

# UNIVERSITY OF MINNESOTA

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May 31, 2006

**Professor Susan Wolf, Chair**  
Consortium on Law and Values in Health, Environment & the Life Sciences  
Mondale Hall, Suite N140  
University of Minnesota Law School  
229-19th Avenue South  
Minneapolis, MN 55455

Dear Susan:

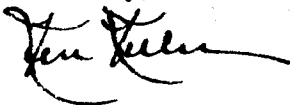
I write as Director of the Center for Science, Technology, and Public Policy, to submit, on behalf of the Center, a proposal entitled "Institutional Considerations for Greenhouse Gas Reductions: Survey and Assessment of Conservation Improvement Programs in Minnesota."

The proposed project is being sponsored by the Center and will be carried out under my general direction. However, much of the actual work will be guided by Professor Elizabeth Wilson, a faculty member in our Center, and Professor Tim Smith, who is associated with the Forest Products Management Development Institute. As you know, I will be on leave of absence during this next year, but I will continue as Director of the Center, returning monthly. Indeed, I will be working with Jennifer Kuzma and Elizabeth Wilson on several other projects as well as this one and we believe we have the logistics worked out so that this arrangement will be effective.

We believe this project addresses one of the important challenges in actually reducing greenhouse gas emissions: the design of institutional structures and stimuli that can actually bring about the changes we know to be technically feasible. Minnesota is an excellent laboratory for this study because of the variety of its electricity producer and distributor organizations. In addition, state government is encouraging the study, which suggests that its results will be of practical value.

We thank the Consortium for considering the proposal.

Sincerely,



Kenneth H. Keller  
Charles M. Denny, Jr. Professor of  
Science, Technology, and Public Policy

*Institutional Considerations for Greenhouse Gas Reductions: Survey and Assessment of Conservation Improvement Programs in Minnesota*

Center for Science, Technology and Public Policy  
and  
Forest Products Management Development Institute (FPMDI)

**Kenneth Keller**, Professor/Director, **Elizabeth Wilson**, Assistant Professor, **Miriam Fischlein**, Ph.D. candidate, Natural Resources Science and Management, **Tim Smith**, Director of the Forest Products Management Development Institute/Associate Professor

**PROJECT NATURE, IMPORTANCE, INNOVATIVENESS, AND HOW THESE FUNDS WILL HELP US FURTHER OUR WORK**

In order to stabilize atmospheric concentrations of greenhouse gases at twice pre-industrial levels (~500ppm), the 'business as usual' emissions trajectory will need to be reduced by roughly 50% by 2050 and by 90% at the end of the century<sup>1</sup>. Approximately 39% of U.S. carbon dioxide emissions originate from the production of electricity<sup>2</sup> and any global policy to limit greenhouse gas emissions must target this sector. Efficiency and conservation are some of the most cost effective options to reduce greenhouse gas emissions, yet barriers to programmatic success can be significant<sup>3</sup>. Efficiency reduces energy demand, beneficial for both the environment and ratepayers. However, creating policies, programs, and organizational structures that reward energy efficiency and conservation is challenging, in part because many institutional and market barriers are ill-structured for optimal project success<sup>4</sup>. For the electric sector, a highly regulated industry, this problem is particularly pertinent and institutional considerations are a key component of program implementation.

The energy efficiency literature recognizes this difficulty, identifying market barriers and differentiating between the "technologically feasible" and the programmatically practical<sup>5</sup>. Evaluating the effectiveness of different policies and programs is an important step towards

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<sup>1</sup> Pacala, S. and R. Socolow (2004). "Stabilization Wedges: Solving the Climate Problems for the Next 50 Years with Current Technologies." *Science* 305(13 August 2004): 968-972.

<sup>2</sup> Energy Information Administration, (2005)

<sup>3</sup> Brown, Marilyn A. (2001) "Market failures and barriers as a basis for clean energy policies." *Energy Policy* 29 1197-1207.

<sup>4</sup> Carter, Sheryl (2001) "Breaking the Consumption Habit: Ratemaking for Efficient Resource Decisions." *The Electricity Journal*. December 66-74.

<sup>5</sup> Prindle, William, Nikolaas Dietsch, R. Neal Elliott, Martin Kushler, Therese Langer, and Steven Nadel, (2003) "Energy Efficiency's Next Generation: Innovation at the State Level", American Council for an Energy Efficient Economy, Report Number E031; Sathaye, Jayant, and Scott Murtishaw. (2004). "Market Failures, Consumer Preferences, and Transaction Costs in Energy Efficiency Purchase Decisions," Lawrence Berkeley National Laboratory for the California Energy Commission, PIER Energy-Related Environmental Research. CEC-500-2005-020; Brown, Marilyn A. (2001) "Market failures and barriers as a basis for clean energy policies." *Energy Policy* 29 1197-1207.

maximizing programmatic results and crafting effective public policy to overcome market barriers and high transaction costs<sup>6</sup>. In this project, these larger institutional and environmental considerations are explored within the context of Minnesota's energy efficiency programs and policy. Minnesota established its 'Conservation Improvement Programs' (CIP) in 1982, requiring electric generators and natural gas providers in the state to dedicate a percentage of their revenue to energy efficiency programs and conservation efforts. An analysis in 2005 by the Office of the Legislature found that additional programs could be cost-effectively implemented<sup>7</sup>. Additionally, while municipality and co-operative organizations generate roughly 32% of electricity in the state, the CIP from these organizations is not subject to the same level of scrutiny and evaluation as the Investor Owned Utilities<sup>8</sup>. Curiously, estimated energy savings per CIP dollar spent by the Municipal and Co-operative Utilities vary several orders of magnitude, ranging from 0.06- 26.19 kilowatt-hours saved per CIP dollar spent,<sup>9</sup> suggesting a lack of accounting consistency across programs. In 2003, municipal and cooperative utility CIP accounted for roughly one third of the \$77 million spent statewide on electric CIP<sup>10</sup>.

In addition to the important academic and larger policy considerations raised by this study, contact with the Department of Commerce has confirmed that analysis of this information would be both useful and timely. We need additional support to accurately assess both the data and the institutional components of the energy efficiency program.

## WORK PLAN

This project merges both theoretical and practical components. The practical component focuses upon analyzing and evaluating newly gathered data on Minnesota's CIP from the Department of Commerce with the goal of understanding both program performance and program diversity. Although they face the same policy environment and regulatory incentives, the organizational responses have been wildly disparate, with some CIP programs posting impressive results, and others reporting much less aggressive programs. To better evaluate why this is so the MN Department of Commerce has initiated the first electronic filing of CIP data for Municipal and Co-operative Electric Utilities, but as of yet, no systematic analysis of the data or programmatic evaluation has taken place. The first task of this project will be to examine and analyze the

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<sup>6</sup> Geller, Howard, Philip Harrington, Arthur H. Rosenfeld, Satoshi Tanishima, Fridtjof Unander. (2006) "Polices for increasing energy efficiency: Thirty years of experience in OECD countries", *Energy Policy* 34 556-573

<sup>7</sup> Program Evaluation Division (2005), *Energy Conservation Improvement Program*, Office of the Legislative Auditor Report, Report No. 05-04, p. 62.

<sup>8</sup> While the Investor Owned Utilities (IOU's) must have their proposed CIP approved by the Department of Commerce, the Municipal and Co-operative Utilities are not subject to approval from the Department. Most small and medium sized towns in Minnesota operate their own utilities within their city limits, and co-operative utilities are essentially conglomerates of small energy producers, providing services jointly through a cooperative distributor. These organizations are not officially money-making entities, as co-ops report to their co-op board and municipal utilities are not-for-profit organizations. Municipal and cooperative utilities with more than 60,000,000 kWh in sales submit post-hoc reports showing their CIP spending and related energy savings. Small municipal and cooperative utilities, those utilities with less than 60,000,000 in kWh sales, are only required to submit a letter verifying that the statutory CIP spending obligation has been met.

<sup>9</sup> Compare this with the range from the IOUs of 5.81-10.24 kilowatt-hours saved for every CIP dollar spent. Program Evaluation Division (2005), *Energy Conservation Improvement Program*, Office of the Legislative Auditor Report, Report No. 05-04, p. 62.

<sup>10</sup> Ibid, p. 12

program data and, where appropriate, develop metrics for comparison and evaluation of programs. Additional relevant data, not collected by the Department of Commerce (cost per kilowatt-hour, organizational incentive structures, for example), will also be assembled. Key research questions guiding the analysis are:

What types of results have the programs been able to achieve?

- How much energy is estimated to have been saved?
- What variability exists within programmatic assumptions and how different are these assumptions within and across programs? How does this affect calculated results?
- How many tons of CO<sub>2</sub> and criteria pollutants have been avoided overall by Muni-Co-operative CIPs?<sup>11</sup>
- What is the estimated \$/ton CO<sub>2</sub> reduction cost?
- How does this compare with IOU CIPs?
- What future opportunities for program enhancement can be identified?

However, program analysis concentrating solely upon kilowatt-hours saved is likely to miss the underlying factors driving each organizations response to the policy stimulus. The second component of this research effort focuses upon developing a qualitative analysis of the considerations driving organizational behavior. While the co-ops and municipal utilities are not profit-seeking enterprises, many factors (declining rural economies, pay compensation structure for directors, and others) directly affect organization strategy and planning. Transaction costs and market failures are often linked to institutional and organizational structure<sup>12</sup>. In addition to grounding this work in the energy efficiency literature, several branches of organizational theory (principal-agent theory, stakeholder theory, organizational culture and identity) will be used as methodological frameworks to structure the analysis and differentiate the operational environment of the organizations.

The Department of Commerce knows that CIP program function varies significantly across the state, yet no systematic evaluation of factors that affect to programmatic performance has yet been undertaken. After programs have been categorized and grouped by external factors, system performance will be further analyzed. Through a series of in-depth structured interviews with program managers from programs with similar external environments but divergent program performance, factors influencing performance will be identified. Additionally interviews with the Department of Commerce and other stakeholder groups (non-profits, municipal utility associations, energy efficiency consultants, etc.) will be used to supplement and provide context for interviews with utility managers. Structured interviews with municipal utility and co-operative managers will be used to develop a typology of institutional and environmental factors that influence energy efficiency program success and general organizational behavior<sup>13</sup>. Considerations driving this component of the project are:

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<sup>11</sup> It is likely that grid-averaged emission figures will be used to calculate the savings.

<sup>12</sup> Blumstein, Carl, Charles Goldman, Galen Barbose. (2005). "Who should administer energy-efficiency programs?" *Energy Policy* 33 1053-1067.

<sup>13</sup> Henriques, I., and P. Sadorsky. (1999). "The relationship between environmental commitment and managerial perceptions of stakeholder importance." *Academy of Management Journal*, 42(1), 87-99.

What are the driving institutional and environmental forces shaping organizational behavior?

- How do these forces interact with one another?
- How do programs differ from one another in terms of:
  - Diversity of investments
  - Internal planning, evaluation of systems, or structures
  - Organizational commitment to conservation plan
  - Training, networking, etc.
- Which factors are deemed most relevant by organizational leaders and key stakeholders for creating an institutional typology?
- Which are the largest challenges to successful program implementation?
- What types of “best practice” have emerged from municipal and co-operative CIP experience?
- What could be done to replicate “best practice” across diverse areas?
- What barriers exist to replicating these “best practices” and how could those be mitigated?

The students sponsored by the consortium will interact with the Department of Commerce, co-operative and municipal utilities, and other stakeholders to analyze data, interview key participants, and create program targeted policy recommendations and documents. In addition, two peer-reviewed publications are planned for this project. The first of these will target the energy use and efficiency literature and focus upon program evaluation and the importance of institutional structure, the second will be aimed towards the policy community, outlining general challenges of management and planning of public programs within different state level organizational environments.

NOTE: IRB approval is underway.

## **PROJECT TIMELINE**

### September-October

- Literature review for public sector institutional behavior
- Develop structured survey instrument for interviews with stakeholders, utility personnel and Department of Commerce employees.
- Meet with Department of Commerce personnel
- Begin data analysis on Department of Commerce Data

### November-February

- Finalize literature review
- Data analysis on Department of Commerce data
- Conduct interviews with stakeholders, municipal and co-operative utility managers

- Develop evaluation matrix and qualitative methodology to better discern organizational motivations

#### March-April

- Draft report on analysis and findings
- Meet with Department of Commerce personnel and get comments on draft report
- Submit draft report to municipal and co-operative utilities for comments and feedback
- Draft peer reviewed publication on programmatic function
- Draft peer reviewed publication on institutional factors affecting organizational operation

#### May-June

- Integrate comments and feedback into data analysis report
- Write report on institutional factors
- Finalize report for DOC, and utilities
- Finalize publications for submission

## **BIOGRAPHIES AND ROLES ON THE PROJECT**

### **Miriam Fischlein**

Miriam Fischlein is a Ph.D. student in Natural Resource Management at the University of Minnesota working with Professor Tim Smith of the Department of Bio-Based Products. Her research focuses on the role of governments and business in attaining environmental sustainability and especially on the impact of private environmental governance. She has also worked on technological innovations in the transport and energy sector and their environmental and social impacts.

In 2003, she earned an undergraduate degree in Political Science from the Institut d'Etudes Politiques (Sciences Po), in Bordeaux, France and in 2005, a graduate degree in Social Sciences from the University of Stuttgart, Germany. From 2000 to 2003, she held a merit scholarship from the Franco-German University. She is also a fellow of the German National Academic Foundation. In 2004, she was in charge of a nationwide German student research effort on Corporate Social Responsibility on behalf of the Association of German Foundations.

### **Kenneth H. Keller**

Dr. Kenneth H. Keller is Charles M. Denny, Jr. Professor of Science, Technology and Public Policy at the University of Minnesota and also Professor of Chemical Engineering and Materials Science. His current research interests include the impact of science and technology on international politics and economics, the policy issues raised by high technology medicine, and the role of American institutions of higher education in research and development.

Educated at Columbia and Johns Hopkins, he spent most of his career at Minnesota where he joined the faculty of Chemical Engineering and Materials Science in 1964, became Vice

President for Academic Affairs in 1980 and President of the University in 1985. From 1990 to 1996, he was Senior Fellow for Science and Technology at the Council on Foreign Relations in New York and, for two of those years, Senior Vice President for Programs. He presently chairs the Medical Technology Leadership Forum and the National Research Council's Board for the Technical Assessment of the National Institute of Standards and Technology. He is also a member of the NRC's Board on Life Sciences.

In 1987, Dr. Keller was named Twin Citizen of the Year and, in 1996, he received a Distinguished Alumnus Award from Johns Hopkins University. He is a Fellow of the American Association for the Advancement of Science and a member of the National Academy of Engineering. He has also been named a National Associate of the National Academies for his contributions to the public policy work of the Academies.

**Dr. Keller** will oversee the project and provide guidance at key junctures.

### **Timothy Smith**

Dr. Timothy Smith is Associate Professor of Corporate Environmental Management and AT&T Industrial Ecology Fellow at the University of Minnesota where he also holds an adjunct faculty position in Marketing and Logistics Management within the Carlson School of Management. He received a BA in business administration from the University of Colorado (1993) and a Ph.D. (1998) and MBA (1996) from Penn State University; he has also held positions in sales and marketing planning in the financial and telecommunications industries. Dr. Smith's research and consulting interests focus on the effectiveness of marketing communications - particularly involving media and sales force interactions. This work has recently been expanded to explore communication effectiveness around "green" messaging, products designed for the environment, and life cycle assessment (LCA) information throughout the supply-chain. Over \$1,000,000 in grants and contracts has been awarded to Dr. Smith and his collaborators in support of these and related research efforts. Sponsoring organizations include: US Department of Energy, US Department of Agriculture, MN Department of Commerce, and various public and private organizations such as the Institute for the Study of Business Markets (ISBM), 3M Corp., Andersen Corp., Louisiana Pacific Corp., and Pentair Corp. His work has appeared in various academic journals including: International Journal of Research in Marketing, Journal of Marketing Research, Journal of Business Research, and International Journal of Life Cycle Assessment. Dr. Smith also serves as the Director of the Forest Products Management Development Institute (FPMDI), a unique industry/University partnership focused on environmental and managerial aspects of the forest products industries.

**Professor Smith** will aid in the supervision of the Ph.D. student.

### **Elizabeth Wilson**

As an assistant professor at the Humphrey Institute of Public Affairs, Elizabeth Wilson works on energy and environmental policy. Her research is focused upon the transition to a carbon managed energy system. She joined the Humphrey Institute faculty in 2005 after serving for six years as an environmental scientist with the National Risk Management Research Lab of the U.S.

Environmental Protection Agency (EPA). At the EPA, Wilson's work focused on integrated technology assessment and supporting the development of a six New England state energy-economic model to facilitate evaluation of regional climate and energy policy options. She also served as a member of the EPA's working group on geologic carbon sequestration and contributed to the Intergovernmental Panel on Climate Change report on carbon capture and sequestration. Prior to her work with the EPA, Wilson worked in Europe researching integrated solid waste management while based at the Catholic University of Louvain in Belgium. She also has worked on the interface between environment and development issues in Kenya, Burundi, and Tanzania. She holds a doctorate in engineering and public policy from Carnegie Mellon University and a master in human ecology from Vrije Universiteit Brussel in Brussels, Belgium.

**Dr. Wilson** will supervise the work of the research assistants supported by this project and participate in the work.

## **BUDGET**

### **Ph.D. Student from Natural Resources Science and Management**

25% 10 Hours per Week

(Salary, \$8,837; Fringe, \$5,772)

\$14,609

### **MS, MPP-STEP, or JD-MS Student**

25% 10 hours per week

(Salary, \$6,127; Fringe, \$5,457)

\$ 11,584

### **2 Weeks Summer Salary for E. Wilson**

(Salary, \$3,889; Fringe, \$1,276)

\$ 5,164

Travel for interviews and one conference

\$1,500

**Total: \$32,856**