



RENEWABLE AND SUSTAINABLE ENERGY INSTITUTE

RASEI is a joint institute between the University of Colorado Boulder (CU-Boulder) and the National Renewable Energy Laboratory (NREL) addressing important, complex problems in energy that require a multidisciplinary, multi-institutional approach. Its mission is to expedite solutions that transform energy by advancing renewable energy science, engineering, and analysis through research, education, and industry partnerships.

RASEI benefits from the strengths of its partner institutions. CU-Boulder is a premier institution for research and education, and its broad spectrum of capabilities and disciplines contributed to its placement of eight in research citation output among U.S. institutions of higher learning (*Science*, Nov. 2010). NREL is the only national laboratory solely dedicated to advancing renewable energy and energy efficiency technologies from concept to commercial application.

RASEI'S FOUR GOALS:

Create Integrated Energy Campus—to create a world-leading venue for energy research and education that benefits from the concentration of academic institutions, federal research laboratories, and businesses involved in the green economy along Colorado's Front Range.

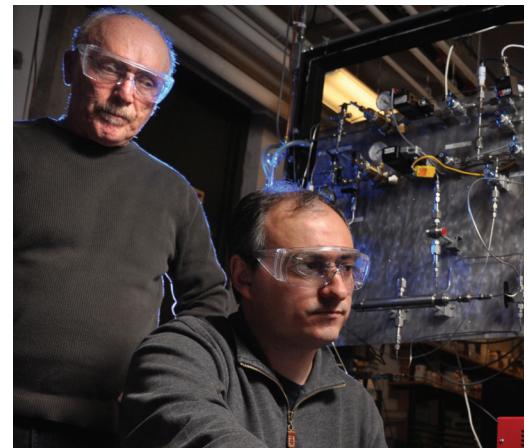
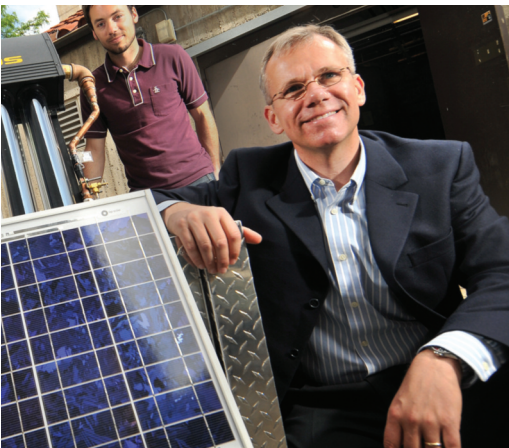
Perform Innovative Research—to develop a comprehensive and multidisciplinary approach to research that meets the scientific and institutional energy challenges of the 21st century.

Educate Energy Leaders and Workforce—to provide programs, lectures, and opportunities that prepare students to become the energy leaders of the future.

Develop Industry Partnerships—to engage industry partners in comprehensive programs involving energy research, education, policy, and technology development.

INTEGRATED ENERGY CAMPUS

RASEI forms the center of an integrated energy campus by combining the best of CU's scholarship and degree programs with NREL's mission and capabilities, in partnership with other academic institutions, federal research labs, and industry. The integrated energy campus is a major component of the "Colorado Research Diamond" described in the CU-Boulder Flagship 2030 Strategic Plan.

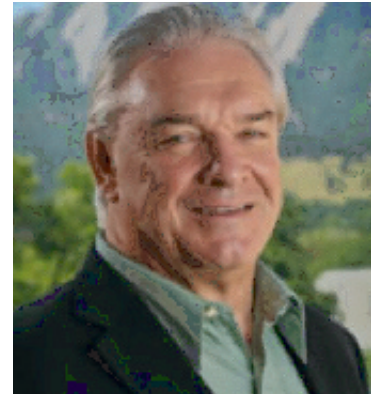


INNOVATIVE RESEARCH

RASEI's comprehensive and interdisciplinary approach to research and education across a range of impact areas is geared toward meeting the needs of emerging industry sectors.

RASEI RESEARCH IMPACT AREAS

- Advanced Biofuels through Synthetic Technologies
- Energy Innovations (partnership with CU Law)
- Grid Innovation
- High Penetration Wind Electricity
- Nanoscience for Energy Capture and Conversion
- Social, Institutional, and Behavioral Analysis
- Solar Conversion and Solar Fuels
- Strategic Industry Concepts
- Sustainable Transportation and Sustainable Fossil Fuels



We face an unprecedented energy challenge.

Demand for energy is projected to double within the next few decades and continue to grow through the end of the century. To meet this ever-growing demand, energy industries of the 21st century need an entirely new infrastructure that produces more energy at a lower cost, uses energy far more efficiently, and improves the security of the supply. This new energy infrastructure needs to rely more on domestic and stable sources, and produce far fewer greenhouse gas emissions.

The scale and complexity of the energy challenge and the intense competition in the energy marketplace necessitate a comprehensive approach for developing new energy industries. Understanding the dynamics of a new marketplace and the factors governing a sustainable energy system are crucial to the success of emerging energy industries.

*Michael Knotek, Ph.D.
Director, RASEI*

2011 Workshop Highlights

Carbon Capture Workshop with Colorado School of Mines Carbon Management Center—

Researchers from academic institutions, national labs, and industry and government partners (including DOE Fossil Energy Office) examined research on carbon capture from power stations (coal and natural gas) and other industry sources of CO₂. Joint activities were initiated from this workshop.

Solar Fuels Industry Research Consortium Workshop—

Representatives from nine global companies with interests in alternative fuels, Department of Energy officials, and researchers from CU, NREL, MIT, Purdue, and Colorado School of Mines met to discuss the potential for creating a consortium focused on developing commercially viable, scalable, solar hydrogen production.

Electronic and Optical Characterization of Nanoscale Systems for Renewable Energy—

This was the second in a series of workshops for researchers from NREL, NIST, and CU to define the needs of measurement science programs at NIST and joint programs with CU and NREL in the area of solar energy research and development.

North American Wind Energy Academy Scoping Workshop (NAWEA)—

Involving 65 representatives from 17 universities, 17 companies, and 6 national laboratories, this wind energy workshop convened to define the role of a wind academy, its mission, vision, and goals in fostering the research required for high-penetration wind deployment.

CU-Boulder to hire 24 energy-related tenure-track faculty positions in next five years.

CU-Boulder has launched a university-wide, multidisciplinary, energy-focused hiring program. Twelve positions are allocated to RASEI and 12 matching positions to multiple departments within the College of Engineering and Applied Science, the College of Arts and Sciences, the Leeds School of Business, and the CU School of Law.

New faculty members will be appointed to tenure-track positions, appointed as a RASEI fellow or affiliate, and will also have the opportunity for joint projects and appointments at NREL. Faculty and staff from CU and NREL are collaborating in the recruitment process.

CU-Boulder to build new complex for energy and environmental programs.

CU-Boulder is building a new complex on East Campus for programs in environmental science, environmental sustainability, and renewable energy, positioning CU-Boulder as a leader in these disciplines. The new complex includes the construction of an 83,708 ft² wet lab building and the renovation of an already-existing 280,000 ft² building for a dry laboratory, classrooms, and office space. Detailed architectural planning is underway with construction scheduled to start in the fall of 2012. RASEI research staff and fellows will be housed in this complex, which is expected to be finished in the spring of 2014.

Top: an artist's rendering of new building

Bottom: existing building slated for remodel



RASEI EDUCATION

RASEI is dedicated to preparing the students of today to become the energy leaders of the future. RASEI offers energy certificates and energy-related courses to students at CU-Boulder and professionals interested in leadership positions in the green economy.

Undergraduate and Graduate Energy Certificates

RASEI's energy certificate programs provide broad exposure to energy issues, with an emphasis on renewable and sustainable energy. Required coursework on energy science and technology, policy, and economics coupled with electives on energy and environment, journalism, ethics, and other topics gives students the skills and knowledge to tackle society's pressing energy problems.

RASEI has awarded 23 undergraduate energy certificates and 21 graduate certificates since the program began in 2008.

Professional Certificate in Renewable Energy

RASEI's Professional Certificate in Renewable Energy is a graduate-level study of renewable energy technologies, policies, and business, and provides participants the core knowledge they need for leadership positions in the field of renewable energy.

The certificate program takes advantage of its location in Colorado—considered a world leader in clean energy—through guest speakers and case studies. Courses are offered online and on campus, and are taught by experienced CU-Boulder faculty. RASEI is enrolling its first class for the spring of 2012.



Paul Komor, Energy Education Director for RASEI and a lecturer in the Environmental Studies Program at CU-Boulder, has expertise in policy issues related to renewable versus traditional energy use, with policy experience in the nation's capital. Komor is one of the recipients of the 2007 Nobel Peace Prize for his work on the Intergovernmental Panel on Climate Change (IPCC) and is the author of the book Renewable Energy Policy (2004).

INDUSTRY PARTNERSHIPS

RASEI's relationship to comprehensive energy research, the integrated energy campus, and its affiliation with academic excellence provide an attractive foundation for industry interaction and partnerships.

RASEI partners with Toyota for plug-in hybrid electric vehicle study in a smart-grid environment.

Toyota Motor Sales, Inc., has loaned (28) 2010 Prius plug-in hybrid electric vehicles (PHVs) to RASEI for field testing in a smart-grid environment. The interdisciplinary research project will gather data on vehicle performance, electricity use, and how households use and charge their vehicles. Xcel Energy is partnering with the Toyota-sponsored research by installing smart plugs in the study households to better understand the effect of PHV vehicle charging on the utility grid.

The Prius PHV can be charged in approximately 3 hours from a standard 110-volt electrical outlet and can cruise in electric-only (EV) mode for approximately 14 miles. For longer distances, the PHV seamlessly switches over to hybrid mode and drives like a regular Prius that uses regenerative battery power and a gasoline engine. The vehicles involved in the study are randomly assigned to households that drive and test the PHVs in 9-week cycles. Barbara Farhar, a senior research associate at RASEI, is the project's principal investigator.



Stay current with RASEI news and events. Join our mailing list. rasei.colorado.edu



BIG energy seminar series

RASEI's Big Energy Seminars explore opportunities that address current energy challenges.

RASEI, in partnership with existing CU-Boulder seminar programs, sponsors speakers from academia, industry, and government with expertise on the scope and breadth of research, technology, and educational opportunities for addressing today's energy challenges. During the fall semester of 2011, RASEI sponsored 17 seminars across a multidisciplinary spectrum of energy research.

Past seminars and video recordings are on the RASEI website at rasei.colorado.edu.

Fall 2011 Seminar Highlights

Jason Bordoff, "Innovating Our Way to a Clean Energy Economy"

Former Governor Bill Ritter, "Clean Energy and the Environment in America: The Colorado Story"

Alexander "Sandy" MacDonald, Director of the Earth System Research Laboratory, NOAA, "Feasibility of Predominant Wind and Solar Energy Over the 48 United States"

Research Profile



RASEI Fellow Kevin Doran presents papers on legal implications of carbon capture and storage.

RASEI Fellow and Research Professor Kevin Doran presented a paper at the 2011 Conference on Carbon Capture and Storage in Pittsburgh, Pennsylvania, which analyzed sub-surface property rights for "pore space" in relation to geologic storage of carbon dioxide. The paper assessed the implications of early 20th Century federal land conveyance statutes for federal ownership of pore space and concluded that the federal government likely holds title to some 70 million acres of pore space under private lands in the West. This research was underwritten by the U.S. Department of Energy.

Related papers were presented at the Energy, Utility and Environment Conference in Phoenix, Arizona, and the 2011 Western Energy Policy Conference in Boise, Idaho, where Doran chaired a session on transmission development and regulatory policy.

Doran recently launched a new project designed to study methane emissions from abandoned coal mines in China. For more information, visit www.chinamethane.org.

CU energy club

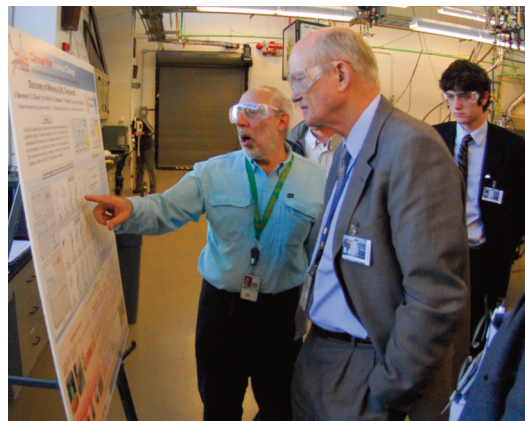
RASEI supports the CU Energy Club, a 1,500-member organization, which connects students and alumni to the emerging industries of renewable energy and clean technology.

2011 Selected Activities

Hosted visit from William Brinkman, Ph.D., director, DOE Office of Science, which included lab visits, question/answer sessions, and a public lecture on the science for energy.

Held public forum on Boulder's energy municipalization initiatives proposed on the November 2011 ballot, moderated by Patricia Limerick, chair, CU's Center of the American West, and seven panelists from industry, government, and academia.

Participated in conference call with U.S. Energy Secretary Steven Chu and other university energy clubs regarding student interests and activities in renewable energy initiatives across the nation.



RASEI Fellow David Ginley explains the work of the Center for Inverse Design, a DOE Energy Frontier Research Center, with William Brinkman, director, DOE Office of Science. Jeremy Halperin, president, CU Energy Club, looks on.



Mailing Address: 27 UCB, Suite 208, Fleming Building
Boulder, CO 80309-0027

Physical Address: 2445 Kittredge Loop Road
Boulder, CO 80309-0027

Main Office Phone: 303-492-0284

rasei.colorado.edu