
# THE CIP REPORT

CRITICAL INFRASTRUCTURE PROTECTION PROGRAM VOLUME 5 NUMBER 5

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## EDUCATION AND TRAINING





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GEORGE MASON UNIVERSITY
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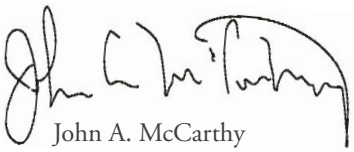
CRITICAL INFRASTRUCTURE PROTECTION PROGRAM

This month's issue of *The CIP Report* focuses on an incredibly important topic to the future of critical infrastructure protection- education and training. While we frequently focus on the many different issues facing the varied sectors that comprise this field (diverse as it is), this cross cutting issue touches all aspects of infrastructure assurance and requires our immediate attention. While the Electric Power Industry provides the case study and data points for this discussion, begun with an examination of reports that highlight the significant shortfall of current and future workers comprising the "human infrastructure" within that sector, all sectors will inevitably feel the brunt of the retiring 'baby boomer' generation and the impact of this human capital loss.

We approach this topic with an article focusing on education and the aging workforce within the Electric Power Industry, but we expand this conversation to include an overview of a new academic program under development at James Madison University, as an example of the current curricula efforts underway to confront future needs, and a brief highlight of the Naval Postgraduate School's Center for Homeland Defense and Security, a mature program that offers a variety of educational opportunities to professionals within this field. But even as we present these two academic answers to the education and training needs required by a retiring workforce and resulting 'brain-drain', Dr. Christine Pommerening, a Senior CIP Program Researcher, presents both sides of the ongoing debate on homeland security's position as an academic discipline and the potential impact this could have on further curricula development.

This month we are pleased to provide a forum for the North American Electric Reliability Council (NERC) to raise the argument that electric utilities should use long-term planning via firm contracts with natural gas suppliers in an Op/Ed contribution from Rick Sergel, President and CEO of NERC. Finally, we include information on the recent fall symposium of the Cyber Conflict Studies Association. As always, we strive to discuss topics of importance to the CIP community and encourage any interested readers to provide articles, and feedback on articles, that can be shared with other professionals within this field.



John A. McCarthy
Director, CIP Program
George Mason University, School of Law

# An Emerging Issue We Cannot Ignore:
## Meeting the Twin Challenges of Education and an Aging Workforce in the Electric Power Industry

Michael E. Ebert, CIP Program

Within the span of the last few months, two reports have been issued – one by the US Department of Energy (DOE), the other by the North American Electric Reliability Council (NERC, its first reliability assessment as the new Electric Reliability Organization) that sound an alarm about the future reliability of the US – Canada electric power system. What makes these reports remarkable from a critical infrastructure perspective is that for the first time both DOE and NERC independently make an explicit linkage between critical "human infrastructure" – the men and women who have provided the North American electricity grid with engineering and technical expertise – and reliability.

This article examines the DOE and NERC reports through the prism of current and future workers. We also interviewed other experts, such as Professor Robert J. Thomas of Cornell University, founding director of the 11 university member National Science Foundation Industry/University Cooperative, the Power Systems Engineering Research Center (PSerc), and Wanda Reder, the president-elect of the IEEE's Power Engineering Society (PES). Collectively, DOE, NERC, Thomas, Reder, *et al.*, point to an emerging issue of national importance: addressing the twin challenges of education and an aging workforce in the electricity sector.

While education and aging workforce concerns are not confined to the electricity sector but rather are part of larger national debates and "baby-boom" demographics, the available data and information suggest that education and workforce issues are more acute in this industry than others. Further, given the criticality of electricity to every other sector of the common North American economy, and its reliable supply vital to other essential public goods, it is important to elevate the public discussion using the solid evidence now available from NERC, DOE and other expert sources such as the PES.

As NERC Senior Vice President David Nevius suggested when interviewed for this article, it is important to consider balanced **approaches** to solve complex, multi-jurisdictional issues. As an example, Nevius points to some voices in the education – aging workforce debates who suggest that we can fix deficiencies in education inputs and outputs and knowledge attrition due to aging via "offshoring" – tapping into foreign sources of education and labor to fill looming workforce gaps, as the IT sector has done. Other voices, including NERC, urge solutions that would require transformations of educational and political institutions using prescriptive formulas to churn out more American power engineers and technical workers. Still others believe we should "buy time" – and thus ignore the urgency of the data – by enticing a large number of the aging workforce to labor many years into retirement. NERC, says Nevius, recognizes that it is not practical or desirable for us to solve the challenges either by letting other countries solve the education – workforce gap for us, although attracting qualified and credentialed foreign engineers might be part of balanced industry – government – academia efforts. He also suggests encouraging electric utilities to better use their senior professionals to "mentor" younger workers to avoid the looming gap.

### DOE Report: Focus, Key Findings and Recommendations

In August, the Department issued a report to the US Congress, Workforce Trends in the Electric Utility Industry. This report is required by Section 1101 of the Energy Policy Act of 2005 (EPACT), and with its issuance DOE has fulfilled at least one of three explicit requirements of this provision (i.e., § 1101(b)(2), "report on trends"). There are two other requirements in

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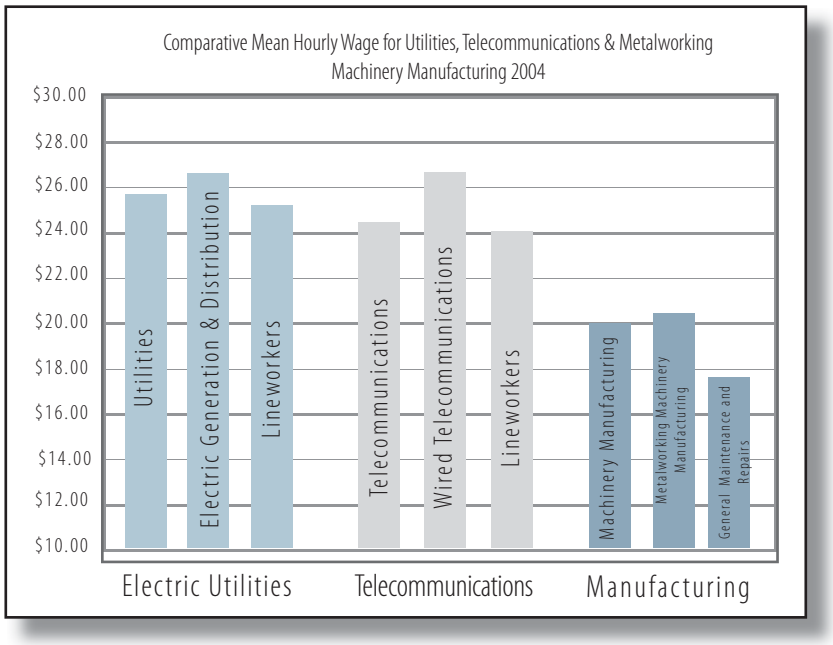
**Electric Power** *(Continued from Page 2)*

Section 1101 – one which requires the Secretary in consultation with the Secretary of Labor and using data collected by that agency, to "monitor trends in the workforce" for engineers, technicians and other "crafts workers." The third requirement, §1101(b)(3), requires the Secretary of Energy, "as soon as practicable after the date on which the Secretary identifies or predicts a significant national shortage of skilled technical personnel in 1 or more energy technology industries," to submit a report to the Congress describing the shortage. The August 2006 report does not appear to have triggered a §1101(b)(3) finding.

In its Executive Summary, the DOE report states:

*Today, the power engineering education system in the United States is at a critical decision point. Without strong support for strategic research in power systems engineering and without qualified replacements for retiring faculty, the strength of our Nation's university-based power engineering programs will wane, and along with them the foundation for innovation in the power sector to meet our energy challenges in the 21st century.*




According to Wanda Reder, "a possible reason why the report did not trigger a §1101(b)(3) finding, besides the questions about how accurate the Bureau of Labor Statistics forecast is, is that the report assumed that in the near-term, power engineering programs would continue to be able to graduate power engineers in sufficient quantities to meet the demand. However, in five to ten years, that may no longer be the case."

The major source of data in the DOE report comes from the Bureau of Labor Statistics (BLS). BLS data series on wages, employment and occupational classifications is a exceptionally rich source of information, particularly after BLS some years ago conformed its occupational series with the North American Industrial Classification System (NAICS) that is used by Census, the Bureau of Economic Analysis and other federal statistical agencies (which allows researchers to link and cross-tab Census and BLS data, for example). Industry experts and academics, such as Wanda Reder, president-elect of the IEEE's Power Engineering Society, and Professor Robert J. Thomas of Cornell's School of Electrical and Computer Engineering, believe that the DOE has done a very good job mining BLS and other data. They have concerns, however, that while the DOE (and NERC) reports are the "best around given the available data," there are fundamental knowledge gaps in the numbers. Some of the weaknesses identified by Reder and other experts we interviewed are future labor market demand data, hiring trends, and identification of new or emerging occupational skill sets that currently are not captured or correctly categorized by existing BLS codes.

The DOE report begins with an examination on electrical lineworkers and other electricity craft workers who typically enter the industry after high school via apprentice-

*(Continued on Page 4)*

Professor Robert J. Thomas
Cornell University

Professor Thomas takes issue with the theory that there is a lack of student interest in power engineering. He sees the problem as a lack of research funding which is necessary to support faculty hires. "University administrations need to know there is a long term commitment to university research in the area. The students need to know there are high paying, interesting jobs."

**Electric Power** *(Continued from Page 3)*
ships, vocational education centers and/or community colleges. Often, the available literature on education and workforce issues in electric power has an emphasis on those workers who pursue BSEE degrees and specialize in Power Engineering both as undergrads and in graduate engineering programs. This report has a message for those six out of ten US high school graduates who do not enter 4-year college degree programs in its section on electrical lineworkers:

*Demand is expected to outpace supply over the next decade. As a result, [lineworkers] are one of the highest paid professions in the United States that does not require a post-secondary education. In May 2005, electrical lineworkers earned a mean hourly wage of $25.14/hour or $52,290 per year. Experienced electrical lineworkers earn well above $32.54/hour and during overtime, based on this pay, could earn $48.81/hour. So an experienced electrical lineworker working 20 overtime hours every month could earn over $79,397.60 per year. However, companies have remarked that they could grow immediately by 400 – 500 more people, if they could find the right candidates.*

| Engineering Discipline | Salary |
|---|---|
| Solid-state circuits | $93,500 |
| Communications | $92,900 |
| Laser and electro-optics | $91,000 |
| Software, aerospace and electronics | $89,000 |
| Components, manufacturing | $88,850 |
| Signals and application | $87,000 |
| Antennas and propagation | $86,000 |
| Medicine and biology signal processing | $85,000 |
| Electron Devices | $84,750 |
| Network administration | $81,000 |
| Power Electronics | $80,050 |
| Circuits and systems | $80,000 |
| Instrumentation and measurement | $76,000 |
| Energy and power engineering | $73,625 |

But can such income potential market signals close the looming workforce gap in linemen and other technical craft occupations? The labor shortage and current workforce demographics are not encouraging. At one of the nation's largest public power companies, only 179 employees out of over 12,500 are between the ages of 20 and 24, whereas 2,891 employees are between the ages of 50 and 54.

The report does not provide similar encouraging income signals for future power engineers. The table below, taken from DOE's report based upon a 1000 IEEE publication, shows that average earnings for power engineers were dead-last compared with other electrical engineering specializations.

DOE's report makes two broad recommendations: The first is to foster better math and science education at all levels of education but particularly early-on and through the secondary level: Students need the right combination of math, physics and chemistry in order to pursue engineering in college. The second is to build interest in energy related careers: There is a perception that energy-related fields are obsolete and old-fashioned. However, there are some significant opportunities for creativity and innovation to meet the challenges of the 21st century. In addition, not all these positions require advanced degrees.

David Nevius, Senior Vice President
North American Electric Reliability Council

"It is important to consider balanced approaches to solve complex, multi-jurisdictional issues."

Federal agencies, such as DOE and the Department of Labor, could work with the private sector to communicate what the energy industry is about and to build awareness for the careers of tomorrow.

## NERC/Electric Reliability Organization Reliability Assessment: Emerging Issues Identified and Recommendations

On October 16, 2006, NERC published its 2006 Long-Term Reliability Assessment. While the organization has issued such reports in the past, the 2006 report was issued in the context of NERC's new designation by the Federal Energy Regulatory Commission (FERC) as the nation's first Electric Reliability Organization (ERO). What distinguishes the 2006 report from its predecessors is a new section, *Key Findings and Recommendations*. Within that section is a highly visible subheading, *Aging Work Force*. According to David Nevius, this topic was elevated as the report moved from draft to final. "When our board reviewed the draft, its members felt very strongly that the aging work force issue must be given high visibility and greater prominence," said Nevius. "We are giving this far greater attention not just in our report, but in our interaction with the media, government officials and academia."
*(Continued on Page 5)*

**Electric Power** *(Continued from Page 4)*

Wanda Reder, President-Elect IEEE's Power Engineering Society

"Our industry is coming to the realization that recruiting and retaining the best people is top priority."

Read Ms. Reder's article on power industry demographics , "Look at the numbers," in *Transmission and Distribution World* (http://tdworld.com/mag/power_look_numbers/index.html).

NERC's report was able to draw upon the data and information similar to that available to DOE. NERC, however, also had access to surveys commissioned by industry where the microdata are not publicly available. One survey cited by NERC is a Hay Group study, which found that:

- forty percent (40%) of senior electrical engineers and 43 percent of shift supervisors will be eligible for retirement in 2009;
- two-thirds of the utility companies surveyed have no succession plans for supervisors and 44 percent have no succession plans for vice presidents;
- the problem is far more acute than professionals, engineers and managers: the skilled labor force will be severely affected; and,
- aggravating the problem of sustaining essential technical knowledge is the dwindling number of students in the power engineering programs of most universities.

NERC makes four key findings/recommendations to adopt "innovative measures to bridge this emerging knowledge gap."

- Establish needed cooperative programs with academia to reinvigorate power engineering education in North America.
- Identify key personnel approaching retirement and implement mentoring programs to impart the experience realized by these individuals.
- Reassess compensation and benefits packages to attempt to retain aging personnel, either part- or full-time.
- Hire engineers and other utility professionals from outside the United States.

**What are others saying and thinking about these challenges? Are there any new initiatives? Are there more specific recommendations?**

In conversations with Nevius, Reder, Thomas and other experts, it is clear that critical thinking in this space indeed goes back several years, especially within academia and organizations like IEEE PES and NERC. Ms. Reder provided CIP Program researchers with several of her articles, including a June 2006 slide show, *Managing the Talent Challenge*, an electronic copy of which is now available on the CIP Program website's library. Reder believes that one of the biggest challenges in higher education is on the demand side:

*We are getting to the point where the physical infrastructure and human expertise in the system are stretched to a critical point. We simply must rebuild power engineering faculty at US engineering schools and this cannot be done without addressing the current dearth of research money for power engineering. At this time, few senior executives in the electric utility industry make the connection between the education – workforce gap and much more robust research*

*(Continued on Page 12)*

| Similarities | Differences | |
|---|---|---|
| | *Lineworkers* | *Power Engineers* |
| Demographics - dominated by "Baby Boomers" | Industry very aware of retirement situation | Industry not completely aware of pending retirement impact |
| Loss of institutional knowledge as more retire | Short-term impact to utility operation | Long-term impact to national competitiveness |
| Mergers, cutbacks, and downsizing over the past two decades | Interest in field is growing | Interest in field is declining |
| In-house training programs being developed by industry to fill perceived voids | Training programs nearly doubled in last 10 years | University programs have declined over the past decade |
| Potential lack of qualified, interested replacements | High pay, especially for limited post-secondary education | Low pay, compared to other concentrations within electrical engineering |

# Why Homeland Security is part of academia without being a discipline

Christine Pommerening, Ph.D., CIPP Senior Research Associate

More and more colleges and universities are setting up graduate degree programs dedicated entirely to homeland security (for example Towson University, University of California San Diego, and the Naval Postgraduate School, *see program information on Page 8*). Even more schools offer concentrations and certificates within traditional degrees. Given the current and foreseeable need for more and better educated experts this seems to make sense. However, many scholars and educators agree that homeland security is in fact not an academic discipline.

Why is it then that we see the programs carrying the label "Homeland Security" proliferating not only in commercial schools advertising on daytime television, but in public and private universities as well? What are the arguments for and against homeland security as an academic endeavor?

This article will first give a brief overview of both sides, and then present a separate argument leading to the conclusion that homeland security is and indeed cannot be an academic discipline.

The argument for homeland security becoming part of the academy is twofold.

One, there are well-established research and higher education programs that have been concerned with related issues for quite a while, albeit not explicitly under the label of homeland security. For example, risk analysis and decision theory have long been part of operations research; and pandemic disease control is part of every public health curriculum. Thus, a homeland security track developed out of these programs is consistent with the principles and practices of academia already. It is merely clarifying and focusing those efforts. Two, there is a clear societal need for higher education in the field, and, more importantly, there are apparent research gaps that the academy can and should address.

> ***"Homeland security is in a pre-paradigm phase. We understand this to mean that unlike medicine, law, engineering, and other professional disciplines, there is no general conceptual agreement about the range of topics that constitute homeland security as a field of study. Consequently there is not a dominant approach to teaching homeland security. We happen to think this is a good thing."***[1]

The argument against homeland security as a generic academic discipline rests on two grounds that are widely and explicitly stated – homeland security is too broad and too new to be a discipline. First, the scope of problems associated with homeland security is simply too broad for establishing the kind of boundaries necessary to form and teach a cohesive set of knowledge. Anything from international relations to information technology and intelligence gathering to fighting pandemics can be viewed as essentially homeland security related. At the same time, we have just recently come to understand that traditional concepts of a country's security are no longer sufficient given the interdependencies and vulnerabilities of modern societies to diffuse threats that can cause large-scale disruptions. The attacks of September 11 have certainly amplified this reorientation, but other factors such as technological and ecological crises play into the process.

Both of these factors, breadth and novelty, can be overcome. It is quite possible that the programs that are being started now will collectively define the scope of homeland security and are thus necessary efforts in finding a common core of knowledge and competencies. It is also quite possible that over time, at least some of those programs will mature from what could easily be seen as an opportunistic fad to established and sustainable departments and faculty within the academy.

There is a third reason, however, that is intrinsic and thus might be more difficult to overcome since it addresses what makes a field of study an academic discipline.
*(Continued on Page 11)*

# Developing a New Academic Program: James Madison University's Information Analysis Major

Kenneth F. Newbold, Jr., Associate Director
Patricia E. Higgins, Assistant Director
Institute for Infrastructure and Information Assurance
James Madison University

James Madison University, working through the Institute for Infrastructure and Information Assurance, created a team of interested faculty to develop a multi-disciplinary curriculum project focused on creating an undergraduate degree in Information Analysis (IA). The IA program will prepare students to solve problems in national, international or business intelligence settings. They will apply the principles of logic and reasoning, and data mining and data synthesis with the influences of cultural and political factors to arrive at a holistic solution. Information Analysis is more than collecting and sorting data. It is more than understanding how to find relevant data (data mining). Information Analysis is about how to use data effectively. This requires the student to have a firm understanding of logic, reasoning, and aspects of how the human mind operates (cognitive psychology) joined with an understanding of cultural and political factors that may influence the relevance of data and a solid understanding of different technologies that facilitate the collecting and evaluation of data. IA students are educated to be critical problem-solvers, using the latest technology coupled with sound problem-solving strategies.

The Information Analysis program incorporates a multidisciplinary approach, utilizing the best academic and technical fields offered at JMU:

- **Social/Political/Cultural Understanding:** The IA Major curriculum will provide an understanding of information gathering and analysis from a historical context that will give the students points of reference for future analysis. An analyst must have an understanding of historical principles to frame existing issues in context to previous success or failures. Whether the problem is in the political arena or the business environment, understanding multi-cultural interactions and ideas are fundamental to creating effective policies and plans. These ideas, scenarios, and knowledge of past events and the current geopolitical climate are integral for anyone in information analysis.

- **Advanced Critical Thinking:** Information analysts must respond to information that is full of uncertainties, irrelevant facts, and complex dependencies and interactions. This requires not simply the ability to think critically but the ability to employ the most advanced and problem-specific critical thinking skills available. The IA major curriculum includes a series of newly-designed courses by the Philosophy Department that address these challenges. These four courses in the curriculum will specifically cover topics that are essential to information analysis, but are rarely (if ever) discussed in standard critical thinking or logic courses. Upon completion of these new courses, students will have strong capabilities in hypothesis testing, causal analysis, counterfactual reasoning, and strategy assessment. With these capacities, they will be able to compose products that are both relevant and reliable.

- **Tools and Technology:** Scientific and technical skills comprise the third facet of an accomplished information analyst. The amount of data traveling from country to country, CPU to CPU, and human to human, and all the combinations and networking in between, coupled with the speed in which these communications travel, will require cutting edge data mining tools and skills to process information efficiently and properly. JMU faculty will instruct students in data visualization and decision support systems currently in use. These

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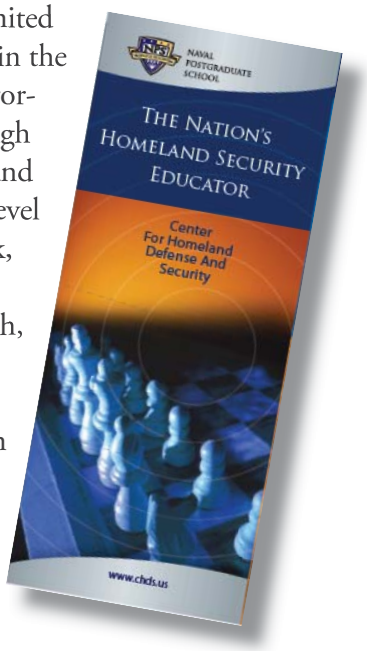
# Naval Postgraduate School
# Center for Homeland Defense and Security

In keeping with this month's topic of higher education's impact on Homeland Security, we would like to highlight the Naval Postgraduate School's Center for Homeland Security and Defense (CHDS) in Monterey, CA. More information is available on this program from their website (http://www.nps.edu/).

Since 2002, CHDS has conducted a wide range of programs focused on assisting current and future leaders in Homeland Defense and Security to develop the policies, strategies, programs and organizational elements needed to defeat terrorism in the United States. The programs are developed in partnership with and are sponsored by the Department of Homeland Security's Office of Grants and Training (G&T) and consist of six primary elements:

1. A fully accredited Master's Degree in Homeland Security (first class graduated in June 2004).
2. Mobile Education Team (MET) seminars for Governors and senior state officials, or for major urban area senior Homeland Security leaders.
3. Homeland Security Executive Leadership Program focusing on priority topics in Homeland Security, such as Intelligence and Fusion Centers, Public Information/Fear Management, Public Health.
4. University and Agency Partnership Initiative.
5. The nation's first and largest digital Homeland Security research library.
6. Research initiatives, including direct links to theses by CHDS Master's program participants.

All CHDS programs are focused on leadership development to enable the United States to win the war on terrorism. Through graduate- and executive-level coursework, seminars, and research, Homeland Security leaders gain the analytic skills and substantive expertise they need to counter terrorism. The programs also prepare leaders to bridge gaps in interagency and civil-military cooperation by bringing together a diverse range of participants to share perspectives and lay the foundation for long-term Homeland Security collaboration. ❖




**JMU Program** *(Continued from Page 7)*

tools make it possible to navigate the evolving challenges posed by the information age in order to extract meaningful intelligence.

The rapidly retiring government sector is creating an expanding demand for intelligence analysts in the private sector, as well as within the government. The critical need is for individuals with a well rounded set of problem solving skills. As the US continues the global war on terror, and as it strives to remain competitive in the global marketplace, a renewable supply of trained analysts is imperative. Development of this program continues and feedback regarding the overall direction of the Information Analysis program is welcome. For more information, please contact Ken Newbold (newbolkf@jmu.edu) or Patricia Higgins (higginpe@jmu.edu). ❖

# The Role of Gas in Electricity Reliability

Rick Sergel, President and CEO
North American Electric Reliability Council

*Periodically,* The CIP Report *provides leading experts in critical infrastructure with an "op-ed" forum to raise issues that are ripe for examination and discussion. In the article below, the president and CEO of the North American Electric Reliability Council (NERC), which in July was designated the Nation's first Electric Reliability Organization by the Federal Energy Regulatory Commission pursuant to the Energy Policy Act of 2005, makes an argument that electric utilities should "bite the bullet" and use long-term planning via firm contracts with natural gas suppliers. This, Sergel argues, could help mitigate potential problems with gas delivery through the physical infrastructure, from wellhead to customers.*

Customer demand for electricity is forecast to increase over the next 10 years by 19 percent, but electricity generation resources by only 6 percent, according to the Long-Term Reliability Assessment published recently by the North American Electric Reliability Council (NERC).

Solutions to close this gap are being pursued, including energy efficiency programs that reduce customer demand, more power plants and more transmission lines. Equally important is the role of fuel supply and delivery in a dependable electricity system. Nowhere is the importance of this role more evident than in the case of natural gas.

Historically, gas and electricity competed as energy sources. Today, their fates are inextricably intertwined, as the electricity industry relies on natural gas as a fuel source more than ever. In the past decade, gas has become the industry's preferred fuel over coal and nuclear power, in part because combined-cycle gas generators are efficient, relatively quick and easy to build, and relatively clean-burning. Almost half of the new power plants planned through 2015 will be gas-fueled, increasing our dependence on gas in the Northeast, Florida, Texas, the Midwest, and portions of the West.

This increased reliance on natural gas, and the growing interdependency of the electricity and natural gas industries, underscore the need for the two to work together so that no one is left in the cold, or the dark, due to lack of heat or power.

Most regions of the country do not anticipate problems with the actual supply of gas in the next 10 years. Of more concern is gas delivery -- both the physical infrastructure through which the gas moves, and the commercial contracts that dictate how and when the gas is transported from suppliers to generators.

The gas pipeline system needs to be adequate to deliver the gas from suppliers to the power plants that burn it (not to mention to the homes and businesses that use natural gas directly as a fuel source). Already, gas pipeline capacity is strained during severe cold snaps. With the amount of new gas-fueled generation being planned, the need for new pipelines and infrastructure improvements is more critical than ever.

However, gas pipeline companies will not build new pipelines to service power plants without long-term, firm contracts. In fact, most new pipelines can be approved by regulators and built only when there are firm contracts in place. But such contracts are not the norm.

Why not? Because electricity gen-

*(Continued on Page 11)*

Richard P. Sergel is President and Chief Executive Officer of the North American Electric Reliability Council (NERC), effective September 12, 2005. Until 2004, Mr. Sergel served as President and Chief Executive Officer for National Grid USA, and was National Grid Group plc Executive Director for North America upon the completion of the National Grid and New England Electric System (NEES) merger in March 2000. From 1998 through the date of the merger, Mr. Sergel was President and CEO of NEES, where he held positions of increasing responsibility since 1979.

Mr. Sergel is presently a director of State Street Corporation. He also served on the boards of the Edison Electric Institute, the Consortium for Energy Efficiency, and the United Way of the Merrimac Valley. He holds a Bachelor of Science in mathematics from Florida State University, a Master of Science in applied mathematics from North Carolina State University, and a Master of Business Administration from the University of Miami.

# Homeland Security -- Homeland Defense Fall Symposium, Cyber Conflict Studies Association

On November 3, 2006, the Cyber Conflict Studies Association (CCSA) held its annual symposium at George Mason University School of Law in Arlington, Virginia. The CIP Program co-hosted the conference, which began with welcoming remarks from James Mulvenon, CCSA Board Chairman, and Sallie McDonald, a Senior Executive at DHS and a Visiting Fellow at the CIP Program.

Titled "Homeland Security -- Homeland Defense," the conference included discussions of policy agendas, the role of the DoD, the state of the cyber battlefield, legal concerns, a review of the DHS exercise Cyber Storm, and the risks of offshoring commercial information technology products/services.

The speakers included: Mark Hall, Director, International Information Assurance Program & Computer Network Defense, Office of the Secretary of Defense Network Information & Integration; Paul Kurtz, Executive Director, Cyber Security Industry Alliance; Jeffrey Wright, Director, Exercise Program, National Cyber Security Division, Department of Homeland Security; Tom Wingfield, Associate Professor, Department of Joint and Multilateral Operations, U.S. Army Command and General Staff College; William McComas, Attorney, Shapiro Sher Guinot & Sandler; Irving Lachow, National Defense University; Jim Wallner, Cyber Defense Agency; and Don Lewis, recently retired Chief, Threat Analysis Division, Defense Intelligence Agency.

Where permitted, the presentations will be made available on the CCSA website www.cyberconflict.org. CCSA is a non-profit organization committed to enriching the research and development agenda related to cyber conflict. CCSA is supported by Norwich University and the National Center at Norwich University Applied Research Institutes.

CCSA has recently published the first volume of its Journal of Cyber Conflict Studies (http://www.cyberconflict.org/pdf/CCSAJournal.pdf), which features articles on information security "privateering;" theoretical approaches to cyber conflict; terrorist cyber capabilities; technical issues in cyber conflict; and attribution.

In addition to the symposium and journal, CCSA organizes various workshops on cyber conflict. Future workshops include: Visualization of Cyber Conflict, Space Dynamics Lab, Utah State University, January 2007; Cyber Arms Control, Naval Postgraduate School, Monterey, California, March 2007; and Infrastructure Risk Assessment, June 2007. ❖

**HS Curricula** *(Continued from Page 6)*

What seems to be missing in the current effort to make homeland security part of the academy is the critical debate and commentary concerning the discipline itself and its assumptions. This gap may also just be a function of time – after the definition of distinctive theoretical foundations, the development of a commonly accepted body of knowledge, and the formation of a scholarly community, the meta-dialogue on homeland security will follow. However, given the evolution of the problem of homeland security, this dialogue may be inherently impossible. The reason is that because in order to be useful as a discipline, homeland security would have to be closely aligned with the institutions that define the need for those professionals. Case in point is the fact that the oldest degree program was developed at the Naval Postgraduate School and aimed at civil servants. Yet, this very alignment might be too close to keep the necessary distance between inquiry and subject. To be very clear – this does not imply that educators and scholars in the field were not independent or that their programs and research were not independent. The problem is simply that the field of study is currently not defined independently from the subject under investigation.

***"Neither workshop attendees nor committee members voiced support for an all-definitive, all-encompassing 'Homeland Security University,' or for the development of independent academic tracks specializing exclusively in homeland security."[2]***

Even a cursory look at the development of established disciplines such as law, economics, political science, or biology shows that they have developed from the inquiry into a very limited set of issues that were in fact initially not defined as problems *sui generis,* but rather emerged as subsets of other empirical or theoretical insights. Homeland security is the exact opposite – it is supposed to deal with an almost unlimited set of issues, and was defined as such not through progress in any other discipline, but by virtue of a task to be completed, i.e. protecting the homeland.

***"Students admitted to the program must have a bachelor's degree in a relevant field (for example, political science, health science, information technology, or others)..."[3]***

In and of itself, this is a perfectly valid reason and warrants every educational and research effort expended, but it does not constitute an academic discipline. ❖

[1] Bellavita, C., Gordon E.M. (2006) "Changing Homeland Security: Teaching the Core." Homeland Security Affairs 2(1) http://www.hsaj.org/?article=2.1.1

[2]National Research Council (2005) "Frameworks for Higher Education in Homeland Security." Report by the Committee on Educational Paradigms for Homeland Security. Washington, DC: National Academy Press.

[3]From the description of the M.Sc. in Homeland Security Management at Towson University; http://grad.towson.edu/program/master/ihsm-ms.asp

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erators traditionally avoid firm gas transportation contracts in favor of less-expensive, interruptible contracts. This is like flying standby instead of purchasing a guaranteed, full-fare airline ticket.

Often, this is not a problem and is economically advantageous. But during times of high demand, such as cold spells when home heating customers and power plants both require more gas than usual, the flow of gas for electricity generation can be interrupted if the generator does not have a firm contract, resulting in the use of more expensive power plants or potentially even power outages.

This situation occurred in New England in January 2004, when a new record for winter peak electricity demand was set. Although power outages were narrowly avoided, the regional system operator, ISO-New England, stated in its follow-up report that "while there was ample gas supply beyond the Northeast, the availability of gas transportation for non-firm customers within New England was a limiting factor and a root cause of both high gas prices and gas unit unavailability."

## Solutions

Preventing electricity shortages due to inadequate fuel delivery systems, or imperfect industry contracting

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*funding. There also are new technologies which either are stuck in the R&D stage or are developed and not being applied – a situation that more directed research could help alleviate. In addition, we also must develop better workforce supply – demand data, which IEEE PES hopes to do with a new recruitment website. We also must honestly confront the industry's image challenge, which extends all the way down to students in middle schools and high schools . . . and also to teachers, guidance counselors and parents. Relative to hiring engineers from places outside of the US, there are visa limitations. If we are to tap this labor pool, Congress will need to change the current approach on visas for highly skilled and educated foreign nationals.*

While there are differences between the "power engineering gap" and the "lineworker/craft workers gap," there also are important symmetries.

Cornell's Thomas had several recommendations, including a need to examine apprenticeship and journeyman timeframes which run many years to see if time-savings can be made consistent with safety and security. Involving the International Brotherhood of Electrical Workers and other trade unions in reform is crucial. He sees a possible quick and somewhat inexpensive solution to a current knowledge gap by conducting a survey which examines trends in the number of electricity sector jobs advertised, but not filled due perhaps to labor shortages or skill gaps. Reder concurs, and says that even absent hard numbers, "my gut says there is a gap, not just for workers who've just exited trades programs or universities, but at mid-career levels." She suggests targeted surveys could help identify the nature and magnitude of education and aging workforce challenges.

New realities are pushing the industry, managers and workers, and academic institutions at all levels. Thomas says that "restructuring has caused some utility companies to wonder what their business really is . . . this is not just a problem in the US, but can be seen from studies and outcomes of restructuring in the United Kingdom." Reder agrees that "market incentives often are short-term, whereas the time horizons for critical human infrastructure education and training are very long. Market dynamics will do what they will, but we need greater awareness of how markets are not just affecting investments in physical infrastructure but in education and research."

Most of those who were interviewed for this article raised concerns about an undue reliance on "offshore solutions" or extending the number of years professionals and technical staff spend in the workforce. Electricity is a very unique commodity; off-shoring solutions and special visas may have addressed domestic workers and skills shortages in the Information Technology sector, for example, but offshoring many critical electric power jobs is not realistic, especially for lineworkers and control room operators. Security concerns will arise, as many jobs in the electricity sector increasingly require recurring background checks, substance abuse tests and security credentials – all of which are more costly and complicated with regard to foreign nationals. Realistically, the politics of immigration have been difficult for both elected officials and citizens in the US.

There are bright spots amid the challenges. Professor Thomas says that it is very significant that "for the first time in my memory, NERC has flagged manpower as a major reliability issue. And this issue has not just found traction at NERC. It is surfaced in almost every utility boardroom." Reder says that at local levels of government and education, positive change is rising to the challenge. For example, she notes that the industry, in cooperation with labor unions and some academic institutions, founded the Center for Energy Workforce Development (http://www.cewd.org) in March 2006. Located in Washington, DC, the CEWD will, in early 2007, launch a new initiative to better understand the electricity sector's workforce gaps. According to CEWD's Director, Ann Randazzo, "We are in the process of kicking off an industry study that will help us understand where critical shortages exist." Ms. Randazzo, who previously worked in the electric utility industry for many years, says that her organization's initial focus has been on lineworkers, powerplant operators, maintenance and repair workers, and pipefitters and pipelayers. CEWD's strategic plan is to move into move into additional job categories where there are gaps, such as power engineering. An example of new curriculae that are being developed at the community college level can be found at the South Georgia Technical College's electrical lineworker apprentice certification program, and CEWD's "Get Into *(Continued on Page 13)*

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Energy" promotion is designed to confront the industry's "image issue," primarily targeted on pre-college age students and their teachers.

## Conclusion

Replacing or refurbishing aging electricity infrastructure is challenging, but long lead times required to effect input – output changes in the education-workforce supply chain are far more complex. Gaps in data and knowledge, particularly with regard to future demand forecasts and changing occupational skill-sets, make it difficult to construct a business case that withstands bottom-line pressures of financial markets, boardrooms and academic institutions. It will take a balanced approach, cooperation and facilitation of dialogues which presently do not exist. Although industry has commissioned consulting firms to conduct targeted surveys of industry professionals to address identified or perceived data gaps, it may be more cost-effective and seamless if an academic institution develops and comprehensive survey instruments that bring educators, educational institutions and students into existing and planned surveys of utility managers and labor organizations. While capturing engineering schools, deans and faculty is essential, the ideal sample would include students and teachers at high schools, voc-ed centers, and 2-year community-technical colleges.

In speaking with professional engineers, concerns about "market realities" often surface, with experts such as Reder noting that in many past policy debates on industry restructuring, power engineers and other technical professionals "often were not at the table." Expanding academic consortia that are engineering-focused to include economics, law and policy institutions might be a way to expand the table and facilitate richer policy discussions. ❖

*Wanda Reder (IEEE), Professor Bob Thomas (Cornell), Dave Nevius (NERC), Gil Bindewald (DOE) and Ann Randazzo (CEWD) made significant contributions to this article.*

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processes, requires the involvement of many. The Federal Energy Regulatory Commission took an important step on October 26th when it ordered power grid operators to develop steps to improve coordination and communication between gas and electric suppliers and users. Power plant owners and operators that contract for gas supply and delivery need to bite the bullet and sign more firm contracts. The fuel supply and delivery industries need to strengthen their critical infrastructures. Governments and the public need to partner with both industries and approve critical gas pipelines, power plants and transmission lines, and regulators need to offer incentives to both industries to increase their systems' capacity. NERC, having identified this vulnerability in our North American electricity supply system, will begin factoring in the reliability of fuel supply and delivery systems when assessing the industry's readiness.

All concerned need to take a longer-term view of the issues of fuel supply and delivery. Our economy and our society demand that we do not leave these key elements of an adequate, reliable, and secure electricity system to chance. ❖

The CIP Program is directed by John A. McCarthy, a member of the faculty at George Mason University School of Law. The CIP Program works in conjunction with James Madison University and seeks to fully integrate the disciplines of law, policy, and technology for enhancing the security of cyber-networks, physical systems and economic processes supporting the nation's critical infrastructure. The CIP Program is funded by a grant from The National Institute of Standards and Technology (NIST).

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