# Challenges and opportunities for improving bulk power system reliability in North America

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NERC's mission is to ensure that the bulk electric system in North America is reliable, adequate and secure. Established in 1968, NERC develops and enforces reliability standards; monitors the bulk power system; assesses future adequacy; audits owners, operators, and users for preparedness; and educates and trains industry personnel. In July 2006, NERC was certified by the U.S. Federal Energy Regulatory Commission as the Electric Reliability Organization for the United States. NERC is working to gain similar recognition by governmental authorities in Canada and Mexico.

Since joining NERC in 1977, Mr. Nevius has been involved in all aspects of NERC's reliability activities as well as NERC's efforts to transition into an industry self-regulatory organization. He currently leads the Reliability Assessment and Performance Analysis Program with support from three group leaders in the areas of reliability assessment, events analysis and information exchange, and reliability metrics.

Prior to joining NERC, Mr. Nevius was employed by Public Service Electric and Gas Company with responsibilities for transmission expansion planning. He holds a B.S. in Electrical Engineering and a Masters in Engineering Management from Drexel University. He is a registered professional engineer in the state of New Jersey.

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# Abstract

The electricity industry in North America has undergone significant changes in the last decade in terms of its regulation, the introduction of competition in wholesale markets, several major blackouts, and finally the establishment of mandatory, enforceable reliability standards.

This paper chronicles the evolution of the North American Electric Reliability Corporation (NERC), and how it is assuming its new role as the Electric Reliability Organization. Hopefully, the account of NERC's evolution will provide the reader with the possibility to compare the North American and European situations regarding respective roles and responsibilities, especially as they relate to protecting and improving electric grid reliability.

## 1. Introduction

It is especially timely for the "European Review of Energy Markets" to review the progress to date and the remaining challenges to the reliability and security of the North American electricity infrastructure.

NERC plays a number of key roles regarding the reliability, adequacy, and security of the North American electricity industry. Formed in 1968 in the aftermath of the 1965 Northeast Blackout to help electric utilities work together to prevent future blackouts, NERC comprises essentially all of the bulk power system owners, operators, and users in the U.S., Canada, and a small portion of Mexico.

Since its formation, NERC's role has grown and evolved in both the depth and breadth of our activities. Most recently, NERC was named by the U.S. Federal Energy Regulatory Commission (FERC) to serve as the Electric Reliability Organization (ERO) for the U.S. NERC is working to gain similar recognition in the various jurisdictions in Canada by the end of 2007.

As the ERO, NERC will be an international, industry-based, self-regulating reliability organization with authority to set and enforce compliance with standards for the reliability, adequacy, and security of bulk power systems throughout North America. Generally speaking, the bulk power system represents the electrical generation resources, transmission lines, interconnections with neighboring systems, and associated equipment, generally operated at voltages of 100 kV or higher. This is an awesome and critically important responsibility for which NERC has been preparing for some time. It is also something that will require the utmost in constructive partnerships between and among all entities in the electricity industry and governments.

## 2. Regulation of Electricity in North America in Brief[1]

To appreciate the context within which NERC operates requires a general understanding of how regulation of electricity is accomplished in North

[1] Excerpted from "North America – The Energy Picture, prepared by North American Energy Working Group, June 2002."

America. The summary that follows is a very brief description of the major regulatory roles and responsibilities. It is by no means a detailed account of these roles as they exist today and as they may change in the future.

The regulation of electricity in North America is a combination of state, provincial, and federal jurisdiction.

In the United States, the FERC approves rates for wholesale sales of electricity and transmission in interstate commerce for private utilities, power marketers, power pools, power exchanges and independent system operators, acting under the legal authority of the Federal Power Act of 1935, the Public Utility Regulatory Policies Act of 1978, the Energy Policy Act of 1992, and the Energy Policy Act of 2005.

State regulatory commissions require utilities to provide adequate, safe, and reliable electric service as a part of an obligation to serve requirement. In about half of the States in the United States, the investor-owned electric utilities are vertically-integrated entities (i.e., utilities that own or control the bulk power generation and transmission facilities, as well as the local distribution facilities). Their facilities are principally State regulated, meaning that State commissions set the retail power sales rates, and the transmission and distribution rates of the utilities. Some State commissions have ordered their vertically-integrated utilities to restructure and divest their generation assets, leaving them primarily with only State-regulated distribution service functions. As of the end of 2005, 27 states were traditionally regulated, three had limited restructuring, 17 had full restructuring, and four had formally reversed, suspended or delayed restructuring.

State commissions also have the authority to regulate the end use of electricity as well as its distribution and delivery. State commissions or other State agencies are also typically in charge of the certification and citing processes for transmission, distribution, and generation facilities. This means that generation and/or transmission facilities cannot be built without State approval.

In Canada, the predominant regulatory authority with respect to electricity infrastructure is provincial. Each province has established its own regulatory regime for approving energy-related projects. The economic regulation of utility companies takes place through regulatory boards for the most part or directly by provincial governments. The adoption of initiatives to restructure the electricity industry has varied across Canada. With the

exception of Alberta, which is a fully competitive market, the balance of Canada's provincial electricity markets are regulated or hybrid in nature, with most having implemented wholesale access. The provinces of Alberta and Ontario have had retail open access since 2001 and 2002, respectively.

The National Energy Board of Canada authorizes the construction and operation of international and designated inter-provincial power lines under federal jurisdiction and regulates electricity power exports, with the key initiatives with respect to the restructuring of both wholesale and retail electricity competition taken at the provincial level. Each province is responsible for all other aspects of electricity regulation, including citing processes for electricity generation and transmission facilities.

## 3. History of NERC

NERC's formation in 1968 was actually preceded by the formation of a related organization, the North American Power Systems Interconnection Committee (NAPSIC). In 1962, a group of utilities located in the Midwest and South, met to prepare for the imminent closure of seven interconnections to form the largest synchronized system in the world. The committee formed to study this new interconnection recommended the creation of an informal operations organization for the future; which would promulgate "operating guides" for the reliable operation of interconnected systems. NAPSIC comprised what today are the Eastern Interconnection, the Western Interconnection, and the Texas Interconnection.

In 1965, a massive blackout in the northeastern United States and southeastern Ontario, Canada prompted the U.S. Congress to propose legislation — The Electric Power Reliability Act of 1967 — that would create a federal agency to regulate electric reliability. Responding to a petition by electric industry executives, the U.S. Federal Power Commission recommended instead the formation of "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."

On June 1, 1968, twelve Regional and area organizations signed an agreement forming the National Electric Reliability Council (NERC). Ten

years later, NERC approved expanding its activities to include the development of planning guides for designing bulk electric systems to address changes in the industry resulting from the passage of the U.S. National Energy Act of 1978.

In 1980, NERC and NAPSIC merged, giving NERC a role in both the planning reliability and operating reliability of bulk electric systems.

In 1987, at the urging of the U.S. government's National Security Council and Department of Energy, NERC formed the National Electric Security Committee to address the threat of terrorism and sabotage targeted against the electricity supply system. At the time, the sole focus of this initiative was on the physical security of the bulk electric systems. It was much later that cyber security considerations were added to NERC's mission.

## 4. Evolution of Competition in North American Wholesale Electricity Markets

The initial introduction of competition into the U.S. electricity industry actually began in 1978 with the Public Utility Regulatory Policies Act, which was part of the National Energy Act of 1978. This legislation led to limited competition among a small group of wholesale suppliers.

In 1991 the U.S. Department of Energy (DOE) issued the "National Energy Strategy," which recommended amendment of the Public Utility Holding Company Act "to allow businesses to build, own and operate power plants for wholesaling electricity in more than one geographic area in order to help develop electricity supplies and stimulate competitive market efficiencies that were not otherwise available under the traditional single-supplier approach." The National Energy Strategy also voiced its support for full utilization of DOE and FERC authorities to encourage more open access to electric transmission facilities.

The recommendations from the National Energy Strategy were embodied in the Energy Policy Act of 1992. NERC was successful in having an amendment included in the Act that bars the federal government from ordering transmission service if the order "would unreasonably impair the continued reliability of electric systems affected by the order." Following the passage of the Act, NERC developed an action plan for the future,

which included: Policies for Interconnected Systems Operation, Policies for Planning Reliable Bulk Electric Systems, Membership Recommendations, and Policies for Dispute Resolution.

Over the next several years, legislative and regulatory initiatives directed at the industry encouraged competition through participation in the electricity marketplace by many new entities. NERC and the Regional Councils opened their memberships and activities to these new participants including independent power producers, power marketers, and electricity brokers. At this same time, NERC developed a set of principles for scheduling electricity interchange transactions — *Agreements in Principle on Scheduled Interchange* — that applied equally to electric utilities, power marketers, and other electricity purchasing-selling entities.

In 1995, the FERC issued a Notice of Proposed Rulemaking (NOPR) on Open Access seeking comments on proposals to encourage a more fully competitive wholesale electric power market. NERC took the lead in addressing the planning and operating reliability aspects of the NOPR and filed a six-point action plan to provide the basis for action by the electric utility industry and the FERC. That plan included:

1. Establish standards for "Available Transfer Capability,"

2. Reflect actual path flows in interchange scheduling to ensure continued reliability,

3. Ensure control area operators have clear authority in emergencies,

4. Ensure compliance with NERC rules in a comparable and fair manner,

5. Establish standards for Interconnected Operations Services, and

6. Ensure that information vital to operational security is shared freely among control areas, but is not available to gain unfair market advantage.

The FERC issued its open access rules in 1996, Orders 888 and 889, and a new age of wholesale competition in the electric industry began. It was these orders, more than anything else, which put NERC on a course to become a self-regulatory reliability organization. Many believe that the legislation contained in the Energy Policy Act of 2005 that provides for this

new system of mandatory enforceable reliability standards was the direct result of the August 14, 2003 blackout. Contrary to this belief, the seeds for establishing mandatory, enforceable reliability standards were planted a full ten years earlier.

## 5. The Need for Reliability Legislation

For more than three decades, NERC and its member Regional Reliability Councils worked in cooperation to provide the essential reliability standards and guidelines for the bulk electric system, and the non-competing utilities voluntarily applied and followed the standards and guidelines to keep the system reliable.

But as the electric industry began its transition from a regulated, vertically-integrated structure to a competitive structure with functional unbundling and disaggregation, it became apparent that it was no longer clear who had the responsibilities for reliable planning and operation of the grid, who should pay for reliability, who should enforce reliability protocols, and what obligations were required of market participants to ensure that system reliability was not compromised.

Customers, market participants, regulators, economists, legislators, and even the President of the United States expressed concern that the reliability of one of the world's most dependable electric systems must not degrade in the new competitive market structure.

Why was there such universal concern for reliability? The answer has to do with the very nature of electricity that clearly distinguishes it from most other commodities. Electricity cannot be inventoried at a level that is demanded by the customer. It represents the ultimate in "just-in-time manufacturing," and any disparity between use and production shows up as a reliability or power quality problem: dimmed lights, burned motors, and, if the problem is severe, brownouts, blackouts, and even system collapse. A failure to perform by only one transmission operator can have disastrous consequences for other interconnected entities and the entire delivery infrastructure. This was never truer than on the afternoon of August 14, 2003, when a widespread grid failure affected 50 million people, over 60,000 MW of electric load, and caused the shutdown of nine U.S. and twelve Canadian nuclear reactors.

So, how did NERC decide that we needed legislation to make this work?

In 1997, an independent "blue ribbon" panel formed by NERC, and an Electric System Reliability Task Force established by the U.S. DOE, determined that, in an increasingly competitive marketplace, grid reliability rules had to be made mandatory and enforceable. These groups separately recommended that an independent, self-regulatory electric reliability organization should be established to develop and enforce reliability standards throughout North America. Both groups also concluded that federal legislation was necessary in the U.S. to accomplish this important task.

This form of "audited self-regulation" is defined as the delegation of power to a non-governmental entity, by Congress or a federal agency, to implement laws or agency regulations, with powers of review and independent action retained by a federal agency.[2] Properly implemented and monitored, a program of audited self-regulation can effectively advance the statutory objectives consistent with the public interest and the interests of the regulated entities. In certain circumstances, this approach can result in even better regulation because the agency's statute and rules are supplemented and enforced by those entities directly involved in the regulated activity, which may have more detailed knowledge of the operational or technical aspects of that activity. The regulatory program also may be more effective because it can be tailored to the individual industry or group. These are the objectives the FERC, the several Canadian provincial governments, and the industry are looking to achieve through the ERO.

Audited self-regulation also means that NERC will:

- Emphasize technical excellence and rely on voluntary technical subject matter expertise from the industry, academia, and government in all aspects of the ERO's mission.

- Maintain and enhance strong and productive relationships with other institutions and stakeholder groups to promote bulk power system reliability.

[2] *See* "Federal Agency Use of Audited Self-regulation as a Regulatory Technique," a report for the Administrative Conference of the United States by Douglas C. Michael (Nov. 1993).

- Cooperate with all appropriate agencies and levels of government in the United States and Canada.

## 6. Energy Policy Act of 2005 and Reliability Legislation

In 1999, NERC and a broad coalition of industry, state, and consumer organizations proposed legislation in the U.S. that would create an electric reliability organization to develop and enforce mandatory reliability rules, with oversight in the United States by the FERC. First introduced in Congress in 2000, that legislative proposal finally was included in the comprehensive energy bill that became law when President Bush signed the *Energy Policy Act of 2005*.

The Act authorized the creation of a self-regulatory electric reliability organization that spans North America, with FERC oversight in the United States. The legislation makes compliance with NERC and regional reliability standards mandatory and enforceable. The legislation respects the international character of the bulk electric system by ensuring that the ERO applies for and receives comparable recognition and approvals from government authorities in Canada.

Under the legislation, the FERC is responsible in the United States for approving the ERO, its governance and procedures, the standards the ERO develops, and any compliance enforcement actions. The FERC also will perform an appellate role for disputes that the ERO cannot resolve. In this regard, the regulatory role that the FERC plays in overseeing an industry self-regulatory organization is somewhat different than its role in regulating transmission rates or wholesale markets. In Canada, each provincial government agency will provide this oversight role.

Reliability standards – developed by people who possess the technical expertise to plan, design, and operate the grid and by people who use it – will become mandatory and enforceable in the U.S. once adopted by NERC and approved by the FERC and appropriate governmental agencies in Canada.

## 7. August 2003 Northeast Blackout

*"On August 14, 2003, large portions of the Midwest and Northeast United States and Ontario, Canada, experienced an electric power blackout. The outage affected an area with an estimated 50 million people and 61,800 megawatts (MW) of electric load in the states of Ohio, Michigan, Pennsylvania, New York, Vermont, Massachusetts, Connecticut, New Jersey and the Canadian province of Ontario. The blackout began a few minutes after 4:00 pm Eastern Daylight Time (16:00 EDT), and power was not restored for 4 days in some parts of the United States. Parts of Ontario suffered rolling blackouts for more than a week before full power was restored. Estimates of total costs in the United States range between $4 billion and $10 billion (U.S. dollars). In Canada, gross domestic product was down 0.7% in August, there was a net loss of 18.9 million work hours, and manufacturing shipments in Ontario were down $2.3 billion (Canadian dollars)."* [3]

The depth and breadth of the investigation of the August 2003 blackout, and the partnership between industry and government in this investigation, was unparalleled in the history of the industry. Most importantly, what was learned from this investigation is being used directly to strengthen the electric reliability framework in North America by:

- Developing new reliability standards,
- Implementing a more active compliance monitoring program,
- Instituting a new reliability readiness evaluation and improvement program, modeled along the lines of the Institute of Nuclear Power Operations Evaluations Program,
- Encouraging the development and use of better tools for system visualization and situational awareness,
- Improving system protection and control systems and their application,
- Enhancing system modeling and analysis capabilities,
- Placing increased emphasis on personnel training, and

[3] "Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations," Canada Power System Outage Task Force, April 2004.

- Establishing new requirements for vegetation management.

As painful and costly as this blackout was, the industry and governments have learned much from it, especially how to work together in a constructive partnership to achieve a common goal – a more reliable electric power system for North America.

NERC, its regional reliability councils, and their members have aggressively pursued the recommendations that were approved by the NERC board on February 10, 2004, in response to the blackout, while also taking into account the additional recommendations of the U.S. – Canada Power System Outage Task Force included in its April 2004 final report that were within NERC's area of responsibility.

The NERC committees, their subgroups, and staff have engaged in numerous analyses, audits, standards, and other activities to improve reliability since the blackout. These include:

- Implemented or laid the foundations for permanent programs, such as operator training and cyber security whose scopes go far beyond the blackout recommendations;

- Established technical groups that are developing best practices and operator tools, such as enhanced Web-based communications among reliability coordinators;

- Rewritten NERC's operating policies and planning standards and drafted many new ones, such as vegetation management and relay loadability;

- Successfully modeled the entire blackout event to better understand exactly what happened during the final, brief moments of the dynamic cascading failure; and

- Confirmed what we already knew — that the industry can provide experts of enormous depth and breadth who are willing to provide their time to analyze these kinds of grid events and recommend ways to improve reliability.

These activities are now an integral part of NERC's mission and included in the specific programs and tasks that NERC will continue to perform as the ERO.

## 8. Realizing the Promise of a Fully Functional ERO

In July 2006, the FERC formally certified NERC as the ERO for the U.S., and NERC is working with governmental agencies in Canada to formalize arrangements with each of them.

NERC has unparalleled experience in performing the functions and activities necessary to be a successful ERO. It has been engaged in the promotion and evaluation of North American bulk electric system reliability and the development of operating policies and planning standards for maintaining reliability for almost 40 years.

NERC's historic mission and the mission of the ERO are coterminous: to promote and improve the reliability, adequacy, and security of the bulk electric system in North America. NERC's philosophy for accomplishing this mission is based on a continuous cycle of activities to achieve reliability improvements: (1) measuring reliability performance – past, present, and future; (2) analyzing and benchmarking the results of those measurements; (3) identifying problems and assessing needs for improvement; (4) developing solutions to address those problems and needs, including new or revised reliability standards; and (5) implementing solutions, including expanded compliance monitoring and enforcement. This ongoing cycle of activities promotes continuous, measurable improvements in reliability.

NERC's mission as the ERO incorporates these fundamental principles:

- Developing, implementing, and enforcing strong reliability standards that are international in scope and consistently applied throughout North America, with regional differences recognized where driven by compelling need.

- Insisting on strict compliance with reliability standards through an independent and rigorous program of compliance audits conducted by NERC and (pursuant to delegation agreements) the regional entities.

- Using monetary and non-monetary penalties for noncompliance with reliability standards that encourage compliance and remediation and recognize the relative severity and importance of violations of individual reliability standards.

- Establishing and promoting a culture of excellence in bulk power

system planning and operations by identifying areas for improvement and examples of excellence through periodic reliability readiness audits.

- Promoting continuous reliability performance improvement through independent reliability and adequacy assessment and reporting; investigating, analyzing, and sharing "lessons learned" about bulk power system events; and developing reliability performance metrics and benchmarks.

- Developing and implementing personnel training, education, and certification programs that encourage and enable compliance with reliability standards and promote excellence in reliable bulk power system planning and operation.

- Reducing vulnerability and improving mitigation and protection of the industry's critical infrastructure by performing a critical role in real-time situation awareness.

In fulfilling its responsibility as the ERO, NERC will carry out the following programs and activities.

## 8.1. Standards Development

NERC has extensive experience developing and implementing bulk power system reliability standards. Since its inception, NERC has developed and implemented operating policies and planning standards, and measured and reported on reliability, to promote the reliability of the bulk electric system in North America. These policies and standards have been developed and implemented by NERC's professional staff working in partnership with nearly one thousand volunteer technical subject matter experts from the electric industry, government, and academia in the U.S. and Canada, in the model of a self-regulatory organization. NERC has an established Reliability Standards Development Procedure, which has been accredited by the American National Standards Institute ("ANSI") and conforms to ANSI's criteria for an effective industry reliability standards development process. In response to the blackout of August 2003, NERC transformed its existing operating and planning standards into Version 0 reliability standards, which became effective on April 1, 2005. These reliability standards are a comprehensive and measurable set of reliability standards for the bulk power system, and make a sound building block for establishing mandatory

reliability standards throughout North America. NERC has and will continue to improve and expand these reliability standards through its open reliability standards development process. In developing its standards, NERC takes into account the standards developed by other organizations, including the Institute of Electrical and Electronics Engineers (IEEE.)

The FERC recently approved for implementation 83 of the 107 standards NERC submitted, and has given direction on the remainder of the standards that they believe need more work. Also pending is a set of new cyber security standards. NERC also filed with the FERC Violation Risk Factors for each of the standards the FERC has made mandatory and enforceable. These factors will be used in determining the range of penalties associated with any violation of the requirements of a given standard. The higher the risk factor, the higher the potential range of penalties that could be applied.

## 8.2. Compliance and Enforcement

NERC Council has an established Compliance Enforcement Program that has been in operation since 1999. Each year, the program is evaluated and improved to incorporate lessons learned. The maturity and effectiveness of the current program reflects the cumulative improvements made over its seven plus years of existence.

NERC has also filed with the FERC draft delegation agreements with each of the eight regional entities that will monitor and enforce compliance with NERC standards on a regional basis. By June 2007, NERC expects to have those agreements in place and begin to enforce compliance with all FERC-approved standards.

## 8.3. Reliability Assessment

NERC conducts and reports the results of independent assessments of the overall reliability and adequacy of the interconnected North American bulk electric systems, both as existing and as planned. The results of the reliability assessments are documented in three annual reports: the long-term (10-year) assessment; the summer assessment; and the winter assessment. NERC also conducts special reliability assessments as circumstances warrant. The NERC board approves all reliability assessment reports before they are published.

NERC has been conducting long-term assessments of the reliability and adequacy of bulk power systems for 37 years. But last October, NERC issued its first ever long-term assessment as the ERO, and filed that report with the FERC, the U.S. DOE, and appropriate governmental agencies in Canada. The report cited four key findings — generating capacity margins continue to decline; construction of new transmission is still slow; fuel supply and delivery for electric generation is critically important; and the industry's aging workforce and electric power education system is presenting significant challenges to future reliability. In addition to these findings, NERC identified a range of actions needed to address them.

While the ERO is responsible for assessing and reporting on the adequacy of the bulk power system, it does not have the authority to set or enforce mandatory standards for adequacy, and neither the ERO nor FERC have the authority to require the expansion of generation or transmission.

## 8.4. Events Analysis and Information Exchange

NERC analyzes significant bulk electric system events to determine root causes and lessons learned; identifies and continuously monitors performance indices to detect emerging trends and signs of any decline in reliability performance; and communicates performance results, trends, recommendations, and initiatives to those responsible to take actions. NERC also monitors and analyzes events that occur outside of North America for important lessons learned and participates in various international electricity forums.

While events analysis has long been a function of NERC, this effort took on a whole new meaning following the August 2003 blackout. Nearly 100 technical volunteers from industry and government, from both the U.S. and Canada, worked tirelessly for months to identify the root causes of this event and to establish recommendations to address those causes. The U.S. – Canada Power System Outage Task Force, formed by the two governments, completed its final report in September 2006. In the letter submitting the final report, the task force said, *"While it is impossible to guarantee that blackouts on the bulk power system will never recur, the Task Force is confident that the actions completed to date, the follow-up work identified in this report, and the new framework for mandatory reliability standards will result in more reliable electric service for the people of Canada and the United States."*

## 8.5. Readiness Evaluation and Improvement

Begun in March 2004 following the August 2003 blackout, this program carries out on-site evaluations on a three-year cycle of reliability coordinators, balancing authorities, transmission operators, and other entities with responsibilities for operating the bulk power system. The principal objectives of this program are to: promote operational excellence in reliability readiness, capabilities, and performance; identify areas for improvement; and highlight "examples of excellence" that can help all entities improve their reliability readiness and performance. In 2006, NERC completed its first three-year cycle of reliability readiness evaluations, and all final reports are posted on the NERC Website. (www.nerc.com)

## 8.6. Situation Awareness, Infrastructure Protection and Reliability Support Tools

NERC develops critical infrastructure protection standards and guidelines, and facilitates the development of reliability support tools and systems for reliability coordinators and other system operators to assist in their situation awareness. NERC serves as the Electricity Sector's Coordinating Council and operates the Electricity Sector Information Sharing and Analysis Center (ESISAC), as specified in Homeland Security Presidential Directive 7.

## 8.7. Training and Personnel Certification

NERC certifies bulk electric system operating personnel pursuant to a program that meets the requirements established by the National Commission for Certifying Agencies. The certification program includes dispute resolution processes and disciplinary action procedures. NERC also administers a Continuing Education Program that approves training activities and training providers to enable operating personnel to obtain quality continuing education hours for credit toward operator recertification.

## 9. Challenges Ahead

Considering that the FERC only certified NERC as the ERO in July 2006, NERC and the FERC have made remarkable progress in standing up this new self-regulatory framework of mandatory, enforceable reliability standards.

A number of challenges still lie ahead.

1. Gaining approval of remaining reliability standards. When the FERC approved 83 of the 107 reliability standards NERC filed initially, it directed NERC to submit significant improvements to 56 of them. This is in addition to the work that remains to respond to the FERC's directives on the remaining 24 standards that are still pending. NERC is awaiting FERC action on the other standards NERC submitted, including standards on cyber security issues.

2. Completing work on standards under development. NERC has a number of additional standards under development, some of which respond to issues identified in the August 2003 blackout.

3. Gaining approval of regional delegation agreements. Regional entities, acting under authority granted to them through delegation agreements with the ERO, will carry out a significant portion of the compliance monitoring and enforcement responsibilities. NERC is awaiting FERC approval of these agreements and the details of the overall compliance monitoring and enforcement program.

4. Finalizing the compliance registry. Regional entities are finalizing the list of bulk electric system owners, operators, and users to whom the approved reliability standards apply. After resolution of any appeals, this list will comprise all the entities that will be monitored and held accountable for compliance with the reliability standards.

5. Finalizing arrangements with government agencies in Canada for recognition of NERC as the ERO in the respective provinces. Some agreements are in place, more work remains to fully implement the ERO in a Canadian context.

Undoubtedly, all participants in this new self-regulatory reliability model will make improvements to standards, rules and procedures as experience is

gained. In the end, it will not be the number of standards approved or how many fines and sanctions are imposed on those who are found in violation of the mandatory standards, but rather how much reliability is improved.