



MIDWEST RELIABILITY ORGANIZATION

How the Bulk Electric System Works

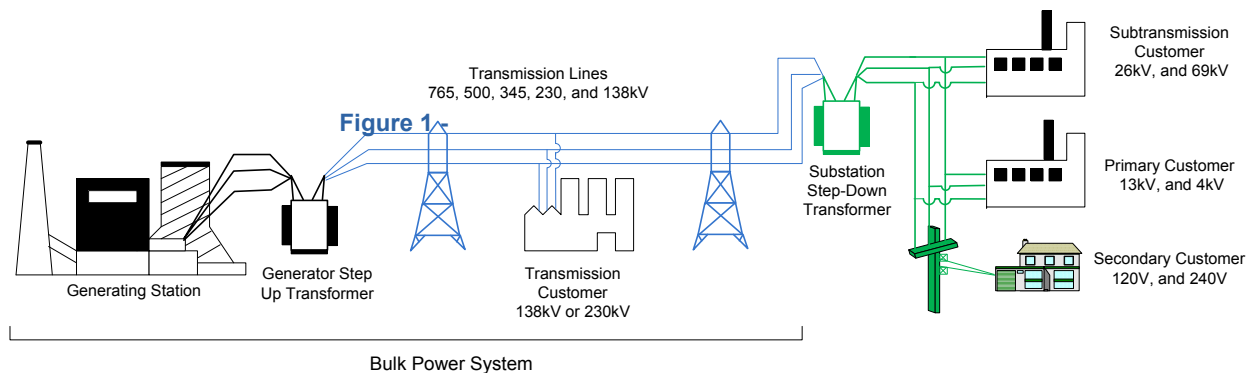
A reliable electric grid allows for the proliferation of electronic and electric devices used for industrial production, home conveniences and life-saving technologies. A reliable electric power industry is the lifeblood of our economy and essential for the standard of living we enjoy today.

Unlike water or gas, electricity cannot be stored. It must be generated and then used immediately. Furthermore, electricity follows the “path of least resistance,” so it generally cannot be routed in a specific direction. This means generation and transmission operations in North America must be monitored and controlled in real-time, 24 hours a day, to ensure a consistent and ample flow of electricity. This requires the cooperation and coordination of hundreds of electricity industry participants.

Color Key:

Blue: Transmission
Green: Distribution
Black: Generation

Electric System Diagram



* Source: [US-Canada Power System Outage Task Force](#)

Figure 1 above depicts the basic flow of electricity, how it's created at power plants and other generating facilities, and then transported across high-voltage transmission and lower-voltage distribution lines to homes and businesses. Generation amounts must continually be adjusted to match the changing loads. All equipment must be monitored for proper operation to avoid overloading. Transformers at substations step the electric voltage up and down to efficiently deliver power to the customers. The Generation and Transmission components make up the [Bulk Electric System](#) (BES).

The [North American Electric Reliability Corporation \(NERC\)](#) was established in 1968 to promote BES reliability. NERC became the international Electric Reliability Organization (ERO) under the Energy Policy Act of 2005 (“EPAAct 2005”) (U.S.A.). On June 18, 2007, the U.S. Federal Energy Regulatory Commission (FERC) granted NERC the legal authority to develop and enforce reliability standards with all U.S. users, owners, and operators of the bulk power system, and made compliance with those standards mandatory and enforceable. In addition to its regulatory responsibilities, NERC: assesses adequacy of the BES annually via summer, winter and 10-year forecasts; monitors the bulk power system; and, educates, trains and

(Continued on page 2)

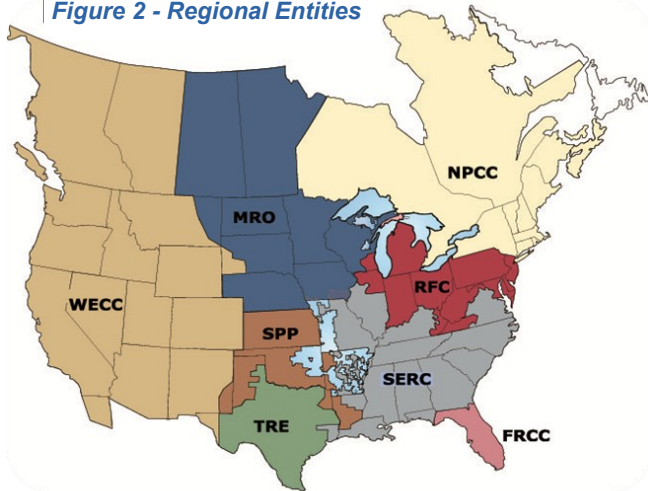


MIDWEST RELIABILITY ORGANIZATION

How the Bulk Power System Works

certifies electric industry personnel. An independent Board of Trustees provides leadership for NERC with oversight by FERC and provincial authorities in Canada.

Figure 2 - Regional Entities



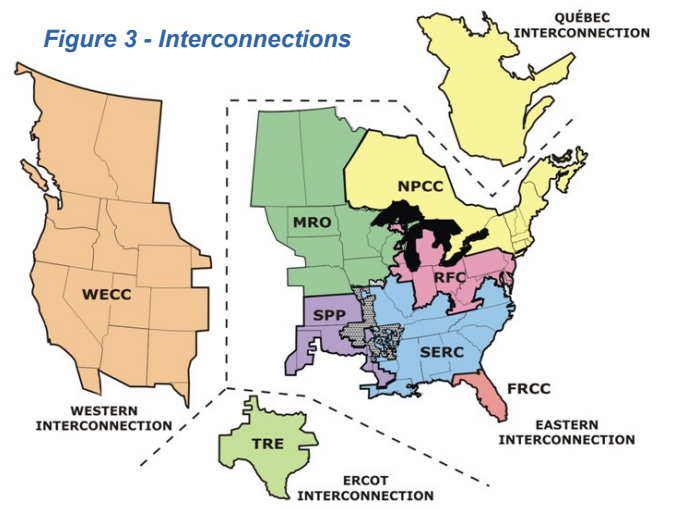
Regional Entities

NERC delegates its authority to eight Regional Entities (REs) to monitor and enforce compliance with reliability standards for the BES (see figure 2). The members of the regional entities come from all segments of the electric industry: investor-owned utilities; federal power agencies; rural electric cooperatives; state, municipal and provincial utilities; independent power producers; power marketers; and end-use customers. These entities account for virtually all the electricity supplied in the United States, Canada, and a portion of Baja California Norte, Mexico.

Regional Interconnections

The BES is divided into three regional grids: (1) the Western interconnection which includes the Mountain states, Canadian provinces and the Pacific Coast; (2) the Texas interconnection; and, (3) the Eastern interconnection which covers the rest of the contiguous U.S. and Canada. Additionally, there is a Quebec interconnection in Canada (see Figure 3).

Figure 3 - Interconnections



NERC defines the reliability of the interconnected bulk power system in terms of two basic and functional aspects:

Adequacy — The ability of the bulk power system to supply the aggregate electrical demand and energy requirements of the customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements.

Security — The ability of the bulk power system to withstand sudden disturbances such as electric short

(Continued on page 3)



MIDWEST RELIABILITY ORGANIZATION

How the Bulk Power System Works

circuits or unanticipated loss of system elements from credible contingencies.

Regarding Adequacy, system operators can and should take “controlled” actions or procedures to maintain a continual balance between supply and demand within a balancing area (formerly control area). These actions include:

- Public appeals
- Interruptible demand — customer demand that, in accordance with contractual arrangements, can be interrupted by direct control of the system operator or by action of the customer at the direct request of the system operator
- Voltage reductions (sometimes referred to as “brownouts” because incandescent lights will dim as voltage is lowered, sometimes as much as 5 percent)
- Rotating blackouts — the term “rotating” is used because each set of distribution feeders is interrupted for a limited time, typically 20–30 minutes, and then those feeders are put back in service and another set is interrupted, and so on, rotating the outages among individual feeders

All other system disturbances that result in the unplanned and/or uncontrolled interruption of customer demand, regardless of cause, falls under “Security.” When these interruptions are contained within a localized area, they are considered unplanned interruptions or disturbances. When they spread over a wide area of the grid, they are referred to as “cascading blackouts” — the uncontrolled successive loss of system elements triggered by an incident at any location. Cascading results in widespread electric service interruption that cannot be restrained from sequentially spreading beyond an area predetermined by studies.

About Midwest Reliability Organization

MRO is a [Regional Entity](#) in North America operating under authority from regulators in the United States and Canada through a delegation agreement with the [North American Electric Reliability Corporation \(NERC\)](#). In the United States, MRO operates under the authority found in Section 215 of the Federal Power Act, through the Federal Energy Regulatory Commission (FERC or Commission) and through other arrangements in Manitoba and Saskatchewan. The primary focus of MRO is assessing compliance with Reliability Standards on entities that own, operate or use the BES, performing assessments of the BES, and technical analysis of matters impacting the reliability of the BES in the north central part of North America. For more information on MRO, please refer to www.midwestreliability.org



(Continued on page 4)



MIDWEST RELIABILITY ORGANIZATION

How the Bulk Power System Works

NERC and MRO conduct an intensive review of studies performed by planning authorities of planned generation resources and transmission system adequacy to ensure it will meet the region's electricity demand. The generation fuel source mix is made up of fossil/coal, hydroelectric, gas/oil, nuclear, and wind/biomass. This diverse generation mix keeps our power system reliable and economical.

Conclusions

Electric reliability is essential to maintain our quality of life. NERC, MRO and other Regional Entities work to minimize the possibility of interruptions of the BES by monitoring compliance with standards and assessing the adequacy of future power supply. We welcome opportunities for increased understanding of reliability risks and collaboration among all interested parties at the local, regional, and international level.

Updated 05/2011