicial authority in legal proceedings that involve utility regulation, statutes, and related issues. It consists of 3 principal commissioners (appointed by Vermont's governor) and supporting staff.

**PTF (Pool Transmission Facility)** - The precise definition of a pool transmission facility is beyond the scope of this document but, generally speaking, it is any transmission facility operating at 69 kV or higher that is networked (not radial). PTF falls under the authority of ISO New England. The construction of new PTF facilities is funded by the ISO on a pro-rata basis among its member utilities. Vermont's responsibility for such costs is about 5% of the total.

**Radial** - A radial line is one that is capable of carrying power in only one direction, similar to a one-way street. Most distribution lines are radial lines, while most transmission lines are not (see also the definition of *network* above).

**Redundant** - Facilities that have backups or alternate ways of operating are said to be redundant, that is, their function can be sufficiently provided even after they suffer a breakdown or failure. The more crucial a component or system, the greater the need for it to be redundant.

**Renewable power source** - A renewable power source is any power source that does not rely on a *finite* resource to keep it running, such as coal, oil, or natural gas, which will eventually run out. Renewable power sources include solar collection systems, wind mills, and hydro generators, because sunlight, wind, and running water will never run out. Generators that burn replaceable fuels also qualify as renewable power sources. Examples include bio-diesel generators that run on crop-derived fuels, and wood-burning generators.

**Rolling blackout** - The deliberate cutting off of electric service to a limited number of customers during conditions of dire system problems. These blackouts are targeted at different groups of customers, first one and then the next, and continuing this way in a cyclical pattern in order to “spread the pain” as evenly and fairly as possible until the problem is fixed. A rolling blackout may also be referred to as a controlled blackout.

**ROW (Right-of-Way)** - A right of way is the long but narrow strip of property on which a transmission line is built. It may be owned by the associated utility or it may be owned privately, with the utility exercising its state-mandated right to use this private property for the public good.

**Substation** - A substation is a fenced-in area where several transmission and/or distribution lines come together and are connected by various other equipment for purposes of switching, metering, or manipulating voltage. Often they contain transformers.

**Subtransmission** - Subtransmission systems are very similar to transmission systems (see also the definition of *transmission* below) and differ only in that they operate at somewhat lower voltage and carry smaller amounts of power. Typical subtransmission voltages include 46 kV and 34.5 kV.

**Synchronous Condenser** - A synchronous condenser is a device located in a substation, that supports voltage on electric transmission or distribution systems, much like a capacitor. But unlike a capacitor, a synchronous condenser has moving parts, that is, it spins like a motor, and its outward appearance is very similar to that of a large motor. Synchronous condensers tend to be more effective than capacitors but also more expensive. They run for very long periods of time and produce a humming sound, but do not burn fuel and therefore do not release emissions into the atmosphere.

**Thermal** - This term is related to the terms capacity or capability. Thermal refers to heat or temperature, which are of concern when electrical equipment is carrying a high demand. Electrical components that exceed their capacity or capability are said to be “thermally overloaded”, meaning that they are carrying too much demand, are growing too hot, and could fail as a result.

**Transformer** - Transformers are the “on-ramps” and “off-ramps” of the “transmission highway”. Specifically, a transformer is a device located in a substation that connects high-voltage equipment to low-voltage equipment and allows power to flow from one to the other. Different voltages are used because higher voltages are better for *moving* electricity over a distance, but lower voltages are better for *using* electricity in machinery and appliances. Transformers (and the substations in which they reside) are commonly described by the two (or more) voltages that they connect, such as “115/46 kV”, signifying a connection between 115 kV and 46 kV equipment.

**Transmission** - Transmission lines and transmission substations operate at high voltage and carry large amounts of electricity from centralized generation plants to low voltage distribution lines and substations that supply small towns and localities. A few transmission lines or even one may be capable of supplying an entire region or metro area. Transmission lines use very tall poles or towers, have long wire spans between poles, and usually traverse fairly straight paths across large distances. They do not tend to follow roads. Typical transmission voltages include 345 kV, 115 kV, and 69 kV.

**VELCO (Vermont Electric Power Company)** - VELCO is a transmission company wholly owned by Vermont’s distribution companies, and responsible for the planning, construction, and operation of Vermont’s transmission system.

**Voltage** - Voltage in an electric transmission or distribution system 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.