North American Electric Reliability Corporation

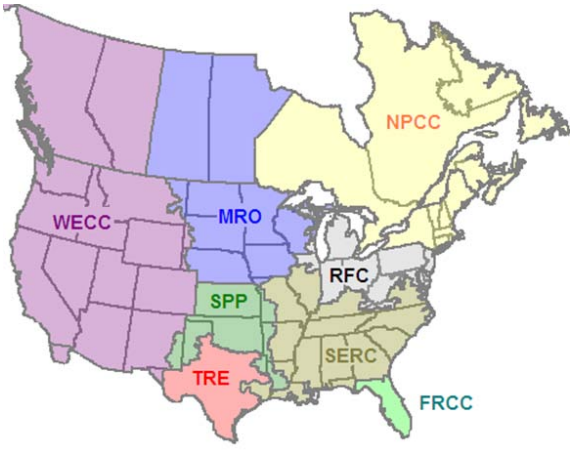
The North American Electric Reliability Corporation (NERC) is an international, non-government, independent, not-for-profit organization that operates as an electric reliability organization (ERO) to improve the reliability[1] and security of the North American bulk power system.[2] NERC is overseen by the U.S. Federal Energy Regulatory Commission (FERC) in the U.S. and governmental authorities in Canada. NERC activities include:

- Developing and enforcing reliability standards
- Monitoring the bulk power system in real time
- Assessing the bulk power system reliability and adequacy
- Investigating disturbances and abnormal events on the bulk power system
- Coordinating physical and cyber security needs
- Auditing owners, operators, and users for preparedness
- Providing education, training, and certification for industry personnel

NERC has about 600 members. The membership is open to all entities, such as utilities (investor-owned, state or municipal, cooperative, federal or provincial, and transmission-dependent), merchant electricity generators, electricity marketers, customers (large and small end-use), independent system operators and regional transmission organizations, government representatives, and regional entities that are interested in the reliability of the bulk power system.

NERC works with eight regional entities (Exhibit 1) to improve the reliability and stability of the bulk power system. The regional entities are established to develop and enforce compliance with the reliability standards within their region. NERC oversees the activity of the regional entities to be sure that delegated functions are consistent across North America.

Exhibit 1 NERC regional entities



FRCC - Florida Reliability Coordinating Council
MRO - Midwest Reliability Organization
NPCC - Northeast Power Coordinating Council
RFC - Reliability*First* Corporation
SERC - SERC Reliability Corporation
SPP - Southwest Power Pool Regional Entity
TRE - Texas Reliability Entity
WECC - Western Electricity Coordinating Council

Map developed by NETL. Source: ABB Velocity Suite[3]

Members of the regional entities consist of utilities (investor-owned, state, municipal, cooperative and provincial), federal power agencies, independent power producers, electricity marketers, and customers.

[1] Many of the technical terms used in this primer are defined in a companion *Glossary for Power Market Primers*
[2] North American Reliability Corporation. (2012). *About NERC*. Retrieved on November 29, 2012, from http://www.nerc.com/page.php?cid=1
[3] ABB Velocity Suite. (2012). *Intelligent Map – US NERC Regions*. Retrieved on November 29, 2012, from https://velocitysuite.globalenergy.com/Citrix/MetaFrame/auth/login.aspx

NERC History

In 1963, the Eastern Interconnection was formed. At the same time, the North American Power Systems Interconnection Committee (NAPSIC), an interregional organization (and NERC precursor), was established. It was a voluntary group of utility system operators that developed criteria and guidelines for reliable operation of the interconnected grid.

In 1965, the largest blackout in the history of the northeastern United States and southeastern Ontario, Canada, occurred. It started at Sir Adam Beck Station, Ontario, Canada, and affected parts of Ontario in Canada, New York, New Jersey, Connecticut, Massachusetts, Rhode Island, New Hampshire, and Vermont (Exhibit 2).[4] The blackout revealed a weakness of a large interconnected system: a small outage (disturbance) in one section of the grid can quickly spread around and interrupt supply to a large geographical area. It also revealed that utilities often have different operating standards and procedures.

Exhibit 2 Area affected by blackout

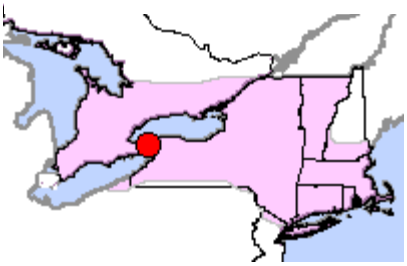


Image developed by NETL.

In 1967, the U.S Federal Power Commission (FERC precursor) submitted to Congress the U.S. Electric Power Reliability Act of 1967 to enhance the reliability and efficiency of the bulk power system.[5] It was recommended to develop a new mechanism for coordination among utilities, to establish regional councils to coordinate planning of the bulk power system, and to submit all extra-high-voltage (at that time it was 200 kV) projects to the Commission for approval. The legislation has never been enacted. In the final report about the 1965 blackout, the Commission recommended to establish:

> […] A council on power coordination made up of representatives from each of the nation's Regional coordinating organizations to exchange and disseminate information on Regional coordinating practices to all of the Regional organizations, and to review, discuss, and assist in resolving matters affecting interregional coordination. […][6]

On June 1, 1968, twelve regional and area organizations formed the National Electrical Reliability Council (NERC) comprised of nine regional reliability organizations. At that time, NERC was responsible only for regional planning coordination guidelines.[2] In 1980, NAPSIC became part of NERC after which NERC become responsible for both the planning and operating reliability of the bulk power system. In 1981, NERC changed the name to the North American Electric Reliability Council after Canada became a member. Over time, NERC's criteria and guidance became policies with both requirements and guidelines; however, NERC did not have the authority to enforce them. In 1997, NERC started working on transferring its planning guidelines to planning standards. In 2002, NERC's operating polices and planning standards became mandatory and enforceable, in Ontario. In 2004, NERC published the first version of 90 measurable, still-voluntary standards.[2] The U.S. Energy Policy Act of 2005 called for creation of a self-regulatory electric reliability organization that would develop and enforce the reliability standards. In 2006, NERC was established as the electric reliability organization of the U.S. In 2007, NERC changed its name to the North American Electric Reliability Corporation, representing a very large cross-section of the industry; FERC approved NERC's delegated agreements with eight regional entities that will monitor, develop, and enforce compliance with NERC standards within their geographic area; and compliance with NERC standards become mandatory and enforceable in the U.S.[2]

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[4] Blackout History Project. (2000). *Needed: More Purpose, Not Just More Electricity*. Retrieved on November 29, 2012, from http://blackout.gmu.edu/archive/life_11_19_1965/life_11_19_65_052.html

[5] Archives and Special Collections Library. (2011). *Congressional Record – Senate – The Electric Power Reliability Act of 1967*(Page 15322, June 12, 1967). Retrieved on November 29, 2012, from http://abacus.bates.edu/muskie-archives/ajcr/1967/Reliable%20Power.shtml

[6] North American Reliability Corporation. (2010). *NERC Operating Manual*. Retrieved on November 29, 2012, from http://www.nerc.com/page.php?cid=1%7C117%7C161%7C226

NERC Today

Today, NERC has about 600 members from a large cross-section of the industry that are split in twelve different membership categories. They offer their knowledge and expertise about reliable planning and operation of the bulk power system, and participate in NERC committees (Exhibit 3).[2] NERC is governed by a twelve-member independent Board of Trustees. The Member Representatives Committee (about 24 representatives from 12 membership categories) is a connection between NERC members and the Board.[2]

Exhibit 3 NERC committees

Committee	Function
Member Representatives Committee	• Elects independent trustees • Votes on amendments to the Bylaws • Provides advice and recommendations to the Board with respect to the purpose and operations of the Corporation
Compliance and Certification Committee	• Engages with, supports, and advises the Board regarding compliance, registration, and certification programs • Monitors NERC's compliance with the Rules of Procedure regarding the Reliability Standards development process
Critical Infrastructure Protection Committee	• Coordinates NERC's security initiative
Operating Committee	• Executes the policies, directives, and assignments of the Board • Advises the Board on operating reliability matters • Maintains a work plan with the business and strategic plans of NERC
Personnel Certification Governance Committee	• Oversees the policies and processes used to implement and maintain the integrity and independence of the Corporation's System Operator Certification Program
Planning Committee	• Promotes the reliability of the interconnected bulk electric systems • Assesses and encourages resource adequacy • Provides a forum for addressing planning and adequacy issues • Advises the Board on issues related to bulk electric system transmission planning and reliability, and resource adequacy
Reliability Issues Steering Committee	• Assists with establishing a common understanding of the scope, priority, and goals for the development of solutions to address issues of strategic importance to bulk power system reliability • Helps NERC and industry to focus on the critical issues
Standards Committee	• Oversees the development of NERC reliability standards

NERC developed more than a hundred reliability standards that are enforceable.[2] They define operating and planning requirements that will provide a reliable bulk power system. These standards belong to one of the 14 standard groups that ensure:

- **Resource and demand balancing**
  - Maintenance of interconnection frequency within predefined limits
  - Recovery from system disturbances
  - Adequate operating reserve requirements
- **Communications**
  - Adequate, effective, and reliable communication between reliability communicator, balancing authorities, system operator, and generator operator
- **Critical infrastructure protection**
  - All sabotage is reported
  - Identification and protection of critical cyber assets

- **Emergency preparedness and operations**
  - Development, maintenance, and implementation of an emergency plan
  - Existence of load-shedding and system-restoration plans
  - Analysis of disturbances to minimize repeated occurrence of the event
- **Facilities design, connections, and maintenance**
  - Proper connection of elements to facilities
  - Management of transmission vegetation
  - Proper maintenance of transmission
- **Interchange scheduling and coordination**
  - Properly scheduled interchanges that do not impact system reliability
- **Interconnection reliability operations and coordination**
  - Placement of qualified authorities, facilities, and tools to mitigate critical conditions
  - Wide-area visibility of the coordinator reliability area
  - Conduct of next-day reliability studies
  - Monitoring of critical parameters of the system
- **Modeling, data, and analysis**
  - Accurate calculation of available system capability, capacity benefit, and transmission reliability margin
  - Consistent procedure and modeling of the system
- **Nuclear safety**
  - Safe operation and shutdown of nuclear power plants
- **Personnel performance, training, and qualifications**
  - Adequate training, proper credentials, and competency of responsible personnel for reliable operation of the bulk power system
- **Protection and control**
  - Coordination and operation of system protection
  - Analysis, testing, and maintenance of protection systems
  - Proper design, maintenance, and operation of special protection systems
- **Transmission operations**
  - Capability of reliability entities in order to return system to normal condition during an emergency
  - Assessment necessary data and development of plans for reliable system operation
  - Monitoring of critical operating parameters in real time
- **Transmission planning**
  - Development of the reliable transmission system under normal and contingency (loss of one or more than one elements of the system) conditions
  - Compliance of each regional reliability organization with planning criteria
- **Voltage and reactive power**
  - Monitoring, controlling, and maintaining of voltage levels, reactive power flows, and reactive resources within applicable limits in real time
  - Generators provide necessary reactive power and voltage support to maintain scheduled voltage
  - Up-to-date service of all automatic voltage regulators and power system stabilizers

NERC also develops and maintains regional reliability standards. When the regional standards are approved, they become part of the NERC reliability standards and they are enforceable. The regional reliability standards allow some flexibility around enforcing a single standard to all regions, and they are used to accommodate regional differences.