



POSITION STATEMENT

RELIABILITY OF THE BULK POWER ELECTRIC SYSTEM

**(Adopted by the IEEE-USA
Board of Directors, 14 Nov. 2008)**

The North American Electric Reliability Corporation (NERC) 2006 and 2007 Long-Term Reliability Assessments¹ note several major challenges to the reliability of our nation's electric power supply. These challenges include declining capacity margins, obstacles to construction of new transmission, fuel supply reliability, and an aging work force. IEEE-USA concurs with NERC's assessment of the most important challenges to reliability and views any threat to electric power reliability with alarm. A decline in the quality and reliability of electric power can seriously impact the nation's economy, as it has already affected some regions that have recently experienced supply shortages and interruptions. Lower grid reliability also undermines national security by reducing the electric industry's ability to respond to sabotage and terrorism.

Complementary to the concerns identified by NERC, IEEE-USA believes industry leaders, legislators and regulators need to take the following specific steps to preserve and improve the reliability of the nation's electric grid:

- Fully implement recommendations contained in the U.S.-Canada Power System Outage Task Force Final Report on the August 14th Blackout in the United States and Canada
- Develop a more in-depth understanding of the statistics and risks of outages
- Deploy more sophisticated maintenance management and diagnostic tools to preserve the integrity of existing infrastructure, and manage aging infrastructure
- Periodically adjust regional operation and planning processes to assure reliability is maintained as the fundamentals of the electrical industry evolve, such as reliance upon a more competitive electric industry structure or shifts toward high penetration of renewable generating technologies
- Refine the regulatory framework to support continued reliable development of the electric system and related infrastructure, including the development of necessary investment incentives for infrastructure and citing approval

- Encourage development of demand response as a vital component of electric system operation and markets
- Plan for diversity and redundancy of generation sources and fuel supplies and delivery
- Assure that design of the system incorporates technologies that support rapid restoration following emergencies, including developing distributed resources and other generation close to load
- Reduce vulnerability of the system to cyber attack and intrusion by investing in technology that is resistant to intrusion, and implementing strong security standards and procedures
- Revitalize research and development in electricity generation, distribution and utilization to enable development of the system of the future
- Develop the work force to ensure that technically qualified individuals are available for staff and leadership positions in both government and industry

Only a comprehensive approach that includes balanced development and effective operation of all available resources -- generation, transmission and demand response -- will assure that the country will maintain a bulk power system sufficient to meet the demands of the 21st century. IEEE-USA urges federal and state policy-makers and senior industry executives to become well versed in the requirements of the NERC reliability standards, and aggressively address the issues outlined above.

This statement was developed by the IEEE-USA Energy Policy Committee and represents the considered judgment of a group of U.S. IEEE members with expertise in the subject field. IEEE-USA advances the public good and promotes the careers and public policy interests of the 215,000 engineers, scientists and allied professionals who are U.S. members of the IEEE. The positions taken by IEEE-USA do not necessarily reflect the views of IEEE or its other organizational units.

BACKGROUND

In 2003, a major portion of the Midwest and Northeast experienced a major blackout. In prior years, other parts of North America also experienced blackouts that had serious economic and safety consequences, and inconvenienced millions of people. In most instances, the disruption lasted only a matter of hours, but the impacts on the areas affected were significant.

A number of important steps have been taken since the 2003 blackout, but much work still remains to further reduce risks to the reliability of the nation's bulk power system. IEEE-USA applauds passage of the *Energy Policy Act of 2005*, certification of the North American Electric Reliability Corporation (NERC) as the nation's Electric Reliability Organization (ERO), and Federal Energy Regulatory Commission (FERC) approval in March 2007 of the first enforceable reliability standards. Compliance with the standards became mandatory for users, owners and operators of the bulk power system on 18 June 2007, but reliability will not be maintained

simply by passage of legislation or standards. Minimizing the possibility of future blackouts also requires implementation of reliability policies that emphasize four factors essential to meeting the requirements of the new standards:

1. Continued development of sufficient electric generation resources, transmission delivery infrastructure, and demand response programs to reliably meet forecasted future electricity demands
2. Effective and competent real-time operation and maintenance of that infrastructure to reliably produce and deliver electricity on a real-time basis, along with prompt restoration following disturbances
3. Adequate physical and cyber security to protect against malicious intrusion and attacks on critical facilities
4. Diversity and redundancy of fuel supply

None of these elements alone is sufficient to meet the country's electric reliability requirements. All are essential to any comprehensive energy policy intended to ensure reliability of the grid. All are reflected in NERC's current or evolving mandatory reliability standards and their enforcement, as well as in its other program areas².

The quality of electric service is dependent upon maintaining a sufficient level of reserve capacity, in both generation supply and the transmission system, to be able to withstand unexpected outages of equipment, sudden increases in demand due to weather, and other emergencies. Reliability is enhanced through deploying these reserves in response to both planned and unforeseen changes to the system. As illustrated by recent experience in the 2003 blackout, and similar less extensive events in other regions of the country, operating the system too close to its limits for extended periods of time can have dire consequences.

IEEE-USA recommendations are intended to highlight areas for continued emphasis and improvement necessary to achieve this objective:

- **Fully implement recommendations contained in the U.S.-Canada Power System Outage Task Force Final Report on the August 14th Blackout in the United States and Canada³**

Many recommendations have been have already been addressed, as indicated in the final report of the task force on implementing its recommendations⁴, but work remains in several areas that are more difficult to address. These include developing new or revised standards or guidelines in protective relay system design, application, maintenance, and testing; under-voltage load shedding systems; and voltage and reactive planning and operation; as well as developing and implementing improved real-time system visualization tools for systems operators, including phasor measurement systems; etc.

- **Develop a more in-depth understanding of the statistics and risks of outages**

Actual system performance may deviate from the underlying assumptions that serve as the basis for its design. Research is needed to better understand how the system, as a whole, is

responding to the changing demands placed upon it. NERC has recently begun work in reliability metrics and benchmarking that will inform this issue.

- **Deploy more sophisticated maintenance management and diagnostic tools to preserve the integrity of existing infrastructure**

Exposure to blackouts can be reduced by utilizing predictive maintenance techniques to minimize the possibility of equipment failures that impose stress on the operation of the system. Use of such systems is not currently widespread in the industry.

- **Periodically adjust regional operation and planning processes to assure reliability is maintained, as the fundamentals of the electrical industry evolve, such as reliance upon a more competitive electric industry structure, or shifts toward high penetration of renewable generating technologies**

The bulk power electric system is a highly interconnected machine whose operation spans political and jurisdictional boundaries. Coordinated planning across these boundaries for developing generation, transmission and demand response is essential. Operation and planning practices must evolve to accommodate changes in industry structure, and increasing reliance upon renewable generating technologies that have varied performance characteristics, development lead times, and desirable locations other than traditional generating technologies. IEEE-USA encourages continued refinement of regional planning processes of Regional Transmission Organizations and utilities, as outlined in the planning principles of FERC Order No. 890. IEEE-USA also supports the provisions for designating the National Interest Electric Transmission Corridors, included in *EPA Act 2005*, and for FERC to exercise its backstop citing authority, as appropriate.

- **Refine the regulatory framework to support continued reliable development of the electric system and related infrastructure**

Federal and state legislators, regulators and other government agencies must work cooperatively to create a consistent policy and regulatory framework for approval of the new infrastructure needed to meet reliability standards in each region, and to ensure adequate infrastructure is developed. Before making commitments for large capital investments, investors and businesses must have a stable investment climate with appropriate incentives and a reasonable level of certainty. IEEE-USA is concerned that jurisdictional disputes, and instability in local or national regulatory rules and policies, can be highly damaging to reliability -- and also be counter-productive to creating a healthy environment for investment. Consistently administered and timely regulatory approval processes for reliability projects needed to maintain compliance with NERC standards, and the availability of cost recovery mechanisms through either stable markets or regulation, are particularly important.

- **Encourage development of demand response as a vital component of electric system operation and markets**

IEEE-USA concurs with NERC's conclusion in the *2006 Long Term Reliability Assessment* that "Demand-side measures, such as business and consumer energy-efficiency programs, interruptible demand contracts, and direct control load management programs, have been

utilized for many years, but the full potential of these resources has likely not been tapped.” Policy-makers must provide a level playing field for evaluating and deploying new demand response technologies and resources.

- **Plan for diversity and redundancy of generation sources and fuel supplies and delivery**

Demand response and conservation alone are not likely to be sufficient to meet the nation’s growing needs for electric supply. Diversity and redundancy of generation sources is a necessity to assure national security and mitigate the risks of not serving load, due to disruption of supply. All commercially viable generation source options, including both conventional and renewable technologies, must be retained to meet the increasing demand for electric energy, and to provide sufficient flexibility to operate the system when unforeseen events occur. To ensure continued generation operation, in the event of disruption of a specific fuel source, redundancy of sources should be encouraged wherever possible. For example, certain plants may have capability to operate on both gas and oil. IEEE-USA also strongly supports development of the nation’s renewable energy resources to provide for expanded supply diversity and redundancy.

- **Assure that design of the system incorporates technologies supporting rapid restoration following emergencies, including developing distributed resources and other generation close to load**

While cost effectiveness is not proven in all cases, such resources can be an inherently reliable part of the grid, improving flexibility of real-time operation, and providing capacity necessary to meet reserve requirements. Distributed resources can be an important tool to further develop diversity and redundancy of supply and maintain delivery system reliability and stability.

- **Reduce vulnerability of the system to cyber attack and intrusion**

The reliability of the nation’s bulk power electric system relies increasingly on advanced control and communications technologies. A significant number of NERC’s reliability standards address Critical Infrastructure Protection. Continued development of and adherence to these standards is a high reliability priority for the nation.

- **Revitalize research and development in electricity generation, distribution and utilization to enable development of the system of the future**

Developing and implementing new delivery systems and electricity storage technologies will be important for the future reliability of the grid. Storage technologies would be particularly beneficial if they can be developed in combination with variable generation sources, such as wind and solar power. In particular, developing “smart grid” technologies should be encouraged and rewarded. Regulators and other policy-makers should exercise care to ensure against implementing policies that would preclude deploying new technologies as they are developed. Results of an effective research and development program will provide system planners and operators with new tools to meet the needs of customers and the nation.

- **Develop the work force**

Some 64 million baby-boomers (more than 40 percent of the U.S. labor force) will be eligible to retire by the end of the decade, creating a potential shortage of up to 10 million workers. Compounding the problem, the number of 35-44 year olds, those normally expected to move into senior management ranks, will decline by 10 percent by 2010. The electric power industry like others must deal with the changing demographics of the work force, at a time when many challenges to reliability exist. Government and industry must adopt policies to maintain the skilled work force needed to ensure system reliability.⁵

A combination of disciplined operation and maintenance of the existing network, comprehensive planning and developing new infrastructure, implementing new technologies, and developing a highly-skilled and well-trained work force will be needed to assure future reliability and adherence to all reliability criteria and standards.

NOTES

¹ 2007 Long-Term Reliability Assessment, North American Electric Reliability Corporation (Oct. 2007), on-line at: <http://www.nerc.com/files/LTRA2007.pdf>. 2006 Long-Term Reliability Assessment, North American Electric Reliability Corporation (Oct. 2006), on-line at: <http://www.nerc.com/files/LTRA2006.pdf>.

² Other NERC programs for ensuring a reliable bulk power system for North America include: Reliability Assessment; Event Analysis and Information Exchange; Reliability Metrics and Benchmarking; Situation Awareness and Infrastructure Security; Training, Education, and Certification; and Reliability Readiness Evaluation and Improvement.

³ Final Report on the August 14th Blackout in the United States and Canada, U.S-Canada Power System Outage Task Force (April 2004), on-line at <https://reports.energy.gov/>.

⁴ Final Report on Implementation of Task Force Recommendations, U.S-Canada Power System Outage Task Force (Sept. 2006), on-line at: <http://www2.nrcan.gc.ca/es/erb/erb/english/View.asp?x=690&oid=1221>

⁵ Further information on work force issues may be found on the [IEEE-USA](http://www.ieeeusa.org) website, including workforce-related position statements (<http://www.ieeeusa.org/policy/positions/index.html>) and a whitepaper on the “Inter-Generational Workforce” (<http://www.ieeeusa.org/volunteers/committees/cwpc/documents/IntergenerationalWhitePaper.pdf>)