Creating New Incentives for Risk Identification and Insurance Process for the Electric Utility Industry (initial award through Award Modification 2); *Energy & Risk Transfer Assessment* (Award Modifications 3 – 6)

Final Technical Report for DOE Award DE-FG26-04NT42250

Issued by

The Center for Infrastructure Protection

(*formerly the Critical Infrastructure Protection Program*)

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Abstract

This is the final report for the DOE-NETL grant entitled "Creating New Incentives for Risk Identification & Insurance Processes for the Electric Utility Industry" and later, "Energy & Risk Transfer Assessment." It reflects work done on projects from 15 August 2004 to 29 February 2008. Projects were on a variety of topics, including commercial insurance for electrical utilities, the Electrical Reliability Organization, cost recovery by Gulf State electrical utilities after major hurricanes, and review of state energy emergency plans.

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Executive Summary

This Final Technical Report documents and summarizes all work performed during the award period, which in this case is from 15 August 2004 (date of notification of original award) through 29 February 2008. This report presents this information in a comprehensive, integrated fashion that clearly shows a logical and synergistic research trajectory, and is augmented with findings and conclusions drawn from the research as a whole.

Four major research projects were undertaken and completed during the 42 month period of activities conducted and funded by the award; these are:

I. Creating New Incentives for Risk Identification and Insurance Process for the Electric Utility Industry (also referred to as the "commercial insurance" research). Three major deliverables were produced: a pre-conference white paper, a two-day facilitated stakeholders workshop conducted at George Mason University, and a post-workshop report with findings and recommendations. All deliverables from this work are published on the CIP website at http://cipp.gmu.edu/projects/DoE-NETL-2005.php.

II. The New Electric Reliability Organization (ERO): an examination of critical issues associated with governance, standards development and implementation, and jurisdiction (also referred to as the "ERO study"). Four major deliverables were produced: a series of preliminary memoranda for the staff of the Office of Electricity Delivery and Energy Reliability ("OE"), an ERO interview protocol and stakeholder/experts interviews, a formal research paper, and a data quality and availability study of North American Electric Reliability Corporation/ERO's disturbances and outages working group ("DAWG") databases.

III. Critical Electric Power Infrastructure Recovery and Reconstruction: Issues & New Policy Initiatives in Four Gulf Coast States After 2005's Catastrophic Hurricanes (also referred to as the "Gulf Coast cost recovery study"). Four deliverables were produced: the original research paper providing preliminary findings and recommendations (29 September 2006), a formal presentation of that report to officials, staff and invited guests at OE's Washington, DC headquarters, a series of update memoranda and quarterly activity updates (1 November 2006 through Q3 – 2007), and a final cumulative update of the original research report

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(February 2008). Documentation and information on these research activities can be found on the CIP website at http://cipp.gmu.edu/projects/DoE-NETL-2006.php.

IV. Evaluation of State Energy Emergency Response Plans (also referred to as the "SEERP project). Two major deliverables were produced: an evaluation of 47 SEERPs with findings, statistical analyses, geospatial renderings (mappings of the States whose plans were evaluated with statistical analysis underpinnings) and recommendations (17 September 2007), and a major revision to the original deliverable to include one additional plan (Missouri), with fully updated findings, statistical analyses, geospatial renderings, and recommendations ("Revision 1," 29 February 2008).

During the period of the award, CIP conducted several secondary research activities for which most deliverables where in the form of *ad hoc* memoranda, brief reports, and emails. A synopsis of all these activities is provided in **Appendix A**.

During the 42 months of research activities supported by the award – from an examination of stimulating markets for commercial insurance to the development of evaluations tools and underlying metrics for assessing the 48 State Energy Emergency Response Plans, researchers often returned to core challenges such as data availability, data consistency and standardization, and especially data quality. One of the primary reasons that commercial insurance either was unavailable or unaffordable (with respect to the latter, always in the context of whether such expenditures were "reasonable and prudent" in the eyes of state officials and commissions) is that a well-formed and reliable set of actuarial data on risks to the electric power industry in contemporary, all – hazards contexts simply was not available. Insurers could not measure risks and therefore set market-based prices commensurate with definable risks.

The insurance workshop hosted by CIP occurred as federal lawmakers were considering major new energy legislation, which on 8 August 2005 was signed into law by President Bush as the Energy Policy Act of 2005 ("EPACT – 2005"). Subtitle A of Title XII of EPACT – 2005 provided a major expansion of the Federal Power Act (FPA); new Section 215 of the FPA contained requirements for mandatory and enforceable reliability standards for the "bulk power system," and the establishment of an Electric Reliability Organization ("ERO") to audit and enforce these standards. As was noted at the workshop, some participants believed that, over time, the data and information utilities provided to the ERO and its regional partners could begin to inform risk profiles for utilities that could, in turn, help mitigate risks and stimulate risk transfer mechanisms

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such as insurance. However, research done in parallel with the insurance workshop using datasets provided by the ERO's predecessor pointed to significant data, governance and standards implementation challenges for the ERO and the industry. The ERO research conducted under the award validated concerns that the ERO, the Federal Energy Regulatory Commission (FERC), and the utilities had much work to do in order for all approved reliability standards to be auditable and enforceable "on the numbers." The last two major research projects reinforced the challenges identified in the first two major activities: absent good, consistent and "apples-to-apples" data and information, assessing risks and measuring changes in risks over time would inhibit well-intentioned policy initiatives: reliability standards that could not be objectively assessed because compliance benchmarks and datapoints were not well established could not be fully enforced.

Experimental Methods

The most common scientific methods employed over the course of research activities conducted under the award consisted of the development and use of interview protocols that were designed to produce consistent responses and thus comparable outcomes. Formal interview protocols were approved; almost all interviews were conducted under a pledge of confidentially. Researchers developed initial samples of prospective interviewees based upon representative industries, jurisdictions, and regions; researchers also employed the "snowball technique" at the conclusion of additional interviews in order to expand the pool and perspectives of all interviewees. The SEERP project required researchers to develop an Excel-based tool with quantitative metrics and guidance sub-metrics that was used consistently as a "yardstick" for assessing each of the 48 plans. The tool was developed collaboratively with the CIP, DOE, consultants, and suggestions from state energy officials who led the development of the NASEO State Energy Assurance Guidelines (Version 2). Creation of this evaluation diagnostic allowed researchers to assess the plans, which varied greatly in content, organization, coverage, etc., against a uniform set of criteria. Evaluations also entailed the creation of a plan evaluation review methodology which would minimize the possibility of researcher bias tainting the final evaluation. A process with more than three review stages was designed, so that researchers would first review a plan on their own, then reconcile results between themselves, and then reconcile them again with the review results done by the research supervisor.

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I. Commercial Insurance Workshop and Research Papers

The initial award's project title was *Creating New Incentives for Risk Identification and Insurance Process for the Electric Utility Industry*. The impetus for this research focus was that with limited exceptions, the market for commercial insurance as a means to mitigate risks as well as to recover from large-scale events (such as hurricanes) was not and today still is not available to the electric power industry. Limited commercial insurance exists for some of the electric power industry's assets on the generation side of the utility, but commercial insurance for distribution and transmission assets either is not available or is prohibitively expensive. A research objective for this initial period of the award was to determine the possible reasons for the industry's "insurance deficit," and to bring stakeholders together to determine how this industry, the insurance and reinsurance industries, and policymakers at the federal, state and even local levels might stimulate an emerging market for commercial insurance.

The Center for Infrastructure Protection (CIP), which is anchored within George Mason University at its School of Law, began its research activities by identification of detailed tasks within the broader research objectives. CIP partnered with other Mason entities, such as the School of Public Policy, as well as with other academic institutions of higher education and external subject matter experts/consultants. Research tasks were established and refined primarily through interviews and surveys of stakeholders. For example, CIP researchers attended the November 2004 meeting of the National Association of Regulatory Utility Commissioners (NARUC) as a means of establishing important state-level contacts, information and perspectives on research tasks. From this and other preliminary research, it was determined that the major deliverables for this period of performance (15 August 2004 – 14 May 2005) included an issues-framing white paper, a facilitated workshop – conference of stakeholders to be held at George Mason University's Arlington, Virginia campus,

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minutes from that workshop, and a final summary report with findings, conclusions and recommendations.

In consultation with the US Department of Energy (the "Sponsor," "DOE"), George Mason University ("Mason") sought and on 30 March 2005 was granted a no-cost extension (amendment no. M001). This amendment provided no additional funding but extended the period of performance from the original 14 May 2005 through 14 December 2005. A pre-workshop white paper was developed by the Center for Disaster Risk Management at Virginia Tech University under the oversight of CIP, with input and review from outside consultants. The white paper was circulated to stakeholders in advance of the facilitated workshop for comment to assist in issue-framing and discussion during the workshop.

On June 22-23, 2005, CIP conducted a facilitated workshop on "Protecting the Electric Sectors' Infrastructure: Building the Business Case for Commercial Insurance." A diverse group of 35 national and international experts from the electricity and insurance sectors discussed and debated the current role of insurance in the electricity sector and the potential for insurance to promote future electricity sector infrastructure protection. The workshop included participants from various federal agencies, senior staff from the US Congress, the Organisation for Economic Cooperation and Development (OECD), academia, insurance companies, engineering consulting firms, public and investor-owned utilities, the Edison Electric Institute, the North American Electric Reliability Council (NERC), and energy sector publishers. A consensus was reached among the participants that the establishment of mandatory, enforceable reliability standards was a critical component to not only improve reliability in the electricity sector, but also to better define insurance risk through improved data reporting and compliance monitoring. The use of insurance was also discussed as a market based tool to promote reliability. A summary of the workshop findings was

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completed by end of July 2005 and distributed to CIP staff, consultants and selected stakeholders for their review. The summary was also included as an appendix in the final project report. An article on the workshop was also published in the July 2005 CIP Report (Vol. 4, No. 1) to provide further dissemination of the workshop findings.

In February 2006, the final report entitled "Expanding the Role of Commercial Insurance in the Electricity Sector to Promote Improved Bulk-Electric System Reliability' was delivered to DOE. The report focused on three broad themes. The first concerned the importance of, and need for, mandatory reliability standards in the electricity sector. The second concerned the role of commercial insurance in supporting an efficient approach to catastrophic risk mitigation and recovery, and the last section concerned the role of the Terrorism Risk Insurance Act (TRIA) which was facing sunset at the time of the workshop. A total of 19 recommendations were contained in the report, many of which remain pertinent today. In general, the report concluded that:

1. In theory, insurance has a role to play in promoting the adoption and compliance with security and reliability standards. In reality it seems that insurance plays a confined and specific role in the electricity sector, principally as a means of protecting the electricity business (largely in the area of generation) from standard operating risks common to most businesses. From this research, it is apparent that the insurance industry is not yet interested in assuming a role in fostering increased investment in electric utility infrastructure protection without the enforcement of reliability standards and valid data associated with the criteria for assessing reliability. Thus, the role of insurance in managing reliability or in mitigating costs of catastrophe is not an active issue for discussion within the practitioner communities.

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2. Any new insurance products should focus exclusively on the transmission components of the bulk-electric system. The majority of the discussion on insurance markets, products and regulatory processes focused on two major areas: 1) how to best approach restoration and cost recovery following a destructive event; and 2) how to best develop insurance capacity or products to enhance electric system reliability.
3. The adoption of mandatory, enforceable reliability standards in the electricity sector is essential to ensure bulk electric system reliability and to promote the development of competitive insurance markets. Voluntary NERC standards had produced inconsistent data and results, with root causes of the Northeast US – Canada 2003 Blackout pointing to unevenness of industry's compliance with voluntary reliability standards. Mandatory standards would serve as a metric to improve reliability and as a benchmark for risk analysis and mitigation efforts.
4. Additional research is clearly needed into the types of data required to assess, with a high degree of accuracy, improvements to bulk-electric system reliability resulting from the implementation of mandatory standards. In addition, as these data become available, insurance market metrics should also be studied for possible correlation with any measurable improvements in the utilities compliance with reliability standards.
5. Separate insurance instruments or products should be developed for terrorism threats versus natural events. The formation of a national captive pool was suggested as one possible mechanism. The national pool would be based upon regulatory models many States had developed to pay for costs associated with restoration and recovery from natural disasters. State pools had limited effectiveness due to inherent

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jurisdictional constraints and the impacts of large-scale natural disasters that did not respect such boundaries.

All deliverables from this work are published on the CIP website at http://cipp.gmu.edu/projects/DoE-NETL-2005.php.

II. Electric Reliability Organization (ERO) Formation, Governance & Standards Study

During this period, another funded research activity was launched to examine electrical power outages datasets. This team began an examination of electric power outages datasets that are collected by what was then the North American Electric Reliability Council (NERC; now the North American Electric Reliability Corporation). In 2006, the Federal Energy Regulatory Commission (FERC) designated NERC as the Nation's Electric Reliability Organization (ERO) pursuant to Title XII of the Energy Policy Act of 2005. By design, the ERO is an industry self-regulating organization similar to the New York Stock Exchange. It can, and does, set policies and standards for its members, which in the case of the ERO is the "bulk electric power sector." – generally construed to mean electric power assets and systems that fall under the rubric of interstate commerce and which excludes local distribution systems. In the United States, the role of the FERC is to "regulate the self-regulator" – that is, to approve the ERO's governance and financial structures, and the policies and reliability standards that are binding on its members. FERC also has ultimate authority with regard to regional delegation agreements and final enforcement sanctions. (In Canada and Mexico, FERC-like federal and provincial agencies establish similar policies and procedures for these sovereigns' electric power industries.) This arrangement allows the ERO to have authorities to establish, audit and enforce a common set of reliability standards for the North American grids.

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Initially, the area of study was to analyze the root causes of electric power outages, to improve the quality of NERC's outages data, and to examine variables such as regionality, seasonality, and other factors *over time*. The research team was aware of pending federal legislation that proposed to make NERC's voluntary electric power reliability standards mandatory for the US bulk electric power system, and worked directly with NERC senior staff on issues of data availability, coverage, consistency and quality. Such data issues are important to the establishment of mandatory reliability standards for which electric utilities performance can be measured and enforced. This research is relevant to the "risk identification and insurances processes" rubric of the original award in that quality and consistent data, if it exists, will help quantify risks and assist the insurance and reinsurance industries in establishing risk metrics – a fundamental requirement for developing a market for commercial insurance. After the enactment of EPACT – 2005, this research team commenced a study of the establishment, governance and financing issues associated with the ERO. Two members of the team also participated as neutral observers and commentators on a large-scale, multi-jurisdictional energy emergency exercise sponsored by DOE's Office of Electricity Delivery and Energy Reliability (OE).

Based upon outcomes from the insurance workshop, and the strength, quality, and potentials of the new research initiatives, the Sponsor and Mason agreed to broadened the title of the grant to *Energy and Risk Transfer Assessment*, and on 15 August 2004 extended the period of performance for the award to 31 December 2006. (See Amendment No. A002.) In September 2005, CIP researchers formally launched the ERO study. An interview protocol was developed and approved which was used to conduct telephone and in-person interviews with ERO stakeholders and other experts. Three members of the CIP ERO research team (Dr. Todd LaPorte, Michael Ebert, and Dr. Kathy Emmons) visited NERC's Princeton, New Jersey headquarters and conducted a series of discussions

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and interviews with senior NERC officials; Ebert also attended FERC ERO hearings and workshops from October 2005 through January 2006. During this period, Dr. James B. Atkins joined the research team as a senior consultant and assisted in facilitating discussions with senior NERC Regional directors and staff, Independent System Operators (ISOs), and state Public Utility Commissioners and senior staff who were authorities and leaders on system reliability and infrastructure protection issues. Over 30 interviews were conducted over a period of three months; the interviews were in-depth, with the typical interview lasting approximately 45 minutes and some interviews extending two to three hours. Aggregated content from these confidential, not for attribution interviews then were then analyzed and integrated into an academic research paper presented at the School of Public Policy and in a derivative report to DOE. The research identified several significant challenges for the ERO, many of which remain relevant:

1. Organizational and cultural transformation of NERC. – Prior to enactment of the Energy Policy Act of 2005, NERC was an industry-funded organization that also drew heavily from the electric power industry for its "adjunct" staffing needs and standards drafting. Industry compliance with pre-2005 reliability standards was voluntary. Further, NERC's regional entities had great degrees of latitude on their operations, policies and standards. EPACT – 2005 gave FERC the authority to designate an ERO for the Nation's bulk power system; the law also provided FERC with the authority to approve NERC's reliability standards or to remand those standards for improvement. FERC-approved standards became mandatory on the industry, and NERC as the ERO now is tasked with auditing, enforcing and even fining the industry that it was a part of. This poses huge challenges in transforming the organization, culture and even ethics of NERC as a corporation. The research identified these challenges, which today have not fully been overcome.

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2. Standards development, especially cyber security. – The research speculated that many of NERC's standards, particularly those associated with critical infrastructure protection and cyber security, represented a floor, not a high bar. Our researchers also raised questions about the standards development process itself, which is laborious and time consuming in part because of the complexity of stakeholders and their weighting in the standards process. The research suggested that, in certain areas the velocity of threats to the bulk power system far exceeded the pace of NERC's standards development processes. This controversy remains today: Congressional hearings in 2006 and 2007 have resulted in draft legislation to amend Section 215 of the Federal Power Act to provide FERC with additional authority to require NERC and the bulk power entities it oversees to implement FERC emergency orders on cyber security. The draft legislation also directs NIST and FERC to examine other potential cyber security standards for bulk power system owners and operators. It is highly probable that the next Congress will take up the unfinished work of the 110th Congress in this area.
3. Data availability, consistency, and quality. – One of the most important findings of the ERO research – a finding that was confirmed by prior research activities that the School of Public Policy team conducted with NERC and others – was that FERC and NERC would encounter challenges when implementing and enforcing mandatory standards due to data deficits, inconsistent data syntax (such as date/time data IDs), what data elements are required to audit and enforce a standard, whether such data is collected or can be collected, who should receive such data on the audit and enforcement side, how should this data be protected, and what should be the data retention policies for bulk power sector entities. These identified challenges are among the most technically difficult tasks confronting the

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industry, FERC and NERC today. In some cases, FERC has approved a reliability standard but the standard will not, at this time, be subject to financial penalty for non-compliance due to data issues.

4. Defining and identifying the "bulk electric power system." – EPACT legislation used the words appearing in quotes at the front of this paragraph to define those entities that would be subject to the new mandatory reliability standards. The ERO research speculated that the number of captured entities would be substantially greater in number than NERC's membership pre-EPACT, and that controversies would arise with newly-identified entities. Further, the research suggested that even the identification of all bulk power entities would be challenging. This has proven to be the case.
5. Regulatory jurisdiction and sovereignty. – The "bulk electric power system" is not confined to the United States; it is North American. Canada long has been integrated into the three major asynchronous AC grids with limited interconnections that constitute the bulk power system, and the pace of Northern Mexico's integration into those grids is increasing significantly. System reliability cannot be maintained and improved if ERO standards and enforcement stop at the northern and southern borders of the United States. Further, the reliability and security of the bulk power system, which is largely interstate commerce in terms of existing federal jurisdiction, reaches into some areas where States traditionally have regulatory authority. The ERO research identified that many state commissions, for example, had insufficient "situational awareness" of the federal EPACT of 2005, and how full implementation would impose costs on electric power entities within States' jurisdiction. Some States also were pursuing their own reliability and security initiatives without sufficient awareness of, and coordination with, FERC and NERC. The research

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further suggested that sovereignty would be a delicate issue for FERC: for FERC to strike down standards that had been collaboratively developed with Canadian and Mexican partners could result in reduced North American cooperation. Fortunately to date, FERC has acted with appropriate sensitivity; see, for example, how FERC dealt with NERC critical infrastructure and cyber security standards in its January 2008 Order.

III. Gulf Coast Cost Recovery Study

The next major research projects conducted under the award benefitted greatly from foundations of knowledge, resources and relationships with a broad range of stakeholders in the private sector and the public sector, particularly with the States, that CIP had developed with the two prior major research initiatives. The findings from the insurance workshop informed work on the ERO project, and there is a significant amount of consistency between the outcomes of the two efforts. Lack of commercial insurance and the inadequacy of traditional means to "self-insure" the restoration and recovery of the electricity sector from catastrophic events became a serious policy issue, primarily for the States after the large, serial hurricanes and tropical storms of 2004 and 2005. It was these complex policy issues that became the focus of the third major research project under this award, which was to study how federal and state policymakers engaged in new catastrophic cost-recovery strategies in response to large regional catastrophes.

In the US federalist context (particularly in State jurisdictionable retail rate regulated environments), electric power utilities recover "reasonable and prudently incurred costs" associated with system restoration and re-building from natural disasters by seeking approval of restoration costs from the state public service commission in which the damages occurred. Lacking commercial insurance, Florida and many other States implemented rainy-day pools known as storm reserves. All ratepayers in an electric utility's regulated service territories pay for the storm reserves as a

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percentage of their monthly utility bills. Thus, States established an important principle of *"who pays?"* for an electric utility's uninsured and uninsurable restoration and recovery costs: ratepayers (customers), not the utility's shareholders, pay for these losses. State regulators periodically true-up or true-down the amounts ratepayers contribute to the storm reserves. Many States, starting with Florida after Hurricane Andrew caused unprecedented losses for the industry in 1992, established "storm reserve funds" for the electric utilities they regulated. During a series of interviews with up to a dozen Florida PSC attorneys, economists, engineers and policy analysts, CIP researchers were able to provide an answer to one of the open questions from the insurance workshop: *what circumstances and events appear to have resulted in the demise of limited commercial insurance for electric power distribution and transmission?* According to Florida PSC staff who were working at the Commission in the early 1990s, commercial insurance for transmission and distribution systems became unavailable or unaffordable after Category V Hurricane Andrew.

In theory and for over 10 years largely in practice, storm reserves coupled with small-to-moderate short duration ratepayer surcharges were sufficient to cover the costs of restoration and reconstruction. All along US coastal regions, States and municipalities experienced large growth of populations and the corresponding infrastructures to support them. Coastal population growth rates were exceptionally robust in warmer climates, such as the Southeastern US and the Gulf Coast – home to much oil and gas infrastructure in the US. Coastal development occurred in areas known to be "in harm's way" – at known risk to hurricanes, tropical storms, surges, and flooding. Significant increases in at-risk costal development, populations and infrastructures created an untenable economic and policy environment for using short-duration ratepayer surcharges to pay for multiple recovery and reconstruction efforts. Storm reserve funds exhibited significant deficits as the result of serial mega-storms and development, first in 2004 in Florida, then in 2005 for Gulf Coast States

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that were hit by Hurricanes Katrina, Rita and Wilma. The frequency and severity of these catastrophes resulted in nearly 100 percent electricity infrastructure destruction in some areas. State lawmakers provided regulatory agencies with authorities to employ new cost recovery options to avoid overwhelming ratepayers with large, short-term increases in their bills, which could further impede economic recovery. Temporary surcharges impose higher utility costs on all classes of ratepayers – residential, commercial, and industrial – in the first two to three years after large catastrophic events. Such costs are thus imposed at the same time households and businesses are struggling to manage other uninsured losses, as well as temporary declines in employment, payroll, and business revenues. At the same time, electricity prices also were on the rise due to other factors, such as increases in primary fuels, environmental remediation, and retail competition stranded cost recovery. The "trickle-in" approach inherent in 24 – 36 month surcharges in some cases forced utilities to engage in expensive short term borrowing to finance the immediate costs of restoration and recovery. As a result, States turned to longer-term financial instruments to pay for short-term storm costs.

Working with the Sponsor, CIP researchers identified four States in the Gulf Coast region for the study: Florida, Louisiana, Mississippi, and Texas. Researchers determined that many of the questions the project sought to address required candid discussions with state officials and utilities. Using methods and techniques that were developed for the ERO research, and building on the informal networks of contacts developed throughout this Award, the CIP research team developed an interview protocol. The team included a former state commissioner, who identified and contacted key resources in the Public Service Commissions (PSCs) of the four States. [In some States, PSCs are referred to as Public Utility Commissions (PUC) or as State Corporation Commissions.] Two law interns working on the team produced a compilation of relevant state authorities (statutes and

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regulations), and of all germane cost recovery hearings and orders that had occurred prior to 2005. The interviews and these compilations provided the foundations for the report and periodic updates that followed. It is important to note that researchers were working with very new laws, implementing regulations, and financial instruments. Fully documented and written information on these new developments did not exist at the time of the research, and new information continues to enter the public domain. Candid discussions and interviews with lawmakers, commissioners, expert staff, and utilities thus was required to accomplish the objectives of the study.

All four States that CIP researchers studied responded to the natural disasters of 2004 – 2005 by providing their commissions and the electric utilities they regulated with an option to avoid large and debilitating rate increases. That option was "securitization" – the use of a new category of asset-backed securities to achieve least-cost service recovery for ratepayers with federal tax benefits. In all four States, legislation had to be enacted to meet federal IRS and state requirements for "storm bonds," long term (10 – 15+ years) instruments that would, in theory, provide more immediate infusion of cash to recover losses while spreading the cost to ratepayers over the life of the bonds.

One of the challenges facing researchers was to developed trusted and rich relationships with regulators, utilities, and other state and local officials who were entering unfamiliar territories and often were understaffed. During the initial three months of interviews and discussions, trust was developed and information was exchanged which resulted in state relationships with the CIP that endure today.

Researchers discovered that while the basic concept of using long term storm bonds to spread out the recovery and restoration costs of events that occurred in 2004 and 2005 was common to all four States, each state chose unique means to securitization. In Florida, for example, only one electric utility sought and received PSC approval to issue storm bonds through a "bankruptcy-

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remote" Limited Liability Company (LLC) for which the utility – Florida Power and Light (FPL) is the sole member and administrator, but which is overseen by the PSC. In this arrangement, the State of Florida did not provide a "full faith and credit" pledge for the bonds, but Florida did pledge regulatory certainty for the life of the bonds. The two major Mississippi investor-owned electric utilities, Mississippi Power and Entergy – Mississippi, were approved by the State PUC for securitization, but in Mississippi all utility storm recovery bonds were bundled together by another state agency, the Mississippi Development Authority (MDA) and issued by the state with a full faith a credit pledge standing behind the bonds.

Louisiana, which suffered more electric power infrastructure loss on a per-capita basis than the other three States, was more difficult to analyze for this project than the others despite excellent information received from its PSC staff attorneys. Overall, policy and regulatory transparency, particularly in terms of available and timely electronic information, was inferior compared to the other States studied. The authorities for Louisiana's PSC are derived directly from its constitution. Louisiana's constitution also provides the City of New Orleans with home rule authorities separate from the rest of the State, including jurisdiction over regulated utilities providing electricity, natural gas, and transportation. The New Orleans City Council, not the Louisiana Public Service Commission, is the regulator for these entities, which in the case of electricity and natural gas is Entergy New Orleans, the only utility to file for federal bankruptcy protection after Hurricane Katrina. Thus, storm cost recovery in this state was particularly complex and in the case of New Orleans, generally opaque to research methods and techniques that worked well in other jurisdictions. One electric utility, Entergy Gulf Coast, provides electricity to customers in two jurisdictions, Louisiana and Texas. Regulators in both States required this utility to provide separate cost recovery accounting within each state boundary, which was not at all easy for the utility to do.

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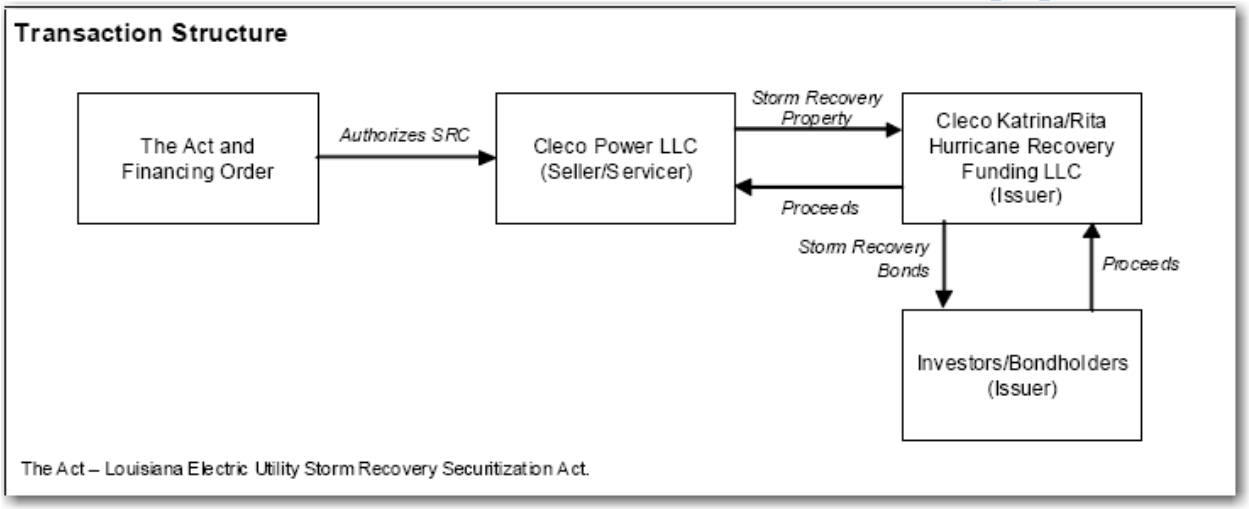
Louisiana also pursued securitization in a tortured manner. The state passed its initial storm cost recovery securitization law in May 2006. Before that law could be implemented and bonds issued, the state's lawmakers essentially repealed large chunks of the 2006 law with a May 2007 act. Securitization in Louisiana thus was delayed, and all storm bonds had to flow through the Louisiana Utilities Restoration Corporation (LURC), a quasi-state agency issuing securities without a full faith and credit pledge, as shown in the chart below:



The initial research report for this project was submitted in accordance with the original project design on 29 September 2006. Additionally, the sponsor and the CIP, recognizing the complexity of the task and delays in the cost-recovery processes in the States that were without precedent (and coupled with a very unusual federal intervention), resulted in the sponsor and the CIP agreeing to provide periodic updates to the original research deliverable, *Paying for the Costs of Catastrophes: An Examination of Electric Power Infrastructure Initiatives in the Gulf Coast After 2005's Hurricanes*. The original project design due date was established using an estimated range for "typical" energy utility cost recovery dockets to be completed. The 2005 hurricane season dockets, however, were unusual in ways beyond magnitude and frequency of the storms themselves:

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1. All state commissions, stakeholder groups such as consumer advocates, and the utilities themselves lacked experience with "storm bonds" (or "securitization"), which required expertise in asset-backed securities (ABS), bond markets, ratings agencies, and somewhat arcane provisions of the federal tax code related to these complex financial instruments.
2. The federal government intervened in energy utility storm cost recovery in a most unusual manner, but which produced actual relief for investor-owned and privately-held electric and gas utilities in just two of the four States studied. This highly unusual intervention – the use of Community Development Block Grants (CDBGs) administered by the US Department of Housing and Urban Development (HUD) as the result of two emergency appropriations bills (December 2005 and June 2006) – was intended to augment existing state cost recovery processes, both traditional and new. Ultimately, these unprecedented grants did provide varying degrees of ratepayer relief in Louisiana and Mississippi, but the funding mechanisms and timelines were sufficiently uncertain that the mere *possibility* of federal grants delayed the dockets (see illustration below). CDBGs even factored into Entergy- New Orleans' bankruptcy strategy.

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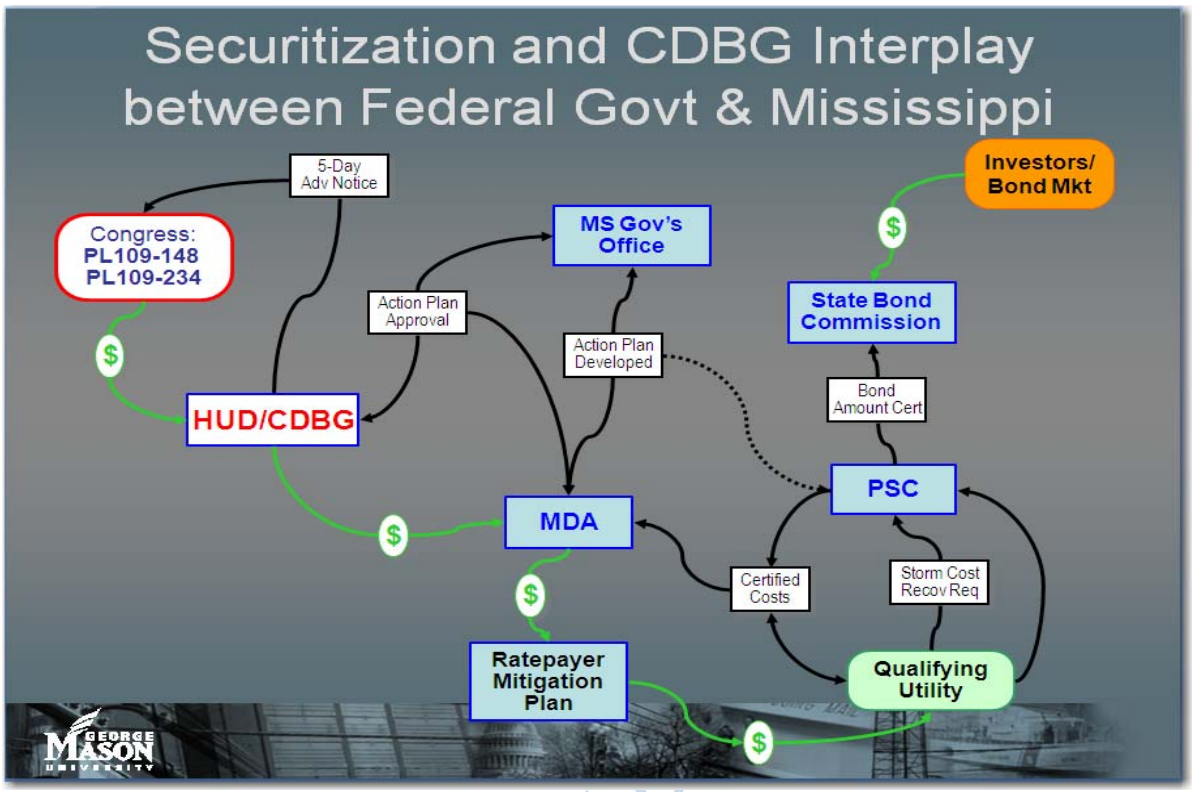

3. After the mega-storms of 2005, three of the four States studied started to implement "infrastructure hardening" programs as proactive responses to future natural disasters. Hardening measures included a new utility storm response center more inland than Katrina's surge (Mississippi), to higher wind load requirements within 150 miles of the Gulf Coast (Texas), to multiple initiatives such as undergrounding, higher engineering standards, etc., in Florida. These measures were intended to reduce future infrastructure damage and destruction as well as to make energy infrastructures more resilient. All state-led initiatives were initially not controversial, but questions of costs and who would pay these costs slowed progress on implementation and/or scaled back initial plans. In Florida, for example, "third party attachers" to electric utility poles (telecos, cable, etc.) successfully raised objections to the Florida Commission staff's late-2006 proposal that led to cut-backs and implementation schedule delay

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decisions in May 2007. Infrastructure hardening has the potential to stimulate markets for commercial insurance over time, particularly for transmission, if longitudinal data points to a significant decrease in risk. The timeframe for producing such information, however, could be a decade or more.

4. Protracted dockets exposed some bond issues to what CIP researchers later determined as the beginnings of the late 2007 – 2008 global financial crises, which began with disturbances in US subprime mortgage backed securities around July 2007. An example is the delays incurred with Cleco's storm bonds. The creation of the LURC appear to further contribute to delays in issuing bonds.

III(b) Taking the Preliminary Gulf Coast Research Forward

Since none of the major utility storm dockets had concluded by the time the CIP research team made its formal presentation to a group of OE officials and staff at the Farragut Building (31 October 2006), the Sponsor and CIP agreed to continue research activities on this task into the future. The Gulf Coast Cost Recovery research project continued to be a funded activity through June 2007. Through early July 2007, the Sponsor received updates in the form of email messages and more formal periodic written updates roughly corresponding to calendar year quarters; three such quarterly reports were issued. In late-November 2007 the sponsor and the CIP agreed to re-initiate this task for the purposes of producing one cumulative update; the cumulative update was delivered to the sponsor at the end of the award period (29 February 2008).

IV. SEERP Evaluations and Regional/Multisector Energy Emergency Exercises

In February 2007, the Sponsor changed OE's primary point of contact for research coordination from Dr. Kenneth Friedman, who had served in this informal position since the

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beginning of original award (*i.e.*, 15 August 2004), to Ms. Alice Lippert. CIP staff compiled a full roster of research activities, from the start of this award through February 2007, and in March 2007 presented the compilation to Ms. Lippert, Mr. Rob Gross and others at the Farragut Building. After the presentation, the new DOE research contact and the CIP team decided to re-direct the overall research thrust to energy emergency preparedness with a specific focus on federal, state and regional coordination.

This change in research orientation led the CIP team participate in large stakeholder meetings and/or emergency exercises as a means of establishing an appreciation in the actual use of State and federal energy emergency plans, and inter-related federal and State reliability and security standards. A member of the CIP research staff attended a NERC and Cybersecurity Workshop (January 2007). CIP's Michael Ebert participated in both the NARUC Winter Meetings (Washington, DC, February 2007), and DOE's summer energy outlook in Denver, Colorado (April 2007), which was co-sponsored by the National Council of State Legislatures (NCSL). CIP senior consultant Dr. James B. Atkins participated and served as a facilitator in the "Blackwater" regional multisector exercise held in Atlanta, Georgia (also in April 2007), while Ebert participated in the "Darkstorm" regional multisector event in Princeton, NJ (July 2007). Post-activity reports, including recommendations, were developed by CIP and provided to OE. To the best of our knowledge, these CIP reports to the Sponsor have not been published.

During the Spring of 2007, CIP staff, working closely with the Sponsor, discussed two major research projects that could be conducted as next steps under the award. One potential project involved an innovative use of Census establishment data, energy assets, emergency evacuation routes and geospatial techniques; this often was referred to informally as the "Census project." Under the processes by which the Bureau of the Census would approve such research to be conducted in the

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Suitland, Maryland RDC, CIP staff held a number of meetings with both Census and OE staff, and developed an evolving project draft. Due to lengthy and multi-agency proposal review processes, the Sponsor and the CIP agreed to continue to refine the proposal for future consideration but to focus research efforts on another project. [NOTE: The preliminary development of this research opportunity, as two other "pre-proposals" developed collaboratively and post-award with OE – NETL staff during March – April 2008, are still valid areas of future research that can be implemented between DOE and the CIP and achieve high returns on such future investments.]

This second project, which was identified by the Sponsor, was selected in May 2007 to be the next major research activity under the award: an evaluation of "state energy emergency response plans," which also are referred to "state energy assurance plans" or "guidelines." Under provisions of a 1990 federal law, the "State Energy Efficiency Programs Improvement Act of 1990" [P.L. 101-440], States that receive certain funding from DOE for general energy conservation and efficiency planning also are required to submit to the Secretary of Energy "energy emergency planning program for energy supply disruptions." (For additional information, please refer to House Report No. 101-646, p. 1654.)

Over the years since passage of the 1990 law, most states have developed and submitted such plans to the Secretary. The States' energy emergency response planning activities took on a new sense of policy direction and urgency as the protection of "critical infrastructures" gained currency in the latter half of the 1990s and particularly after the terrorist attacks of 9/11. The National Association of State Energy Officials (NASEO), working in partnership with other State-based groups such as the National Association of Regulatory Utility Commissioners (NARUC), the National Council of State Legislatures (NCSL), the National Governors Association (NGA), and the U.S. Department of Energy, produced voluntary guidelines for the development and exercising such

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plans. The most recent NASEO guidelines, "Version 2," were published in November 2005. What is important here is that while the emphasis, orientation and States' planning activities have evolved and grown significantly since 1990, the federal authorities remain grounded at that moment of policy development when concepts of interdependent "critical infrastructures" did not exist.

In late May – Early June 2007, DOE provided CIP with the hard copy texts of 47 State and territory energy emergency /assurance response plans, which the research refers to as "SEERPs." The Sponsor and CIP agreed to the follow research tasks:

1. Using the NASEO *State Energy Assurance Guidelines Version 2* (November 2005), extract a set of qualitative and quantitative benchmarks and develop these benchmarks in an Excel-based evaluation matrix from which each individual State plan will be assessed.
2. Develop simple quantitative metrics in this Excel Workbook that were used by the CIP evaluation team that would allow core NASEO energy planning guidelines and principles to be transformed into quantitative values.[1]
3. Develop an evaluation methodology to mitigate inherent differences that would exist among individual members of the evaluation team. Even highly skilled experts who evaluated plans independently of each other would arive at different, and completely defensible, evaluation

[1] The NASEO Guidelines, as well as the NIPP, are narrative documents for which quantitative benchmarks and metrics are not included. To evaluate plans consistently and as fairly/objectively as possible required us to "map" the guidance, all of which is voluntary, into a coherent yardstick. We read the documents and extracted key guidance statements from them. We then developed a simple quantitative range, zero through 3, to evaluate the 48 plans vis-à-vis the key guidance statements. We obtained buy-in from stakeholders at every stage of developing the evaluation tool and metrics. A value of zero was assigned if our evaluation team and multi-tiered evaluation process determined that a given plan did not in any way reference or follow the key guidance statement. A value of 1 was assigned if the plan only made "cursory" reference to the key guidance statement. A value of 2 was assigned if the plan spoke to the key guidance statement in more than cursory fashion but less than comprehensive fidelity. A value of 3 was assigned if the plan was 85% to 90%+ faithful to the key guidance statement. We chose the "85% to 90%" fidelity expression based upon researchers' observational estimate of the overall state of the plans *vis-à-vis* the maximum possible value that a highly "NASEO Guidelines faithful" plan could attain. This maximum value is the product of the number of core evaluation metrics – 18 in all – multiplied by the highest numeric value each metric could receive – a 3, or 54. 85 to 90 percent fidelity is an assessment analogous to assigning an grade of a B-minus to a B-plus in an academic setting.

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results. The purpose of having multi-tiered, multiple evaluations of the same plan with at least two multi-person reconciliations was to squeeze as much subjective bias as possible out of the process.

4. Produce a research report on the results of the evaluations. During late July and early August 2007, the Sponsor and the CIP met to discuss and to agree on a limited set of statistical analyses of the results, including some geospatial visualizations ("maps") of aggregated data and information.[2]

The CIP team, working in collaboration with the Sponsor, developed and gained approval for the Excel-based evaluation tool using the NASEO *Guidelines*. They developed simple metrics for assigning quantitative values (0, 1, 2, 3) to each benchmark in the tool, and further developed "sub-metrics" to assist in the identification and refined assessment of evaluation criteria. A three person core evaluation team examined each of the SEERPs individually, in groups of two, and ultimately in groups of three; at each group stage, reconciliations were performed among individual and team preliminary findings with the primary objective to reach full consensus. Toward the end of the project, other expert staff (CIP internal and external) were brought into the evaluation process to perform "spot-checks" on evaluation results, to perform statistical analyses, and to render certain statistical results into aggregated geospatial mappings. Findings and recommendations include:

1. The quality, consistency and coverage of the SEERPs we evaluated varied considerably; some States submitted "plans" which our team truly could not determine met the low bar required by the 1990 federal law, while the top quartile of

[2] The statistical analyses were intentionally limited. With 18 core metrics and 56 sub-metrics, there are numerous kinds of statistical analyses that can be performed. We worked directly with the sponsor to determine which statistical analyses had the potential to best inform the research project consistent with data quality/availability, and time and budgetary constraints.

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SEERPs ranged from above average to good when measured against the NASEO *Guidelines* using the Excel tool.

2. In the five major assessment categories, and with all plans considered as a whole, serious weaknesses were found in two of the five major metrics categories: *security related measures*, and *infrastructure and consequence analysis*. Cyber security measures were notably deficient in almost all plans.
3. In two of the other major assessment categories – *organizational relationships and responsibilities*, and *public information* – many SEERPs fared better against the NASEO *Guidelines* than the two categories noted immediately above. Researchers noted that "one might logically expect that state governments should do well in these areas because they speak to historic core functions of government."
4. With a few notable exceptions, state plans that had been written *after* publication of NASEO Version 2 (November 2005) were more likely to be in the highest quartile. States that had taken advantage of federal assistance, measured by acceptance of SEP funding, tended to have high-performing plans.
5. Recommendations include: (a) Share the results of the evaluations with the States, particularly through organizations such as NASEO and NARUC; (b) In identified "problem categories" such as *Infrastructure & Consequence Analysis*, *Security – Related Measures*, and *Response Measures & Mitigation Efforts*, provide greater specificity, examples and clarity in future versions of the NASEO guidelines; (c) Consider asking the Congress for additional authorities to augment and update the requirements of the 1990 federal law that was enacted when the words "critical infrastructure protection and resilience" were not part of energy experts' lexicon; (d) Consider

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periodically re-evaluating plans to measure progress; and, (e) Develop the Excel evaluation tool into an instrument state and federal officials can use as part of a plan-building toolkit to develop, exercise and when necessary implement better SEERPs.

IV(b) SEERP Revision 1

The original, 47-plan evaluation and analysis report was delivered to OE on Monday, 17 September 2007. A few weeks after delivery, the sponsor requested an update to the original report to include one additional state report, Missouri. Both parties agreed to extend the period of performance to accommodate the additional works; the period of performance initially was extended to 31 December 2007, and through the final amendment of the award the period of performance was extended to 29 February 2008. The addition of one additional state necessitated the re-work of all statistics and geospatial renderings, as well as re-writing all sections of the report which referenced this data and discussions of large, anonymous categories of States into quartiles. "Revision 1" to the State Energy Emergency Response Plans Evaluation which included the 48th plan were finished and delivered to OE at the end of the award, 29 February 2008.

V. Conclusions

Reflecting back over the major research projects that were undertaken during the 42 months of the award, we believe that the research as a whole followed a logical progression in both direction and findings, although one would have to admit that when our research team first examined issues associated with lack of commercial insurance for the electric power industry we could not have foreseen how the lack of insurance would manifest itself in asset-backed securities as a substitute for catastrophic event insurance, nor how these new financial instruments would become entangled in

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today's financial crisis.[3] From the first research task to the final one under this award, one important deficit emerges consistently as an impediment to better public policies, and the ability of critical energy infrastructures not just to be better protected, against all hazards, but to be more resilient and reliable in normal times and more capable to recover quickly in abnormal periods of crises. That deficit is having a coherent, consistent set of risk related data and information. It is a "root cause" that has manifestations in lack of commercial insurance; in developing reliability, CIP, and cyber security standards for the ERO; and in developing improved public policies and regulations to respond to the kinds of large-scale and interdependent catastrophes of today's critical infrastructure environment. In other words, many of the questions and challenges that were present at the start of these research activities under this award are salient today. This does not mean the research results were lacking. To the contrary, we believe the need remains for a continuity of research on the economics and regulation of critical energy infrastructures, most notably on metrics and information that will drive better policy decisions and lead to measurable results over time.

This research has led to the establishment of trusted relationships between CIP research staff and state energy officials, and a far better appreciation for the need for the federal government to better understand what is occurring within and among the States – and vice-versa. Public sector – private sector partnerships are important, although it is important to think of "the public sector"

[3] With the exception of Florida's June 2005 law, statutory authorities these states provided to allow utilities and the commissions the option of "securitizing" storm recovery costs did not exist prior to the Spring of 2006. What the States did, in effect, was to create a new class of securities for which there was no established rating, and the four States' statutes created essentially four different kinds of financial instruments. In general, most statutes had a common requirement that if the option to securitize was chosen, the financing scheme had to result in "least-cost financing." That means the storm bonds had to achieve a credit rating of AAA or equivalent from the three major ratings agencies – S&P, Fitch, and Moody's. The processes in bringing the dockets to closure and bringing the bonds to market took far longer than anyone expected. And in the case of one state, the securitization process was not very transparent. New securities instruments with no ratings actuarial, issues of process transparency, and bad timing came into play. Many types of asset-backed securities, not just subprime mortgage-backed securities, and the ratings behind them came under intense scrutiny starting around June 2007. Unfortunately for Louisiana and a couple of its utilities, storm bonds did not reach the markets until after the credit, liquidity, and ratings crises hit.

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broadly in the context of our federalist system. Equally vital are federal – state – local public sector partnerships. One of the major accomplishments of the research conducted under this award was its focus on the roles of the States in protecting critical energy infrastructures and the importance of the States in developing and implementing measures to make those critical energy networks more resilient and reliable. The award has advanced the body of academic literature over the past 42 months of activities; more work, of course, remains and CIP and this university are exceptionally well positioned to be a major partner to DOE's research needs in the future.

Only part of the legacy of this award are its benefits to the public, and to state and local governments. The award also provided an opportunity to assemble a diverse group of analysts and researchers who have gained experience and added to the knowledge base of this important critical sector of the Nation's economy. Several graduate students and law interns received modest funding and/or tuition assistance as a result of this award. At least three students who were part of research teams supported by this award have chosen post-graduation careers in the field of critical infrastructure protection studies, which we believe is one of the most important returns on federal investments in academic research.

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Under this grant, the CIP Program performed the following work:

1) As part of the *"Energy and Measures for Risk Mitigation and Transfer"* project, CIPP staff conducted a series of interviews and larger group discussions with utility executives and regulators on the subject of insurance and risk mitigation.

2) CIPP staff, with the assistance of academic partners from Virginia Tech, wrote a white paper on June 21, 2005 entitled *"Insurance & the Nation's Electrical Infrastructure: Mutual Understanding & Maturing Relationships."* The paper presented the finding that the use of commercial insurance has not been properly adopted in the U.S. as a tool to promote superior risk management behavior, especially for the purposes of building an electric power system that would provide a high level of dependable, reliable power to the customer base.

3) CIPP staff organized a workshop entitled *Protecting the Electricity Sector's Infrastructure: Building the Business Case for Commercial Insurance* from June 22 to June 23, 2005. A diverse group of thirty-five international and national experts from the electricity and insurance sectors discussed and debated the current role of insurance in the electricity sector and the potential for commercial insurance to promote future electricity sector protection, reliability, resilience and disaster recovery.

4) CIPP staff, also with the assistance of academic partners Emily Frye, CIP Senior Consultant Dr. James B. Atkins, and CIP principal researcher Dr. Kathy Emmons, produced a second white paper in February 2006, entitled *"Expanding the Role of Commercial Insurance in the Electricity Sector to Promote Improved Bulk-Electric System Reliability."* This paper synthesized the discussions in the workshop and drew research and policy conclusions from the discussions held there.

5) A GMU School of Law intern was detailed to the Department in late 2004 – early 2005 who worked under the direction of OE senior staff. The law intern produced a legal analysis of the Department's authorities under the Defense Production Act of 1950. OE staff found

the analysis to be of such high quality that it was provided to the agency's Office of General Counsel.

6) Starting in February 2005, a CIPP graduate research assistant contacted NERC and eventually obtained all NERC outages data from 1984 to 2002. This data was in a variety of formats and data fields and syntax were inconsistent and irregular. The graduate research assistant moved the data into a single consistent format, harmonizing fields and syntax to the extent possible. The resulting Excel spreadsheet was then imported into a newly developed Access structure, with sample queries provided. The results were presented to Mr. Bob Cummings of NERC at an early August 2005 meeting on the GMU campus. Mr. Cummings commented favorably on the Access database and made further recommendations. Graduate researchers and CIPP faculty also raised technical requirements for data and metrics necessary to implement the Electric Reliability Organization provisions of the Energy Policy Act of 2005. Several structures were developed with Mr. Cummins and provided to NERC. During the spring semester of 2006, three graduate students revisited the Access database, made further refinements to the data, and attempted various statistical analyses of the data (multiple regression techniques) using SPSS. The results of this exercise were provided to the Department in May 2006.

7) CIPP staff attended a June 2005 DOE – multi-jurisdiction energy emergency response exercise as neutral observers and participated in hot wash after the exercise. They provided a memorandum regarding their observations, along with suggestions and recommendations in August 2005.

8) In September 2005, CIP staff commenced research into the development and formation of the Electric Reliability Organization as required by the Energy Policy Act of 2005. They also provided an assessment of the FERC notice of proposed rulemaking. They attended a 3-day reliability summit in September 2005. CIPP staff provided a memorandum of summit activities and conducted a limited number of *ad hoc* interviews at the summit regarding the Electricity Reliability Organization and the FERC rulemaking. They developed an interview protocol in consultation with the agency and with internal GMU human subject research requirements. The focus of the Electricity Reliability Organization research was on: the

legislative history, statutory implementation, and FERC/ERO activities – particularly governance, regional issues, and data availability and quality supporting the reliability standards. This research became the basis of an academic research paper produced by a graduate student at the School of Public Policy (February 2006), followed by a non-published white paper produced by Ebert and Atkins of the CIP Program for OE in March 2006.

9) In May 2006, two law interns, supervised closely by senior CIPP staff and CIP Senior Consultant Dr. James B. Atkins , engaged in a thorough review of state authorities to engage in energy utility cost recovery from retail customers. In consultation with the Department, four states were selected: Florida, Louisiana, Mississippi and Texas. Senior CIPP staff and the consultant developed an interview protocol and sent letters to selected state Commissioners and staff. During the months of June – September 2006, CIPP conducted a number of serial interviews with staff experts, often at the highest levels and across the disciplines of law, economics, regulatory policy and engineering. The research project expanded significantly when CIPP staff discovered federal Community Development Block Grant funds might be provided to privately-owned energy utilities. A formal research paper, executive summary and detailed appendices were submitted to the Department on 29 September 2006. Because state cost recovery activities were on-going, it was determined to continue to monitor developments and incorporate new findings into a presentation to OE officials and invited guests. During this period and in consultation with OE, CIPP researchers informally vetted research findings to various experts, including NARUC and IPU. A slide show and formal presentation was made to OE on October 31, 2006. Periodic updates were provided to the agency, primarily through emails and discussion. Starting in November 2007 and at the request of the Sponsor, CIP prepared in a single reference document a "cumulative update" for the Gulf Coast cost recovery research project and provided this document as the final research deliverable under the Award, which concluded on 29 February 2008.

10) CIPP staff also examined energy infrastructure "hardening" initiatives that some Gulf Coast states and/or energy utilities had commenced as part of this same report. CIPP staff and a law intern continue to periodically monitor cost recovery dockets, the provision of federal

grants, and conduct on-going, informal interviews with public utility staff experts; the most recent monitoring activities occurred in mid-February 2007 and early March 2007.

11) CIPP staff attended the Institute of Public Utility's 38th Annual Regulatory Policy Conference in Richmond, VA from December 4 – 6 2006, a NERC Cybersecurity Workshop in January 2007, the NARUC Winter Meeting in February 2007, and the Disasters Roundtables hosted by the National Academies in April and June 2007. They provided the Department with an overview of presentations and workshops witnessed and used these events as an opportunity to publicize the work done by OE at the sponsor's request.

12) As representing the CIP and funded by the award, Dr. James B. Atkins was invited to attend a regional, multi-sector energy emergency exercise, code-named "Blackwater," which was convened in Atlanta, Georgia over two days in April 2007. Dr. Atkins served as a facilitator and a participant. Working with FOUO documents and information, Dr. Atkins produced a summary report and critique on the Blackwater exercise (May 2007).

13) CIP Principal Research Associate for the award Michael Ebert was invited to participate in the Department of Energy's Summer Fuels Outlook energy conference, which is co-sponsored by the National Council of State Legislatures (NCSL). Mr. Ebert observed and informally commented on the proceedings, which took place over three days in Denver, Colorado (April 2007).

14) Michael Ebert also participated another Department of Energy regional energy emergency exercise, code-named "DarkStorn," which was convened in Princeton, New Jersey over two days. He was assigned to various plenary session and break-out teams that were comprised of corporate energy executives, senior utility staff, and state and local PUC commissioners, staff, and emergency responders. Mr. Ebert provided the Sponsor with a brief summary and recommendations after the event (July 2007). He also briefly addressed the general audience about on-going research the CIP was conducting under the award and the auspices of OE (see next two paragraphs).

15) Research activities described in numbered paragraphs 11 through 14 (above) were useful steps in the overall research processes leading up to work on the last major project and deliverables conducted during the final year of the award. In particular, participants at both Blackwater and DarkStorm were involved in energy emergency simulations based, in part, on use of their states' SEERPs to implement simulation scenarios.

16) CIPP staff, with the assistance of a two law interns, Senior Consultant Dr. James B. Atkins, School of Public Policy Assistant Professor Naoru Koizumi and two SPP graduate research assistants, examined the NASEO State Energy Emergency Guidelines and extracted a series of benchmarks to be used in evaluating state energy emergency response plans. They then used these benchmarks to evaluate the plans submitted to OE and broke down the results into broad categories. The resulting report was submitted to the Department on September 17, 2007. At the request of the Sponsor, and with the provision of one additional SEERP on 15 October 2007 (for Missouri), CIP researchers prepared a 48-plan revision of the original report, and re-ran the statistical analyses and geospatial renderings as required to accurately represent Missouri within the original evaluation report. CIP delivered *Revision 1* of the SEERP project to DOE in February 2008.

GEORGE MASON UNIVERSITY | School of Law

CRITICAL INFRASTRUCTURE PROTECTION PROGRAM

14 November 2008

Ms. Carla Winaught
U.S. Department of Energy
National Energy Technology Laboratory
Acquisition and Assistance Division
626 Cochrans Mill Road
Post Office Box 10940
Pittsburg, PA 15236-0940

Re: Principal Investigator's formal letter of transmittal of Final Cumulative Technical Report of All Research Activities conducted pursuant to DOE GRANT DE-FG26-04NT42250.

Dear Ms. Winaught:

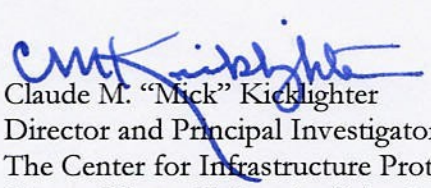
We are pleased to provide you with the Final Cumulative Technical Report, in electronic (PDF) and printed formats, associated with the above referenced Award.

This report fully documents and summarizes all work performed during the Award's period of performance – *i.e.*, 15 August 2004 through and including 29 February 2008 – in a comprehensive manner. The report clearly presents findings and conclusions produced as a consequence of all the major and subordinate research projects, tasks and deliverables. The report presents the information in an integrated fashion, and includes summative findings and conclusions drawn from the research taken as a whole.

If you have any questions or comments, please do not hesitate to call me or the principal research associate, Michael Ebert, who had day-to-day managerial responsibility for the Award from 24 May 2006 until its conclusion on 29 February 2008. Michael's direct line is (703) 993-2288.

Thank you for your support of the Center for Infrastructure Protection (formerly the Critical Infrastructure Protection Program) at the George Mason University School of Law. We look forward to continuing our relationship with and the U.S. Department of Energy.

Sincerely,



Claude M. "Mick" Kicklighter
Director and Principal Investigator
The Center for Infrastructure Protection
George Mason University School of Law

Cc: Robert Gross
Joseph Paladino
Denise Riggi
Daniel D. Polsby, Professor and Dean, GMU School of Law
Michael E. Ebert, CIP

GEORGE MASON UNIVERSITY | School of Law

CRITICAL INFRASTRUCTURE PROTECTION PROGRAM

14 November 2008

Ms. Carla Winaught
U.S. Department of Energy
National Energy Technology Laboratory
Acquisition and Assistance Division
626 Cochrans Mill Road
Post Office Box 10940
Pittsburg, PA 15236-0940

Re: Principal Research Associate's formal cover letter to accompany Principal Investigator's Final Cumulative Technical Report of All Research Activities conducted pursuant to DOE GRANT DE-FG26-04NT42250.

Dear Ms. Winaught:

I write to you in my capacity as the principal research associate who served as day-to-day program manager and research team leader for the above – captioned grant from 24 May 2006 through the end of the Award on 29 February 2008.

Four major research projects were undertaken and completed during the 42 month period of activities conducted and funded by the award; for three of these (Roman numerals II, III, and IV), I provided managerial oversight and research team leadership; for the first, I have carefully evaluated all available documentation contained in the project archives.

I. Creating New Incentives for Risk Identification and Insurance Process for the Electric Utility Industry (also referred to as the "commercial insurance" research). Three major deliverables were produced: a pre-conference white paper, a two-day facilitated stakeholders workshop conducted at George Mason University, and a post-workshop report with findings and recommendations.
II. The New Electric Reliability Organization (ERO): an examination of critical issues associated with governance, standards development and implementation, and jurisdiction (also referred to as the "ERO study"). Four major deliverables were produced: a series of preliminary memoranda for the staff of the Office of Electricity Delivery and Energy

Reliability (OE), an ERO interview protocol and stakeholder/experts interviews, a formal research paper, and a data quality and availability study of NERC/ERO's disturbances and outages working group databases.

III. Critical Electric Power Infrastructure Recovery and Reconstruction: Issus & New Policy Initiatives in Four Gulf Coast States After 2005's Catastrophic Hurricanes (also referred to as the "Gulf Coast cost recovery study"). Four deliverables were produced: the original research paper providing preliminary findings and recommendations (29 September 2006), a formal presentation of that report to officials, staff and invited guests at OE's Washington, DC headquarters, a series of update memoranda and quarterly activity updates (1 November 2006 through Q3 – 2007), and a final cumulative update of the original research report (February 2008).

IV. Evaluation of State Energy Emergency Response Plans (also referred to as the "SEERP project). Two major deliverables were produced: an evaluation of 47 SEERPs with findings, statistical analyses, geospatial renderings and recommendations (17 September 2007), and an revised evaluation of a total of 48 SEERPs with updated findings, updated statistical analyses and geospatial renderings, with conclusions and recommendations ("Revision 1," 29 February 2008).

During the entire period of performance and in tandem with the four major research activities described above, the CIP conducted several secondary research activities, mostly in the forms of short *ad hoc* memoranda, three to ten page briefs, and fast-response email messages. A brief description of all these activities is provided in **Appendix A** of this Final Report.

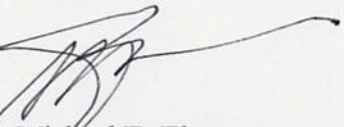
When taken as a whole, the deliverables and research activities represent an impressive body of work in highly technical areas of the energy sector, especially electricity, and related interdependent areas, particularly cost recovery, financing, insurance, and risk/reliability standards and metrics. Many of the research activities were conducted by multi-disciplinary teams. These teams were constituted by academics from George Mason University and other institutions of higher education. The teams also included practitioners of energy regulation, and specialized subject matter experts. One of the most impressive components of the research teams, however, has been Mason's talented law interns and graduate research assistants. This award has provided financial support for these future leaders to learn about, and make contributions to, the academic knowledge base of energy systems within complex interdependent networks of people (at the federal, state and local levels) and technical systems.

Much of the activities which constitute the four major research projects involved building trusted networks of people who work directly in the fields of study. This occurred not just in workshops or multi-party discussion groups, but via individual interviews and conversations. In many instances, these conversations provided those we interviewed with situational awareness of how parties in other states were tackling the same challenges. For example, during interviews and conference calls conducted during major research area III, *Critical Electric Power Infrastructure Recovery and Reconstruction:*

Issus & New Policy Initiatives in Four Gulf Coast States, interviewees were eager to know how their colleagues in the public sector and the private sector were using new policy instruments and unusual sources of funding.

Please do not hesitate to contact me directly at (703) 993-2288 or via email, mebert@gmu.edu, if you have any questions. Thank you for your support of the Center for Infrastructure Protection (formerly the Critical Infrastructure Protection Program) at the George Mason University School of Law. It has been a pleasure to have been associated with this award since June 2006, and all of us at the Center for Infrastructure Protection look forward to new opportunities to work with the U.S. Department of Energy.

Sincerely,



Michael E. Ebert
Principal Research Associate
DOE Grant DE-FG26-04NT42250

Cc: Denise Riggi
Rob Gross
Joe Paladino
Ken Friedman
Alice Lippert
Angela Rainey, Mason OSP Closeout Specialist