REPORT TO THE UNITED STATES CONGRESS
FROM THE
FEDERAL ENERGY REGULATORY COMMISSION STAFF

FERC USE OF THE GRID RELIABILITY APPROPRIATION FOR FISCAL YEAR 2004

Following the August 14, 2003 blackout, the Congress appropriated an additional $5 million for fiscal year 2004 for the Federal Energy Regulatory Commission (FERC) budget, to be used to address grid reliability and investigate the blackout. This report describes how the Commission has used those funds.

FERC's approach to grid reliability over the past year has been three-fold: to learn from the past, to understand the present, and to foster strategic improvements for the future. This report describes FERC's three-fold approach. Although FERC does not have direct statutory authority to mandate reliability improvements, FERC has been working closely with the electric industry and its stakeholders to identify appropriate reliability opportunities and to encourage improvements. FERC has done this by pulling together a group of talented engineers with direct experience on grid operations and reliability issues, and leveraging these limited resources strategically and creatively to focus on critical grid needs.

Some key accomplishments for FERC's reliability effort over fiscal 2004 include:

- Contributing leadership and investigative talent to the Joint U.S- Canada Power System Outage Task Force, which produced the Interim and Final reports on the August 14, 2003 blackout.
- Providing technical research and policy leadership to help understand and implement appropriate and consistent vegetation management along the nation's transmission lines.
- Urging the industry-led North American Electric Reliability Council (NERC) to adopt tougher, clearer and enforceable new reliability standards to replace the current voluntary reliability guidelines.
- Working with NERC in performing reliability audits.
- Undertaking a number of research studies on reliability-critical issues, including replacement transformers, grid operator training, System Control and Data Acquisition (SCADA) vulnerability to cyber attack, and the potential impact of gas pipeline disruption on gas supplies and electricity production.
- Working with partners such as the Canadian government, state electricity regulators, and the U.S. Nuclear Regulatory Commission to develop long-term institutional solutions for grid reliability challenges.
- Issuing a Policy Statement on Matters Related to Bulk Power System Reliability, in Docket No. PL04-5-000 (107 FERC ¶ 61,052). The Policy Statement coupled with the Commission's earlier commitment (Docket No. PL01-6-000) allows utilities to recover prudently incurred costs necessary for security and reliability measures.

Of the $5 million in supplemental appropriations related to grid reliability for fiscal year 2004: 39% has been spent on staff salaries and support, 44% has been spent on consultants and research contracts, 4% has been used for travel in support of the blackout investigation and reliability activities, and the remainder is uncommitted as of September 1, 2004.

INTRODUCTION

In the wake of the August 14, 2003 blackout of the Northeast United States and Ontario Canada, the President signed into law H.R. 2754, the FY 2004 Energy and Water Development Appropriations Act, which included the appropriation for the Federal Energy Regulatory Commission (FERC). The FY 2004 Energy and Water Development Appropriations Act provided $204.4 million for FERC activities in the fiscal year that began on October 1, 2003, an increase of $5 million over the budget request. The statement on the part of the Congressional managers noted that the increased funds were provided for FERC work related to the August 2003 blackout and for subsequent implementation of enforceable reliability standards. This report explains how FERC has used those funds to understand the causes of the blackout and to improve grid reliability.

The North American electricity grid faces a challenge – it uses some technologies invented in the early 1900s and facilities built primarily in the mid-20th century to serve an economy with electricity demands and needs of the 21st century. Today's needs reflect unprecedented levels of demand. In the United States, electricity demand has grown by 2.1 percent annually over the past ten years.[1] Much of that electricity is used to power appliances such as computers, medical equipment and industrial machinery that can be harmed by power quality fluctuations or even momentary power interruptions. But while there has been extensive investment in generation plants to meet the growing thirst for electricity, there has been little corresponding investment in transmission lines to connect those loads to the plants – between 1986 and 2002, peak demand across the United States grew by 26%, and U.S. electric generating capacity grew by 22%,[2] but U.S. transmission capacity grew little beyond the interconnection of new power plants. As load grows, the increased power flows across the lines from producers to users are causing increased congestion on the lines and increasing the difficulty of operating the system safely and reliably. One analysis found that between 1982 and 2002, normalized transmission capacity declined at a rate of 1.5% per year, although electricity sales nearly doubled,[3] and concluded:

> Most of the recent and planned investment in transmission facilities is intended to solve local reliability problems and serve growing loads in large population centers. Few projects cross utility or regional boundaries and are planned to move large blocks of low-cost power long distances to support large regional wholesale electricity markets. Thus, many opportunities to lower consumer power costs will

[1] North American Electric Reliability Council, "Long Term Reliability Assessment,"
[2] U.S. Energy Information Administration, "Energy Annual Data Book," 2003 edition.
[3] "U.S. Transmission Capacity: Present Status and Future Prospects," Eric Hirst, for Edison Electric Institute and U.S. Department of Energy, 2004, p.7.

be forgone because of insufficient transmission capacity.[4]

The vast majority of the outage minutes experienced by U.S. electric customers occur because of a problem on the local distribution system, as from ice storms or tree branches contacting distribution lines. Short, localized outages occur on distribution and local transmission systems fairly frequently with little social impact and cost. The remaining minutes of outages are caused by system-wide disturbances affecting millions of people. These are quite rare, and usually result from a failure on the bulk transmission network that cascades across a region, with enough disruptive impact to cause the electric industry, lawmakers and regulators concern over how to prevent the next blackout.

Maintaining and improving grid reliability is complicated by several factors:

- The transmission grid is inter-connected and interdependent, so a weakness in one area or a single event (like a tree contact, equipment failure or attack) can cascade and take down other areas.
- Recovery mechanisms for utility reliability investments vary by state and are not always adequate or timely to cover the expenditures; this discourages consistent utility commitment to needed reliability actions such as vegetation management. Outside a few incentive plans that link utility compensation to some reliability performance metric, few grid providers are rewarded for good reliability. Most are not punished for bad reliability until a significant failure, or noticeable string of small failures, occurs. Moreover, significant work is needed to develop and improve these metrics.
- The public often opposes some key measures that could improve reliability, such as increased tree trimming and preemptive load-shedding in a local area in an emergency to protect the greater grid.
- Regional transmission operators and independent system operators have stepped forward to provide regional transmission coordination and reliability management services across several regions of the country, but these RTOs and ISOs have varying capabilities, maturity, geographic scope, and cooperation from transmission owners, so RTO or ISO reliability performance is not yet a universally effective solution for grid management.
- As currently constituted, NERC is an industry-managed organization and its current reliability standards vary in quality, clarity, and true effectiveness at assuring reliable grid operations. Thus there is not always equivalent sound, effective or equitable interpretation and implementation of NERC rules across all transmission owners and operators to assure consistent, reliable performance.
- Absent the passage of reliability legislation mandating industry-wide compliance with grid reliability rules, or a specific mandate by a regulatory body with jurisdiction, compliance with reliability rules is voluntary and varies in quality, resources and scope of application.

Within this context, FERC has undertaken a strong portfolio of work to improve grid reliability, starting by understanding current industry practices and the NERC reliability rules now in place and under development. As will be discussed below, these efforts have already

[4] Ibid, p. vi.

helped to improve grid reliability.

FERC's Reliability Effort

The FERC is the primary economic regulator for the nation's bulk electric power system, setting rates for wholesale electric power sales and the use of interstate transmission owned or operated by public utilities (as limited by the Federal Power Act). Traditionally, FERC has looked at reliability issues only to the extent that they affected economic regulation pursuant to the Federal Power Act. However, in this process FERC staff has developed expertise in the operation of the interstate transmission grid and bulk power markets. Therefore, when the United States and Canadian governments staffed the Joint Power System Outage Task Force to investigate the August 14, 2003 blackout, they appointed the Chairman of the FERC to that body and assigned a senior FERC staffer to co-chair the electric system investigation. Shortly thereafter, the Congress and the President appropriated an additional $5 million "for FERC work related to the August 2003 blackout and for subsequent implementation of enforceable reliability standards."

In January 2004, following a significant commitment of staff effort to the blackout investigation, FERC officially started up a Reliability Team within its Office of Markets, Tariffs and Rates. This group began with a core of experienced FERC engineers and high-level consultants with extensive expertise in grid operations, reliability and regulatory issues. FERC built its work on the blackout investigation and prior work on infrastructure security, cyber-security, infrastructure evaluation and market design, plus its long-standing experience with the electric and gas industries, to begin work on a number of projects designed to better understand and improve grid reliability and security.

These projects fall into three categories relating to their purpose. The first category of Reliability Team efforts focused on learning from the past, and was centered around understanding the August 14 blackout and its causes. While FERC focused its remedial efforts on the most immediate problems to assure that the weaknesses causing or contributing to the blackout were addressed, FERC is also committed to addressing longer term reliability issues confronting the industry.

A second category of Reliability Team efforts focused on present grid conditions: What is happening on the grid today with respect to reliability? As current conditions and issues are better understood, FERC can learn from the past and work with industry to design and implement policy solutions, such as market design and infrastructure investment policies, to address and resolve those issues.

A final group of Reliability Team efforts encompasses strategic research and initiatives to address long-term reliability and security issues constructively and creatively.

FERC's reliability initiatives, organized in the categories above, are discussed below.

Team Formation and Composition

In January 2004, Chairman Wood created the FERC Reliability Team, with support from his fellow Commissioners, announcing the group's formation in February (http://www.ferc.gov/press-room/pr-archives/2004/2004-1/02-11-04-nerc.asp). To build the team, FERC began with a core of experienced staff engineers, including those who had worked on the blackout investigation, led by FERC's co-chair on the blackout investigation. To complement this group, FERC hired a group of contractors with specific skill-sets and expertise in grid operations and reliability, nuclear operations, electricity technologies, and R&D project management. Most of these contractors began working with the FERC team in January 2004. In February FERC issued the posting for the Team's permanent director, and completed the hire of director Joseph McClelland in July 2004 out of a highly competitive field of applicants.

The Reliability Team works within FERC's Office of Markets, Tariffs and Rates, to assure that grid reliability considerations are fully integrated with market and commercial issues in the Commission's regulatory deliberations. From this position, team members consult and contribute to the agency's work on rulemakings (for instance, the Small Generator Interconnection rule) and cases (such as PJM grid expansion and Midwest Independent System Operator market expansion).

Over the long term, FERC expects to staff the Reliability Team with approximately thirty full-time staff, using primarily in-house staff but hiring contractors as necessary to assure that key expertise is available as needed. The Office of Personnel Management has authorized FERC to add ten new Senior Level positions to staff the group, and FERC has committed a Senior Executive Service position for the division director. As of September 7, 2004, FERC has twelve professionals on the Reliability Team (including eleven engineers and one economist) and six contractors (five engineers and one lawyer), and draws on the expertise of others across the agency.

FERC's Reliability Team Approach

Because legislation has not yet been enacted to provide FERC with clear statutory authority to develop and enforce appropriate reliability standards, nor to order all industry members to operate reliably, the agency has taken a different interim approach to improve grid reliability. In its role as economic regulator, FERC regulates the rates that public utility transmission owners can charge, as well as cost recovery for reliability authorities such as RTOs and ISOs. So FERC can use its regulation of rates to push for more reliable operations and higher standards, even without the power to adopt and enforce those standards.

FERC recognizes the importance of being a strong advocate for reliability and the necessity of public dialog on these important issues. FERC Commissioners and senior staff speak at many industry events and meet with industry members in a variety of venues, and use those opportunities to express their expectations for reliable operations and appropriate practices. Members of FERC's Reliability team participate in all NERC technical committees, and work in public and private discussions to support better reliability standards and practices.

Although FERC's Reliability Team is still growing, the team boasts a solid breadth of operational experience and technical expertise. The team produces high quality products that

earn industry support, takes independent positions to challenge the industry's common assumptions and practices, and performs creative, solid analyses that help to explain or frame key reliability and security issues and offer new options to move forward toward public interest solutions.

FERC RELIABILITY WORK IN FISCAL YEAR 2004

Category 1 -- Learn from the past

The Blackout Investigation

Following the August 14, 2003 blackout, FERC Chairman Pat Wood III was named to the U.S-Canada Power System Outage Task Force and Alison Silverstein, advisor to Chairman Wood, was named as a co-chair of the Electric System Investigation. The electric system investigation was co-chaired with the US Department of Energy and Natural Resources Canada, and it was a collaborative endeavor with industry, coordinated through the North American Electric Reliability Council. Since the investigation entailed extensive data collection and analysis, FERC assigned six engineers to work for almost three months with industry experts in Princeton, New Jersey, to refine the data on electric system events. At the same time, the investigation co-chairs worked full-time through April 2004, at sites across the Northeast and Ontario, to understand what happened in the blackout and its causes. Total travel costs for FERC staff working on the investigation totaled approximately $70,000.

The investigation yielded the following work products to explain what happened and why:

- On September 12, 2003, the US-Canada Task Force released a chronology of the events relating to the blackout on August 14.
- On November 19, 2003, the Task Force released an interim report on the blackout.
- On December 18, 2003, the Task Force released an interim report on Utility Vegetation Management and its role in causing the blackout; this report was performed for the investigation under funding and management by FERC. On March 2, 2003, FERC issued the Utility Vegetation Management Final Report.
- On April 5, 2003, the Task Force issued, "Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations.
- On September 7, 2004, FERC submitted a report on utility vegetation management practices to Congress with recommendations for needed practices and guidance.

All of these documents can be accessed through this link: http://www.ferc.gov/cust-protect/moi/blackout.asp .

The causes of the blackout have driven much of FERC's reliability agenda since August 2003. Those causes were, in summary:

- First Energy and the East Central Area Reliability Council (ECAR) did not adequately understand First Energy's Cleveland-Akron area system, nor operate it at appropriate

voltage criteria.

- FirstEnergy had inadequate awareness of its system conditions in real time.
- FirstEnergy failed to adequately manage tree growth in its transmission rights-of-way.
- Grid reliability organizations failed to provide adequate real-time diagnostic support.

The final blackout report also identified a number of institutional issues that contributed to the blackout, principally relating to the need to clarify and strengthen NERC's reliability rules and compliance program, and noted the inherent weakness of a voluntary reliability and compliance system.

Vegetation Management

To support the blackout investigation, in September 2004 FERC hired experts from CNUC Consulting to conduct the field investigation into the role of tree contacts in the August 14 blackout; this investigation was documented in the December 2003 Interim Report on Vegetation Management. After the interim Task Force report found that lack of adequate tree-trimming along transmission lines was a cause of the Northeast blackout, and a cause of many significant blackouts in North America over the past four decades, FERC expanded the scope of CNUC's work to produce a broader analysis of transmission vegetation management issues and recommended best practices for vegetation management for grid reliability (documented in the Task Force's Final Vegetation Management Report).

To collect information on whether vegetation management on transmission rights of way might be a problem for the summer of 2004, the agency issued an order to electric utilities in April 2004 directing them to report on their vegetation management activities by June 17, 2004. This information was analyzed and submitted as a report to the Congress on September 7, 2004, (available at http://www.ferc.gov/industries/electric/indus-act/reliability.asp). The data collected indicate that a significant amount of tree-trimming was conducted in the spring of 2004, and that most identified potential problem vegetation had been remedied. FERC shared these data with state utility regulators, representing the National Association of Regulatory Utility Commissioners, and developed joint policy recommendations for the Congress and industry stakeholders on ways to improve vegetation management for grid reliability.

Improving Reliability Standards

On December 1, 2003, FERC held a conference with NERC, industry members, and other stakeholders to discuss the challenges of improving grid reliability (http://www.ferc.gov/industries/electric/indus-act/reliability/2003.asp). All representatives agreed that NERC and the industry needed to focus on significantly improving the clarity of and compliance with industry reliability standards.

Early in 2004, NERC and the electric industry began working to modify the collection of existing operating rules and practices to make them clearer, less ambiguous, and more enforceable. A senior FERC auditor served on this committee and participated in all of the expedited activities and meetings to review, rewrite, and revise these rules to create "Operating Templates" that are now being used immediately by the industry for reliability improvements

and compliance determinations.

Following release of the final Blackout Report, on April 14, 2004, the Commission acted to address compliance with the report's recommendations by issuing a Statement of Policy with regard to reliability (107 FERC ¶ 61,052). The statement encouraged NERC to expeditiously modify reliability standards to make them clear and enforceable, defined compliance with NERC standards to be consistent with Good Utility Practice (as described in the Open Access Transmission Tariffs on file with the Commission), warned that the Commission would act on a case-by-case basis to address specific reliability problems, and addressed the recovery of prudent reliability costs.

On May 14, 2004, consistent with the recommendation of the Blackout Report, FERC hosted a technical conference with the Department of Energy and Natural Resources Canada to discuss improvement of the electric industry reliability standards (http://www.ferc.gov/EventCalendar/EventDetails.aspx?ID=977&CalType=%20&CalendarID=0&Date=5/30/2004&View=List). Members of the FERC Reliability Team presented a staff paper offering recommended priorities that the industry-NERC standards revision effort should address (accessible through above link).

Through NERC committees, the electric industry is now working to develop clear, enforceable reliability standards, on a schedule that aims to adopt many of the new standards in early 2005 (https://www.nerc.net/standards/ReliabilityStandards.aspx?tabindex=0&tabid=23). Members of the FERC Reliability Team serve on each NERC committee, and the Chairman regularly attends meetings of the NERC Board of Directors, so FERC can communicate its reliability concerns and goals to NERC management and the industry. FERC Reliability staff will review the standards as they are developed and offer feedback to the drafters as appropriate to assure that the standards are clear, enforceable, and support high grid reliability. Absent reliability legislation, FERC's role to date with respect to the content of reliability standards has been in an advisory capacity only.

FirstEnergy System Analysis and Improvement

As the blackout investigation progressed, FERC began working on how to remedy the failures that caused the blackout. A critical step in this effort was issuance of a FERC order on December 23, 2003 (105 FERC ¶ 61,372) to FirstEnergy (FE) directing the utility to study the characteristics and weaknesses of its Cleveland-Akron service area. As FE worked on this study, NERC issued a set of recommendations -- to the industry and to FE and ECAR in particular – designed to remedy the operational problems that caused or contributed to the blackout. FERC assigned a senior engineer to monitor progress of the FE study and participate on the team of industry members assembled by NERC to oversee FE's compliance with the recommendations. The FE study and oversight activities continued from January through June 2004, confirming that FE had made improvements to its transmission system facilities and materially improved its operational practices to achieve better reliability.

Summer 2004 Grid Readiness

On July 15, 2004 – four months after NERC's release of its blackout recommendations, two months after release of the U.S.-Canada Task Force final blackout report, and one month before the anniversary of the blackout – FERC hosted a Summer 2004 Reliability Conference in Cleveland, Ohio, to hear reports from Midwest grid operators and coordinators on the grid's readiness to meet summer loads. The participants reported significant improvements in grid operations and practices, including significant increases in operator training, and concluded that the grid is much more reliable today than it was in the summer of 2003. (Transcript and materials at http://www.ferc.gov/EventCalendar/EventDetails.aspx?ID=1064&CalType=%20&Date=7%2f15%2f2004&CalendarID=0).

Tracking Blackout Recommendation Implementation

The blackout report recognized that despite past investigations of previous blackouts, the North American electric industry keeps experiencing blackouts caused by the same few problems – principally, inadequate vegetation management, insufficient operator training, insufficient reactive power, inadequate system visibility for grid operators, and ineffective communications in and before emergency situations. Therefore, the Task Force stressed the importance of implementing the recommendations of the present report, in the hope that these lessons could be learned and acted upon. FERC is working with the US DOE, Natural Resources Canada and NERC to formally track the recommendations and whether and how they are being implemented across the governments and industry. The tracking report will be publicly posted and updated regularly. The two nations issued a follow-up report on the anniversary of the blackout, "The August 14, 2003 Blackout, One Year Later: Actions Taken in the United States and Canada to Reduce Blackout Risk." (available at http://www.energy.gov/engine/content.do?PUBLIC_ID=14135&BT_CODE=DOEHOME&TT_CODE=GENERICDOCUMENT)

Category 2 – Understand the Present

With a better understanding of the grid and institutional weaknesses that caused the blackout, FERC turned to a number of opportunities to better understand current system issues and potential threats. The activities and issues discussed here address situations and issues that have not yet become major reliability or security problems, but they have the potential to become significant problems in the future. Therefore, FERC and industry attention to these issues now may help prevent or forestall future reliability failures and reduce grid vulnerability to attack.

Reliability Readiness "Audits"

In early 2004, NERC proposed to supplement its compliance program with a new program of reliability audits, in which industry peers visit reliability coordinators and control area operators to conduct a systematic review of their capabilities and practices and identify both areas needing improvement and good practices already in place. Over time, these reviews will allow all in the industry to identify and work toward achieving operational excellence above and beyond the levels that will be codified in electric reliability standards.

The reliability "audits" began with an ambitious schedule to evaluate all of the entities involved in the August 2003 blackout, and to review the entities managing at least 75 percent of North American electric load before the summer of 2003. Since the audit teams are composed of industry volunteers, FERC was concerned that there might not be enough volunteers, and that the teams might not always be consistent or objective in their evaluations. Therefore, FERC committed to send two experienced engineers on every audit team. The reliability reviews began in February 2003, and 34 visits were completed before October 1, 2004. Another 18 have been scheduled for completion by the end of 2004, and the industry plan is to cycle through all industry members every three years. Audit team evaluations are posted at http://www.nerc.com/~rap/audits.html . FERC intends to continue its participation in these NERC-coordinated audits because of their value to the industry in improving the quality of grid operations.

FERC has scheduled a conference with NERC and the industry for September 29, 2004, to discuss what has been learned from these reliability readiness reviews. The conference will examine the overall findings and trends with respect to reliability organizations' strengths and weaknesses, look at how to identify and institutionalize best reliability practices, and discuss ways to improve the reliability "audit" process.

Reliability Footprint Responsibility Analysis

Although NERC and the industry have clarified the different functions that must be performed to achieve grid reliability, observations by FERC staff on the Reliability Readiness "Audits" indicate a lack of consistent assignment and understanding of which entities are responsible for performing each function in some utility "footprints". Thus, FERC has begun working to identify, across each utility geographic territory, which entity is supposed to perform each reliability function, and whether that responsibility and function is actually recognized and being performed. This differs from NERC's current "registration" effort because NERC's registration invites an entity to self-identify which reliability functions it performs, but NERC is not examining whether there are gaps in either functional performance (are there functions that no entity has registered to perform?), geography (are there areas where some reliability functions are not being performed?), or where accountability and performance are not clearly understood by all reliability contributors. Because this task is such an important element in assuring North American reliability, FERC expects this analysis to continue through at least fiscal year 2006.

Reliability IT and Software Tools

The 2003 blackout was the first blackout in which software and information technology system failures were a major contributing factor. The blackout report identified the information technology problems in some detail and recommended the adoption of improved real-time tools for system operators and coordinators, along with better data updating and exchange practices. FERC's Reliability Team developed two projects to address this issue. First, building on data collected in the reliability audits about the actual reliability software in use in the 23 reliability and grid operators reviewed, FERC engineers identified a set of minimum reliability capabilities available in commercially available reliability software, and further identified a set of "best available" reliability software capabilities. This analysis has been shared with the electric and

software industries for their use and feedback. (See the Macedo presentation at the link below.)

Given the significant investments that the electric industry is now making in new information technology for both reliability and market management, FERC's Reliability Team hired a consultant (Gestalt ---) to prepare a paper on "Best Practices for Information Technology Management for Grid Reliability and Markets" (to be available soon on FERC's website). This information was shared with industry members at FERC's July 14, 2004 technical conference on "Information Technology for Reliability and Markets," as a companion piece to the minimum competencies study above. The conference also touched on cyber-security issues. (Presentations and transcript at http://www.ferc.gov/EventCalendar/EventDetails.aspx?ID=1102&CalType=%20&Date=7%2f14%2f2004&CalendarID=116 .)

Nuclear Power Plants and the Grid

As the blackout report makes clear, the cascading outage caused 265 power plants to shut down, including 20 U.S. and Canadian nuclear power plants. FERC's Commissioners have met with the US Nuclear Regulatory Commission (NRC), and reliability staff have met several times with NRC staff, to better understand the implications of the blackout specifically, and grid reliability generally, for nuclear power plant operations and safety. FERC staff participating in the NERC reliability readiness reviews have asked questions and gathered information relating to nuclear plant operations, communications and safety in field audits to better understand grid reliability coordinators' and control area operators' grasp of nuclear plant issues. FERC staff has testified on this subject before the NRC, and FERC and the NRC have signed a formal memorandum of understanding that commits the agencies to work together on the issues of grid reliability and nuclear plant safety.

Gas Pipeline Disruption Impact Analysis

In 2003, over 16 percent of US electric generation came from natural gas-fired power plants, and 23 percent of total US energy use from natural gas.[5] In late 2001, FERC staff began working with the natural gas industry to understand, on a region-specific basis, how a significant reduction of gas pipeline capacity (as from a terrorist attack) might affect gas users and prices downstream. Since that time, the study has expanded from examination of a single region to work through half the gas-consuming regions in the United States, under funding from the US Department of Energy, and study coordination is shared among the industry and FERC, DOE and DHS. Findings from the regions studied to date have been shared with industry and customer stakeholder groups, including the electric generation community and NERC. In 2004, FERC committed $200,000 of its reliability budget to continuing the gas pipeline disruption analysis, and has continued its leadership on the issue. Also in 2004, the electric industry (under NERC coordination) built on this analysis to formally analyze the interdependence of the electric and natural gas sectors (http://www.nerc.com/~filez/geitf.html). As the primary regulator for both bulk electricity and interstate gas pipelines, FERC will support these recommendations as appropriate.

[5] U.S. EIA "Annual Energy Review 2003", Tables 8.2a and 1.3.

E-Tagging Analysis

When electricity is purchased and transmitted across the bulk power grid, the transmission is given an electronic label, called an "e-Tag", that contains information such as the size and duration of the power transmitted, its producer and purchaser, and its points of origin and destination on the grid. The information used in e-Tags facilitates grid reliability management as well as wholesale market management. But not all power flowing across the grid is e-Tagged. Tag audits conducted for the blackout investigation revealed that a significant volume of electricity, and number of shipments, were not tagged and therefore not fully visible to the grid operators. Some un-tagged transactions reflect the historical practice that where the power plant owner and the load-serving entity are the same company, those transactions are not tagged; in other cases, transactions should be tagged but the parties neglect to do so. Within the Eastern Interconnection, tagging (or the lack thereof) has commercial as well as reliability implications. Tagged transactions may be cut under Transaction Loading Relief procedures, so the power won't flow and the producer won't be paid. Therefore, transactions without e-Tags have a competitive advantage and could, in some cases, compromise grid reliability.

FERC's Reliability Team is working with NERC to study e-Tag practices and their implications in greater detail, and will produce a report in late 2004. This analysis will contribute to a companion examination of whether companies that serve as control area coordinators receive commercial benefits that serve as a disincentive to control area consolidations that might improve grid reliability.

Engineering Analyses – Fast Response

FERC's Reliability Team looks at the implications of various events on grid security and reliability as the need arises, collecting information and briefing the Commissioners and other staffers as appropriate. Examples of events for which the Reliability Team conducted fast observation and analysis include individual grid congestion events, wildfires along western transmission corridors, the loss of a transformer in an Arizona substation, the Western drought, and the reduced coal deliveries from the Powder River Basin. The Reliability Team also contributes a grid operations perspective to work done by FERC's Office of Market Oversight and Investigation, and to the cases and tariff analyses that come before the Commissioners for decision.

Category 3 -- Build for the future

The last group of FERC reliability projects is designed to look ahead at the strategic issues and opportunities facing the grid, and offer some creative solutions and possibilities that could improve grid reliability and infrastructure security. Since the scope of FERC authority to mandate reliability solutions is not clear, FERC will use its intellectual and financial capital to develop new ideas for industry consideration. Where these yield compelling opportunities that earn industry and government support, FERC will work cooperatively with other stakeholders to develop further consensus and to foster additional investments of money and talent from the stakeholder community to achieve these solutions.

Reliability Standards

One of the most important activities that will affect long-term grid reliability is the on-going development of new reliability standards, now underway through the NERC process. As discussed above, this involves both the improvement of existing rules and practices for grid operations and planning, and development of new standards for issues such as vegetation management and operator training. FERC Commissioners and reliability staff are following these developments closely, reinforcing the importance of this work, monitoring specific proposals and offering informal feedback as appropriate. When Congress passes the pending reliability legislation, FERC would have the responsibility of reviewing and approving the adopted standards, and overseeing the compliance and enforcement program.

Operator Training Study

The blackout investigation determined that the lack of swift operator understanding and action on August 14, 2003 contributed to the blackout, and that the official industry requirements for operator training and certification are inadequate. The Task Force called for a formal study into the best practices for operator training. Given the importance of the issue, the Commission directed staff to undertake such a study rather than waiting for industry to do so. FERC's reliability program is paying for the study, with oversight from an advisory board composed of experts in training from organizations with similarly demanding operations and training requirements, such as the United States Navy and the Institute of Nuclear Power Operations. The contract for the study was issued this summer, and the study schedule calls for completion in spring 2005, with an opportunity for industry and public comment. The final study recommendations should contribute to industry and NERC's specification of operator training requirements and methods. NERC will participate in the Commission's study.

Lake Erie Loop Study

For decades it has been understood that electricity flows between the northeast United States, the Midwest, and Ontario across the transmission paths to the north and south of Lake Erie in amounts that do not follow the assumed transmission paths or payment flows. The unplanned flows (also called loop or parallel flows) congest some of the transmission lines, blocking flows that benefit certain line owners and their intended customers, while those owners are not compensated for the unplanned use of the lines. Other companies benefit from the flows without paying for them. The Lake Erie Loop flows have been observed and discussed for years, but to date the industry has not come up with a technically and economically feasible solution to the problem, which affects both electric reliability and markets.

FERC's Reliability Team is undertaking a new study of the Lake Erie Loop flows, starting with mathematical modeling of historical electricity transactions and comparing them to measured electricity flows (made available by NERC). Once the initial data analysis is completed, FERC intends to share the analysis and findings with the public and stakeholders. FERC's hypothesis in undertaking the long-term work is that the range of solutions to loop flow management will come from some combination of four arenas – new investments in transmission

infrastructure, changes in grid operations rules and controls, changes in the tariffs that set transmission compensation schemes, and changes in market rules. With a better understanding of current power flows and the corresponding flows of money and costs for the power, FERC and the industry will be better able to design, evaluate and manage Lake Erie loop flows in the future.

SCADA (System Control and Data Acquisition) Vulnerability Study

The conference managers' statement in the FERC appropriation expressed concern that NERC's cyber-security standard, adopted August 15, 2003, omits process control systems, distributed control systems, and electronic relays for generating stations, switching stations, and substations from the definition of critical cyber assets. The statement encourages FERC to ensure that process control systems, switching stations, and substations are adequately protected by any cyber-security standards issued for the national power grid.

NERC is now working with the electric industry to revise the cyber-security standard adopted in 2003; the new version must be completed and adopted by August 2005. They are working to refine the existing rule, and considering whether to broaden software security requirements and to expand its application to process control systems (including System Control and Data Acquisition, or SCADA systems. It is not clear that FERC has the authority under existing law to address the Congressional conference managers' concerns about SCADA, as expressed in the FERC appropriation language. However, FERC is working to improve the industry's understanding of how vulnerable the grid may be to SCADA cyber-attacks, and how feasible and cost-effective it may be to protect vulnerable, grid-critical SCADA from attack. FERC has contracted with the Idaho National Energy and Environmental Laboratory, one of the nation's leading cyber-security and SCADA research institutions, to study these questions and provide some definitive information on which SCADA elements are both critical to overall grid operation and vulnerable to attack. When the study is completed later in 2004, the industry will be able to better tailor the cyber-security standard and target industry cyber-security expenditures toward high-value remediation.

Grid Reliability Metrics

A common management precept holds that you cannot manage something unless you can first measure it. At present, most grid reliability metrics measure performance on the grid at the distribution level, as it affects end-use, retail customers. Few metrics address transmission-level grid performance and reliability, so FERC's Reliability Team is exploring ideas about possible measures and metrics, and discussing the possibilities with the Department of Energy and various industry members. Since there is little data collected on reliability, it may be very difficult to develop precise, useful and informative reliability metrics.

Participation in NERC Committees

Most of the work on reliability and standards development within the electric industry is performed by industry members working through NERC committees. Key issues are discussed in these committees and task forces and experts debate and resolve issues over months of

discussion and consensus-building. FERC representatives have non-voting seats on each of the NERC committees, which meet four or more times per year, and contribute actively to the issues to assure that as regulators they understand the technical issues, and that the industry understands FERC's public interest concerns and expectations. The relationships established and maintained through NERC committee work enhance FERC staff effectiveness.

Standardization of Small Generator Interconnection Agreements

Distributed generation – the use of small-scale generation and combined heat and power devices at locations spread across the grid, rather than in large central-scale power plants – is a technologically feasible option with increasing popularity. The use of more distributed generation (DG) and combined heat and power (CHP) at customer and utility-chosen locations can, over the long-term, significantly increase overall energy efficiency (by reducing transmission line losses), increase grid reliability (with more production of reactive power close to load, greater fuel diversity, and decreased dependence on a few large power plants) and reduce society's vulnerability to grid failure (as evidenced by the role of back-up power and energy storage for critical energy users like hospitals, airports, traffic lights, elevators and financial center computing).

But the difficulty of easily connecting a small generator to the grid – legally and contractually as well as electrically – is an obstacle to greater DG use. FERC began working on standardized interconnection agreements under rulemaking processes for both large and small generators in 2001, and adopted standardized interconnection language, terms and procedures for large generators in 2003. Small generator issues proved more difficult to reach agreement on, with disagreements on technical and jurisdictional issues. However, discussion has continued on the small generator issues and FERC Reliability Team engineers are leaders in the small generator interconnection rulemaking, which is expected to conclude in 2004.

Collaboration with Canada on NERC Issues

Because of the close economic relationship between the United States and Canada and the interdependency of our electric and natural gas markets and infrastructure, FERC has always communicated closely with Canadian energy officials on trade and infrastructure issues. The blackout emphasized the importance of closer cooperation on grid reliability and management issues as well, starting with joint coordination of NERC and any successor organizations as entities that must be managed consistently and cooperatively by both nations.

In early 2004, anticipating Congressional passage of the reliability legislative provisions, FERC began working with Canadian officials to develop a process to allow the provisions of any reliability legislation pertaining to the North American Electric Reliability Organization to be implemented in a cooperative, parallel fashion in both the US and Canada. FERC, DOE and Canadian federal and provincial officials have held extensive discussions on an alternate funding mechanism for NERC, and other institutional issues pertaining to reliability.

Collaboration with Other Agencies and Stakeholders

Since grid reliability has many dimensions and influences, FERC works to build and sustain relationships with the many agencies and stakeholders who can influence or affect grid operations. At the federal level, FERC works closely with the Department of Energy's Office of Energy Assurance, Department of Homeland Security, the Department of Transportation's Office of Pipeline Safety, Coast Guard, the Rural Utilities Service, and others on reliability and security issues. At the state level, FERC works closely with the National Association of Regulatory Utility Commissioners and participates in NARUC's Critical Infrastructure Protection and Reliability Committees, among others. FERC also works with individual grid managers and owners on reliability issues, and with a broad array of stakeholder associations, such as the Edison Electric Institute, American Gas Association, American Public Power Association, and others. In an interdependent world, cooperation and collaboration will yield better results for grid reliability and other goals than unilateral action alone.

Collaboration with Companies to Protect and Improve the Bulk Power Supply System

It is important to implement cost recovery policies in order to encourage investments in our Nation's bulk power supply system. Companies that are engaged in the evaluation, planning, operations, maintenance, and construction of bulk power supply facilities need assurance that their prudent investments to safeguard security and reliability will be fairly compensated. As the regulator of interstate energy commerce, FERC is uniquely positioned to study, issue, and implement such policies.

On September 14, 2001, the Commission issued a Statement of Policy, in Docket No. PL01-6-000, 96 FERC ¶ 61,299, where it acknowledged that companies might need to adopt new procedures, or install new facilities, among other things, to safeguard the reliability of their systems.

1. The Commission assured companies that it would "approve applications to recover prudently incurred costs necessary to further safeguard the reliability and security of our energy supply infrastructure…. Companies may propose a separate rate recovery mechanism, such as a surcharge to currently existing rates or some other cost recovery method." This is an exception to the generally applicable prohibition against trackers and surcharges.

2. Since the issuance of this statement, the Commission has received filings from nine companies (two natural gas pipelines, five oil pipelines, one electric utility, and one LNG operator) to establish security cost trackers or other mechanisms to recover outlays for new equipment and other security related matters. The Commission has approved some and set others for hearing.

As was referenced in the "Improving Reliability Standards" section of this report, on April 19, 2004, the Commission issued a Statement of Policy on Matters Related to Bulk Power System Reliability, in Docket No. PL04-5-000 (107 FERC ¶ 61,052). This Statement of Policy relies in part on the earlier Statement of Policy, emphasizing the Commission's commitment to allow utilities to recover prudently incurred costs necessary for security measures. The statement also expressed the Commission's willingness to consider on a case-by-case basis proposals by

utilities to amend their open access tariffs to include limitations on liability. To date, the Commission has not had an occasion to apply this policy, although the Midwest Independent System Operator recently made a filing, in Docket No. ER04-1160-000, that includes such a proposal.

USES OF FERC's RELIABILITY BUDGET

FERC has used the $5 million budget allocated for reliability for the following purposes:

- Personnel salaries and support -- $1,071,000
- Consultant services and research contracts -- $2,470,000
- Travel – $202,500, including $70,000 relating to the blackout investigation, $80,000 for reliability audits, and $50,000 for travel including NERC meetings, presentations and conferences
- Uncommitted as of September 1, 2004 -- $1,257,000

CONCLUSION

The proposed reliability legislation will improve the Nation's bulk power supply system because it will allow FERC to review and approve or remand NERC-adopted reliability standards and strengthen federal enforcement of electric utility compliance with high quality reliability standards. These measures will reduce the likelihood of the next major blackout by improving operational reliability on the nation's bulk power supply system. In addition, implementation of clear and enforceable standards governed by a regulator – FERC – will reduce the vulnerability of the bulk power supply to outside attacks. Without passage of the bill, the nation will see continuing variability in utilities' performance of their reliability responsibilities as there is no clear regulator for the reliability of the nation's bulk power supply system. This will yield lower grid reliability, higher risks, including the opportunity for more regional and inter-regional blackouts and higher electricity costs for all Americans.