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Research Brief: Alternative Energy

Northeastern University - Government Relations

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Northeastern University

Alternative Energy Research

Northeastern is committed to creating a more environmentally sustainable planet by lessening dependence on foreign oil and reducing greenhouse gas emissions. To that end, our scientists are working with government agencies, industry leaders, and renowned research institutions to develop viable, cost-efficient alternative and renewable energy sources.

These advances in alternative energy are part of the University's larger commitment to solving the world's most complex problems, particularly in the areas of **health**, **security**, and **sustainability**.

Northeastern's Clean Energy Pioneers



Luca Caracoglia, assistant professor of civil and environmental engineering

Research focus: Caracoglia is currently working on ways to capture "torsional flutter," the same wind force that destroyed Washington State's Tacoma Narrows Bridge in 1940. Devices that would harness such energy would work as secondary systems on buildings or for other smaller-scale uses, rather than replacing wind turbines. To induce torsional flutter, he is designing a blade airfoil that can rotate on hinges—a simple and compact mechanism that can be efficient at low or moderate wind speeds.

Recent grants: \$430,000 from the National Science Foundation for current research focused on the effects of wind on tall buildings.



Joan Fitzgerald, professor and director of the Law and Public Policy program

Research focus: Fitzgerald examines the economic opportunities for cities that focus on sustainability and reducing greenhouse gases. She recently authored a book on the topic called *Emerald Cities: Urban Sustainability and Economic Development* (Oxford University Press, 2010). Fitzgerald has provided expert testimony to the Appropriations Subcommittee on the Labor, Health and Human Services, Education, and Related Agencies on supporting the advancement of low-wage workers in green technology and health care.

Recent grants: \$243,000 from the Rockefeller Foundation as part of a collaborative grant with Duke University and Worldwatch Institute.

Spotlight

Northeastern's Center for Renewable Energy Technology (NUCRET) has received six federal grants totaling more than \$8 million to conduct research that will focus on powering the next generation of electric cars and consumer products.

The Department of Energy (DOE) awarded Northeastern the majority of the funds, including a four-year, \$6.38 million grant to develop a cost-effective and energy-efficient nonplatinum-based fuel cell catalyst for electric vehicles. The new technology would replace internal combustion gas engines with fuel cells.

NUCRET director and Northeastern professor Sanjeev Mukerjee and his team are collaborating on the project with a host of universities, the National Laboratory, and other partners, including the chemical firm BASF, Los Alamos National Lab, and Nissan. The goal is to develop a more affordable, fully electric vehicle that would hit the market between 2016 and 2018, Mukerjee says.

For Mukerjee, who has been researching this field for 20 years, this DOE grant "represents the greatest opportunity for engendering a breakthrough."

"These grants put Northeastern at the forefront of materials science," says Mukerjee, professor of chemistry and chemical biology. "Our leadership role will define the future development of these materials for years to come."

The DOE also provided NUCRET with two additional grants. One will support a collaboration with the University of North Florida and Johnson Matthey to develop portable methanol fuel cells for consumer applications. This next generation of fuel cells would enable laptops and other devices to run for months without being recharged.



Rosanna Garcia, associate professor of marketing

Research focus: Garcia’s recent National Science Foundation–funded survey of 7,500 car owners measured interest (found to be low) in alternative fuel vehicles (AFVs), including hybrids, plug-in hybrids, electric cars, and diesel cars. Her future research is focused on how to collect market data about future technologies like AFVs, and how to reduce the uncertainty and risks of new fuel technologies for the “average” car buyer in order to speed the diffusion of AFVs. She is also investigating the best ways to inform buyers (advertising, word-of-mouth, test drives) about AFVs, and is developing a web-based game to teach middle-school students about the environmental impact of automobiles.

Recent grants: \$150,000 as part of a \$1.9 million collaborative grant from the National Science Foundation; \$155,000 from the MacArthur Foundation.



Yiannis Levendis, distinguished professor of mechanical and industrial engineering

Research focus: Levendis has tackled a host of clean energy-related problems, most notably ways to reduce harmful emissions from the use of fossil fuels and ways of incinerating petroleum-based castoffs—like plastics, styrofoam, and tires—cleanly and to harness their energy instead (a kilogram of plastics contains the same energy as a kilogram of gasoline or diesel oil). He and his colleagues are also looking at ways to fashion carbon nanotubes out of waste plastics and to create a usable fuel out of bagasse, the fibrous vegetation left after sugar cane is processed for sugar and ethanol.

Recent grants: More than \$1 million in various grants from the National Science Foundation, the Department of Energy, and the Environmental Protection Agency.



Sanjeev Mukerjee, professor of chemistry and chemical biology, director of the Northeastern University Center for Renewable Energy Technology.

Research focus: Mukerjee and his team are developing less expensive materials for catalyzing fuel cells used to power cars, homes, and power plants. He and his colleagues are also working on rechargeable batteries that would power laptops continuously from days to a week.

Recent grants: \$8 million through a variety of grants from the Department of Energy, the Department of Defense’s Army Research Office, Dupont, and the U.S. Army’s Communications-Electronics Research, Development, and Engineering Center (see Spotlight for details).

PLASTICS GET A SECOND LIFE

Under the leadership of Yiannis Levendis, distinguished professor of mechanical and industrial engineering (details above), a team of undergraduate and graduate engineering students at Northeastern developed a waste combustor, which breaks down non-biodegradable plastics to create an alternative source of fuel.

Their prototype—which served as the undergraduates’ senior capstone project—was featured at the fifth annual MIT Energy Conference in March 2010.

Levendis, who has pursued research on the combustion of plastics and other post-consumer wastes for the past 20 years, is currently focusing on the concept of vaporizing solid plastic waste, which would reduce levels of harmful emissions during the combustion process.

“The inspiration behind my research is the quest to develop clean, cost-efficient power sources in the face of dwindling fossil fuel reserves,” Levendis said. “It will also help get rid of unsightly, non-biodegradable plastic waste that cannot be recycled.”

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