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The Energy and Environment Initiative (EEi) engages expertise from multiple research disciplines, along with industry leaders and government agencies, NGOs, and the public to develop and promote relevant and impactful activities and research at Rice that have a transformative effect towards Energy Sustainability. Our target audience is our students, faculty, staff, collaborators, and stakeholders in government, industry, and NGOs. For more information, please visit our website at eei.rice.edu.

Welcome to the inaugural issue of the Energy and Environment Initiative (EEi) newsletter. In this first edition we feature several of our key 2016 activities and set the tone for the new year in 2017. We intend to publish quarterly and hope you find the material informative and interesting.

RESEARCH ANNOUNCEMENTS

Seed Grants

We have selected a new round of collaborative, cross-disciplinary seed grants this December that will be active over the next 12 – 24 months. These three grants were selected from a number of excellent submissions to the Rice University Provost's Creative Ventures Fund – Energy and Environment Awards. The objective is to support research that will better our environment as well as our energy reliability, security, and affordability, not just in the United States but also in the global marketplace. Congratulations to:

- Maarten de Hoop and Alan Levander – “Proposal for Development Funds for a DoE Energy Frontiers Research Center”
- Rob Griffin, Philip Bedient, and Jamie Padgett – “Simulation of the Release and Fate of Petrochemical Materials from Aboveground Storage Tanks Following Severe Storms in Houston”
- Aydin Babakhani – “High-Resolution 3D Radar Imaging of Fluids and Smart Proppants in Porous Media”



Water Technology

Rice University was awarded an NSF grant for a Nanotechnology-Enabled Water Treatment (NEWT) Center. This center will promote research technologies that can supply drinking water to underdeveloped countries, as well as address the challenges of fracking water in the oil and gas market. The center also works closely with Rice's Baker Institute Center of Energy Studies (CES) to advance progressive management and policies. Read more about the NEWT [here](#).

Subsea Systems Institute (SSI)

SSI is a collaboration of Rice University, the University of Houston, and the Johnson Space Center. The mission is to promote transformative research in subsea systems that will ensure the safe, efficient, and failure-resisting operations and maintenance of offshore operations. The SSI was awarded in a State of Texas competition for a research center with funds that are distributed from the U.S. Treasury as a result of the RESTORE Act. Additional information about SSI can be found [here](#).

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COLLABORATIVE AGREEMENTS

Energy & Environmental Research Center (EERC)

EEi recently signed an agreement with the EERC from the University of North Dakota to establish a cooperative arrangement in the areas of transformative research for the development and deployment of technologies aligned with the mission of the EERC. Work performed under this agreement may include (but are not limited to) these areas of mutual interest: computational engineering, manufacturing of advanced materials, subsurface mapping and performance, enhanced oil recovery and chemicals production, and remote monitoring and assessment through advanced sensing.

A biannually scheduled technology exchange alternately hosted between Rice and the EERC will commence in February 2017.



EVENTS



Technology Outlook 2025

EEi hosted our partners from DNV-GL in October 2016 for their presentation of Technology Outlook 2025. The Norwegian group DNV GL is an internationally recognized commercial and standards organization that issues a report every five years looking a decade ahead at anticipated marketplace changes, both societal and commercial, and the transformative emerging technologies in a variety of industries, including oil and gas, petrochemicals and electric power, merchant shipping and transportation, the environment and life sciences, as well as others. A copy of the report can be found [here](#).

PetroChallenge 2016

We hosted our second annual student competition called PetroChallenge in October 2016. Hosted by our partners at NeXT, a division of Schlumberger, participating students receive a hands-on, team-oriented, educational experience that offers them the opportunity to gain insight into the decision-making steps involved in the exploration and production business process faced by oil and gas companies. Our two winning teams will go head-to-head against the winning teams from Penn State University and the University of Wyoming at the North American PetroChallenge Finals in January 2017.



EDUCATION

Leadership and Decision Making in the Energy Industry

EEl's first foray into the online education has received enthusiastic feedback from learners. The 15-week course ran through December 2016 and provided students with information first hand from industry experts in the oil and gas, petrochemicals, and electric power markets. Attendance surpassed our initial goals and follow-up courses are currently being designed. Monitor our website for updates on the next offering of the current course as well as future courses. The trailer for the current course can be found [here](#).



FEATURE FACULTY

This is the first of our featured faculty research in pursuit of our EEl mission. As the quarterly newsletters continue we will feature a vast array of the transformative technologies we are developing at Rice for the energy and environment marketplace.



Dr. Aydin Babakhani

[RISC Lab](#)

Featured technologies:

- Nanotechnology sensors
- Data gathering and analysis for leak detection and safety assurance
- Efficient and environmentally advanced fracking and footprint optimization to increase productivity

The Rice Integrated Systems and Circuits (RISC) laboratory directed by Prof. Aydin Babakhani develops advanced sensors technologies for leak detection and energy exploration and production. The RISC laboratory focuses on the fundamental sciences related to physics and electronics of silicon-based integrated sensors and antennas. The sensor research in the RISC laboratory covers two broad areas:

- Permanent online monitoring sensors.
- Miniaturized proppant-sized battery-less sensors with energy harvesting capability.

In the first area, the RISC laboratory has developed the world's first High Pressure High Temperature asphaltenes and corrosion sensor technology that can monitor paramagnetic chemicals such as asphaltenes in real-time. This is done all electronically and without using any chemicals or other consumables. The asphaltenes sensor technology was recently tested in a major oil field in Canada by one of largest Canadian energy producers. The second field trial will be conducted in Permian Texas by one of the largest U.S. independent producers. This technology helps energy producers to significantly reduce the operating cost and minimize the environmental impacts by reducing the usage of chemical inhibitors for asphaltenes and corrosion. Another technology that is being developed in the first category is a sensitive THz gas spectrometer for on-line monitoring of H₂S, CO₂, and other polar molecular in surface facilities. In addition, the RISC laboratory builds a miniaturized mass spectrometer and a variety of microwave/radar sensors for online monitoring of chemicals in a multi-phase flow system.

In the second area, the RISC laboratory develops proppant-sized sensors than can be sent to reservoir during hydraulic fracturing jobs. These sensors aim to produce a high-resolution image of the fractures in the reservoir with spatial resolution of 1ft. They are also able to measure reservoir properties such as temperature, pressure, chemicals, stress, pH, etc. In addition to fracture mapping, the second category includes cement embedded sensors that are used to continuously monitor the quality of cement and report leakage of environmentally hazardous gases such as methane and CO₂. These sensors can also be used to detect corrosion and water breakthrough in the cement.

Upcoming Events

January 13 – 14, 2017

North American PetroChallenge Finals
Schlumberger, Inc.

January 17, 2017

Jones Graduate School of Business – Energy Initiative
“Energiewende” – Integrating Renewables in the Grid and the Market
McNair Hall – Shell Auditorium
Rice University

January 18, 2017

GSTC Winter Member’s Meeting

January 19, 2017

Norwegian Consulate General – Lunch’n Learn
Charles McConnell speaker – “A New Administration – What Energy & Environmental Policies Can We Expect to See?”
Norway House

January 26, 2017

“Leadership and Decision Making in the Energy Industry” Course Symposium Finale
McNair Hall – Shell Auditorium
Rice University

February 16, 2017

Bloomberg – “Future of Cyber Security: Spotlight on Oil & Gas in Houston”
Charles McConnell panelist

February 23 – 24, 2017

LNG Summit USA
Charles McConnell keynote speaker

March 6 – 10, 2017

CERAWeek – Rice EEI University Partner Participation

Special thanks to our partners:

