

# Council of Energy Research and Education Leaders

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### Paul Wilson, Ph.D.

Chair, Energy Analysis and Policy Program, *University of Wisconsin-Madison*

The Council of Energy Research and Education Leaders (CEREL) is a multidisciplinary organization of leaders of university-based energy centers and programs working together to advance the role of higher education in the energy field. The National Council for Science and the Environment (NCSE) serves as the Secretariat, while the Association of Public and Land-grant Universities (APLU) is a founding member and partner with NCSE in supporting CEREL.

## MISSION

- Increase the contributions of university energy research and education to the challenges facing society
- Promote efforts to advance knowledge and learning in interdisciplinary energy fields
- Elevate the importance and awareness of the role of energy in human affairs across every segment of society
- Foster cooperative efforts among CEREL members and other scientists and engineers; federal, state, and local agencies; industry; and non-governmental organizations

## GOALS

- Enhance the visibility of the benefits of research and education in the interdisciplinary energy fields, and achieve recognition that these are integral to U.S. policy goals in education, energy, national security, economic development, and environmental quality
- Create and strengthen links among interdisciplinary energy sciences, studies, technology, research, and development in academia, federal labs, and industry
- Increase and more effectively utilize funding for energy research, education, workforce development, and communications
- Serve as a resource for objective, authoritative information related to research and education in interdisciplinary energy sciences, studies, and engineering
- Establish and share resources about people, programs, organizations, and curricula in energy research and education

## ACTIVITIES

**Research** – advocating for support of university-based energy research as well as advancing and elevating the national debate about energy

**Education** – sharing approaches to preparing the future workforce

**Collaborating for Success** – engagement, education and outreach, and communications

## MEMBERSHIP AND MEETINGS

Membership is open to any college or university-based energy department, center, or program, each of which has a single representative and separate membership fee. See current members on reverse. Our Annual Program Conference will be held Nov. 3-5, 2010 in Golden, CO with tours of National Renewable Energy Laboratory facilities as a highlight.

## CONTACT US

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## **CURRENT MEMBERS (as of JUNE 2010)**

### **SPONSORING MEMBERS:**

#### **INSTITUTION**

Association of Public and Land-grant Universities  
Southern Illinois University Carbondale  
University of California, Berkeley  
University of California, Los Angeles

University of Kentucky  
University of North Carolina Charlotte  
University of Southern California  
University of Wyoming

### **MEMBERS:**

#### **INSTITUTION**

Arizona State University  
Ball State University  
Columbia University  
Desert Research Institute  
Florida A & M University

The George Washington University  
Michigan State University  
Missouri University of Science & Technology  
New Mexico State University  
Ohio State University  
Purdue University  
South Dakota State University  
University at Buffalo  
University of California  
University of California, Davis  
University of Colorado at Boulder  
University of Connecticut  
University of Delaware  
University of Idaho  
University of Illinois at Urbana-Champaign  
University of Maryland  
University of Michigan  
University of Minnesota  
University of Nebraska–Lincoln  
University of North Carolina at Chapel Hill  
University of North Texas  
University of South Florida  
University of Tennessee  
University of Texas at San Antonio  
University of Toledo

University of Wisconsin–Madison  
Wayne State University

West Virginia University

#### **ENERGY CENTER/PROGRAM**

Coal Research Center  
Energy Biosciences Institute  
Center for Energy Science and Technology  
Advanced Research  
Center for Applied Energy Research  
Global Institute for Energy and Environment  
Energy Institute  
School of Energy Resources

#### **ENERGY CENTER/PROGRAM**

Arizona Institute for Renewable Energy  
Center for Energy Research/Education/Service  
Lenfest Center for Sustainable Energy  
Renewable Energy Center  
College of Engineering Sciences, Technology & Agriculture  
Law School  
Mechanical Engineering Department  
Energy Research & Development Center  
Cooperative Extension Service  
Institute for Energy and Environment  
Energy Center at Discovery Park  
Agricultural Experiment Station  
Office of the Vice President for Research  
California Institute for Energy and the Environment  
Energy Institute  
Office of the Vice Chancellor of Research  
Center for Clean Energy Engineering  
Center for Energy and Environmental Policy  
Environmental Biotechnology Institute  
Center for Advanced Bioenergy Research  
Energy Research Center  
Michigan Memorial Phoenix Energy Institute  
Initiative for Renewable Energy & the Environment  
Energy Systems Laboratory  
Institute for the Environment  
Office of the Vice President for Research  
Clean Energy Research Center  
Howard H. Baker Jr. Center for Public Policy  
College of Engineering  
Center of Advanced Renewable Energy and the Environment  
Energy Institute  
Alternative Energy Technology Program  
National Biofuels Energy Laboratory  
Advanced Energy Initiative  
Department of Geology & Geography



The **National Council for Science and the Environment** (NCSE) improves the scientific basis of environmental decision-making through collaborative programs with diverse communities, institutions and individuals. We work for a society where environmental decisions are based on an accurate understanding of the underlying science, its meaning and limitations, and the potential consequences of action or inaction.

While an advocate for science and its use, NCSE does not take positions on environmental policy issues and is dedicated to maintaining and enhancing its reputation for objectivity, non-partisanship, and achievement.

NCSE has programs in five strategic areas:

## **STRENGTHENING EDUCATION AND CAREER DEVELOPMENT**

NCSE brings members of the academic community together to improve their environmental programs and increase their value to society. Programs in this area include the:

- **University Affiliate Program** provides services to advance programs at over 150 member schools ranging from large private and public research institutions to smaller liberal arts institutions.
- **Council of Environmental Deans and Directors** brings academic leaders together to improve the quality and effectiveness of interdisciplinary environmental programs on the nation's campuses.
- **Council of Energy Research and Education Leaders** fosters interdisciplinary collaboration among leaders of university-based energy programs to advance the role of higher education in the energy field.
- **Campus to Careers Program** partners with government agencies, businesses, and foundations to advance young people in environmental careers through fellowships, internships, and other means.
- **EnvironMentors Program** prepares high school students in underserved communities for college programs and careers in science and environmental professions. There are eight chapters in Alabama, Arkansas, California, Colorado, Massachusetts, Nebraska, North Carolina and Washington, DC.

## **SCIENCE SOLUTIONS FOR ENVIRONMENTAL CHALLENGES**

NCSE brings stakeholders together to develop and implement science-based solutions to specific environmental challenges. Programs in this area include the:

- **National Commission on Science for Sustainable Forestry** provides practical information and tools to serve the needs of forest managers and policymakers to improve sustainable forestry.
- **Wildlife Habitat Policy Research Program** produces information and tools to accelerate the conservation of wildlife habitat in the United States through State Wildlife Habitat Plans.
- **Outlook Forest Research Dialogue** enhances research coordination, collaboration, and partnership within the forestry community.

## **NATIONAL CONFERENCE ON SCIENCE, POLICY AND THE ENVIRONMENT**

NCSE annually brings together over 1,000 leaders from science, government, corporate and civil societies to develop strategies to improve decision-making on a major environmental theme. Following the conference, the strategies are disseminated to catalyze new initiatives within key communities.

## **COMMUNICATING SCIENCE-BASED INFORMATION – THE ENCYCLODIA OF EARTH**

The Encyclopedia of Earth engages over 1,000 environmental experts and 50 partnering organizations from 60 countries to provide free access to information on every environmental issue to a global audience.

## **SCIENCE POLICY**

NCSE builds understanding of, and support for, environmental science and its applications, and the programs that make it possible. We present expert testimony to Congressional committees, consult regularly with key decision makers in government, and work to promote funding for environmental programs at federal agencies.

## **The Vital Contributions of Universities to the Nation's Energy Future: Investing in Academic Research as Part of a Coherent & Sustained National Energy Strategy**

### **A. National Energy Strategy**

1. There must be an immediate massive effort to transform U.S. and global energy production and consumption towards greater sustainability, stability, and security. We recommend that this be embodied in a National Energy Strategy developed by the new Administration.
2. This effort must involve coordination among governments at all levels as well as incentives for the private sector to capitalize on and enhance market forces. This requires leadership that extends cooperatively throughout and beyond the federal government.
3. An objective understanding of science and the full impact of energy options should guide decision-making. To enable this, tools such as life cycle analysis, to assess and compare the strengths and weaknesses of different energy systems, are needed to guide decisions in all economic sectors, particularly transportation, housing, agriculture and energy production. All relevant agencies should be directed to develop an operational policy on the importance of science for energy decision-making.
4. The new National Energy Strategy should include a multi-year, multi-sectoral research, development, demonstration and deployment (RD3) plan for improving the diversity and reliability of the energy supply while reducing environmental impacts and improving energy predictability. This plan should include a specific and substantial role for university energy research (see part B, page 3).
5. Substantial investment from government and the private sector will be needed to develop and implement this plan as current levels of R&D energy investment are inadequate to meet our energy challenges. Energy R&D should be tripled in the short term, to \$15 billion/year, and then ramped up to 5 to 10 times its current level.
6. The scientific component of a new National Energy Strategy should recognize and support a broader range of fields than has been the case historically, including such areas as architecture, biotechnology, community planning, education, history, information sciences and technology, microbiology, nanotechnology, and various social sciences, as well as the traditional energy fields of physical sciences and engineering. These should be integrated into funding strategies for a new multi-disciplinary field of energy science and technology and a companion field of energy studies.



7. The new National Energy Strategy should also include research on impacts of investment, tax, and other financial and regulatory policy instruments.
8. Sustained and broad federal investment in basic energy research will power an energy revolution by “priming the pump” through generating the revolutionary, not evolutionary, ideas to solve large-scale problems. Universities are especially well-equipped to carry out revolutionary research.
9. The nation’s capacity for energy research, exploration, production, and sustainable use must be expanded. Only universities and colleges are positioned to generate the talent base that is needed for the new energy future.
10. These investments will create employment that will assist in short- and long-term economic recovery and stability.
11. Inquiry-based and experiential education on all levels, including consumer education, is a key component of engaging the citizenry in wise energy choices. This can be coupled with efforts to build energy-smart and healthy schools and other initiatives to improve infrastructure. Universities are particularly well-positioned to provide science-based energy education.
12. The Administration should engage the American public in substantive discussion about their energy consumption habits and emphasize that energy is not just about the supply side.
13. The Administration and Congress should increase the budget of the Energy Information Administration. More and better data are needed on the full range of energy and related environmental issues.
14. The Administration and Congress should dramatically increase investment in university-based energy research and education as part of an overall increase in energy investment.

## **B. The critical contributions of universities and colleges to energy R&D and education**

### **I. Current levels of R&D energy investment are inadequate to meet our energy challenges**

- a. \$3 - 4 billion, or less than two percent of federal R&D, is devoted to energy, compared to 10% in 1980.
  - i. By comparison, this is less than half what our largest pharmaceutical firm spends on R&D, and is two percent of the total price of the Apollo program in today's dollars.
- b. The FY08 allocation for DOE Energy and Science R&D is \$6 billion (about one percent of all federal R&D), with \$3.6 billion going to basic research at Office of Science. Much of this basic research is not oriented towards energy.
  - i. For comparison, FY08 budget for NIH: \$29.46 billion; DoD: \$77.78 billion
  - ii. Yet the energy sector is the largest single industry, worth \$1.9 trillion, compared to the \$1.7 trillion health sector and \$1.2 trillion national defense sector
- c. Universities receive less than half of DOE Science R&D.
- d. Investment in energy research at other agencies – NSF, USDA, Commerce, Interior – is relatively small.
- e. Need substantial, sustained investment in university research for the long term instead of fluctuating interest in energy research as oil prices rise and fall

### **II. Sustained and broad federal investment in basic energy research will power an energy revolution by “priming the pump”**

- a. The US cannot rely on the private sector alone
  - i. Corporate energy R&D is also negligible relative to similar industries
    1. 2004: totaled \$1.2 billion, or <0.25% of total energy revenue
    2. pharmaceutical and semiconductor firms invested 18% and 16%, respectively, of revenue in R&D
  - ii. The private sector is more focused on narrowly applied research than on basic energy science.
  - iii. Recent surge of venture capital flows to near-market-ready ideas, instead of to basic research, and will likely dry up in wake of economic crisis
- b. Transformative nature of basic research is essential for true innovation
  - i. “revolutionary, not evolutionary, ideas to solve large-scale problems” (Stephen Forrest)
  - ii. “applied science leads to improvement in old methods, while pure science leads to new methods” (C. H. Llewellyn Smith)
  - iii. Longer-term fundamental science research leads to “disruptive discoveries” (Raymond Orbach)

### **III. Basic research spurs innovation and economic growth**

- a. Over 90% of new economic growth results from public & private sector investments in innovation (Economics Nobel Laureate Robert Solow).
- b. Investments in energy research lead to significant payoffs in innovation and commercialization (see Margolis and Kammen, “Underinvestment: the energy technology and R&D policy challenge,” *Science* 285, 690-692; Nemet and Kammen, “U.S. energy research and development: Declining investment, increasing need, and the feasibility of expansion,” *Energy Policy* 35(1): 746-755).

- c. Very strong correlation between investment in innovation and performance of energy technologies in the marketplace
- d. In Denmark, Norway, Germany, Spain, Portugal, etc., substantial investments in clean energy have paid off in job growth and increasing the proportion of renewable resources in national electricity supplies.

**IV. Universities are well-equipped for energy research**

- a. Large industrial laboratories (e.g. Bell), responsible in the past for notable scientific and technological breakthroughs, have discarded basic research programs.
- b. Advantages of university energy research
  - i. Synergistic role of universities
    - 1. Interdisciplinary nature & systems-level thinking
    - 2. Future workforce preparation & energy education
    - 3. Role in community education
    - 4. Regional and cross-industry collaboration
  - ii. More agile – can respond quickly to increased funding
  - iii. Include a diverse array of scholars who can coalesce quickly for multi-disciplinary collaboration
  - iv. Academic environment encourages free-thinking and inquiry
  - v. Tightly linked to energy education and workforce preparation
- c. Close partnerships between research universities and industries can quickly demonstrate and commercialize promising ideas.

**V. Only universities are positioned to generate the talent base to generate green jobs and energy breakthroughs**

- a. Every individual involved in energy research, innovation, and production beyond a certain technical level receives education in universities and colleges.
- b. The academic system of formal education in coursework, coupled with research assistantships and independent research, prepares the nation's future scientists and engineers for their careers regardless of where they are employed.
- c. Investment in academic research thus provides irreplaceable co-benefits in education and preparation.
- d. There is tremendous student interest in issues of climate and energy. For example, the energy club at MIT has around 700 members.

**VI. Specific recommendations for federal support of energy research**

- a. Energy R&D should be tripled in the short term to \$15 billion/year and then ramped up to 5 to 10 times its current level (according to MIT President Dr. Susan Hockfield and Obama Energy Advisor Dr. Daniel M. Kammen), with increased emphasis on academic energy research.
- b. Immediately establish a long term National Energy Strategy that would include a multi-year/decadal research, development, demonstration, and deployment (RD3) plan for energy sustainability and security, with a specific and substantial role for university energy research.
  - i. The RD3 plan would be created by a multi-agency, multi-sectoral process, involving the National Academies of Science and Engineering
  - ii. The RD3 plan should provide funding for academic research in a variety of fields through a diversity of departments and agencies including NSF, NIST, USDA, EPA, DoC, DOE, DOI and DoT.
- c. RD3 investment should be part of any economic stimulus package.

- d. Longer-term, to establish stable funding, use revenue from cap-and-trade auction permits, a cap-and-invest system, or regular appropriations process (Rep. Ed Markey, Dr. Stephen R. Forrest).
- e. Congress should create long-term funding mechanisms for public/private sector research initiatives.
- f. Congress should fund university research centers that support and integrate natural science, social science and engineering research and development. These include the Energy Frontier Research Centers proposed by the DOE.
- g. Congress should appropriate funds and direct research agencies/organizations to collaborate to fund trans-disciplinary natural and social science research into integrated energy systems.
- h. Congress should develop and enact a National Energy Education Act to provide support for development of energy education programs from kindergarten through graduate school and in informal as well as formal education.

Also see: "[Investing in the Future: R&D Needs to Meet America's Energy and Climate Challenges](#)", hearing before the House Select Committee on Energy Independence and Global Warming on 9/10/08; "America's Research Universities: Paving the Way for a Sustainable Energy Future through Collaboration, Commercial Innovation and Workforce Education", CSU roundtable at Dirksen Senate Office Building on 10/15/08; "Energy for a Sustainable and Secure Future" (2006), and "Environmental Research and Education Needs: An Agenda for a New Administration," National Council for Science and the Environment

## CONTACT INFORMATION

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