Message from the Director

At Purdue, we believe strongly in discovery with delivery – the need to translate fundamental scientific discoveries of the nature of matter and energy to real-world engineering solutions.

The purpose of this newsletter is two-fold; first, to share with you some of the innovations in energy that our faculty and their research teams are engaged with, their partnerships with industry, and their entrepreneurial spirit in start-ups commercializing energy technologies; second, to invite your partnership in creating the deep interactions among academia, industry and government that are necessary to realize the vision of a sustainable and secure energy future. We have an exceptional community of over 150 energy researchers.

We are training our best and brightest undergraduate and graduate students in transdisciplinary research, to think beyond the current paradigms and be a creative and influential national and international resource. We invite you to visit us either virtually at our web site (www.purdue.edu/dp/energy), join our mailing list (email a request to energy@purdue.edu), or on the ground at Discovery Park, Purdue’s $750 million adjunct campus devoted to interdisciplinary research with societal impact.
Purdue students designed their INhome to reflect traditional Midwestern architecture with state-of-the-art technology (Jim Tetro/U.S. Department of Energy Solar Decathlon)

Purdue Solar Decathlon

Purdue University finished second overall and first in energy balance in the Solar Decathlon 2011, a solar house competition in Washington, D.C., sponsored by the U.S. Department of Energy. Nineteen teams, including four from outside the United States, designed and built affordable, energy-efficient, solar-powered homes for the competition. Work on INhome involved more than 200 students studying technology, engineering, liberal arts, agriculture, krannert, and health and human sciences. Contact William Hutzel, Mechanical Engineering Technology, hutzellw@purdue.edu, 765-494-7528

National Medal of Technology and Innovation

Rakesh Agrawal, a distinguished professor of chemical engineering at Purdue University, received the National Medal of Technology and Innovation from President Barack Obama. The award is the highest honor for technological achievement bestowed by the president of the United States. Agrawal, the Winthrop E. Stone Distinguished Professor in the School of Chemical Engineering, holds 600 patents and has authored 93 technical papers. A citation for the award recognizes him for “an extraordinary record of innovations. These innovations have had significant positive impacts on electronic device manufacturing, liquefied gas production and the supply of industrial gases for diverse industries.” Contact Rakesh Agrawal, Chemical Engineering, agrawalr@purdue.edu, 765-494-0805

Green Tech America

Green Tech America (GTA) is focused on the development and commercialization of an innovative, yeast-based cellulosic ethanol technology pioneered by Prof. Nancy Ho. Based upon this technology, GTA will expand into several growth areas: marketing the Ho-Purdue yeast for cellulosic ethanol production, cellulosic ethanol production by GTA, generation and marketing of innovative new co-products produced simultaneously with cellulosic ethanol production, development of other yeast-based products and development of new renewable energy and chemicals from CO₂. In addition, GTA will provide technical assistance to cellulosic ethanol producers and collaborate with ethanol and cellulosic ethanol producers to produce and market additional co-products using GTA’s new cellulosic ethanol yeast derived from the Ho-Purdue Yeast. Contact Nancy Ho, Chemical Engineering, nwyho@greentechamerica.com, 765-588-3834, www.greentechamerica.com

National Academy of Sciences committee

The biofuels industry will not be able to meet the cellulosic production requirements of the Renewable Fuel Standard without significant advancements in technology or investment, according to a National Academy of Sciences study prepared for Congress. Wallace Tyner, the James and Lois Ackerman Professor of Agricultural Economics at Purdue University, co-chaired the committee, which presented its findings to congressional staffers, agency representatives, the executive branch and the National Press Club in Washington, D.C. Contact Wallace Tyner, Agricultural Economics, wtyner@purdue.edu, 765-494-0199
Higher energy efficiencies of thermoelectric devices

Among the various renewable energy and energy conservation solutions, thermoelectric-based generator and solid-state cooling/heating devices have the advantage of being all solid-state devices with no moving parts, which makes them silent, reliable and scalable. Wu and his colleagues have developed a way to mass produce nano-scale nanowires, thus allowing the system to operate with over 80 percent higher efficiency. Similar technologies for high temperature applications, employing environmentally friendly and readily abundant materials to produce thermoelectric devices, and using polymers to make flexible thermoelectric devices also have been developed at Purdue. Contact Jon Gortat, Purdue Research Foundation, jdgortat@prf.org, 765-588-3485; Yue Wu, Chemical Engineering, yuewu@purdue.edu

Engineering high-yield non-food bioenergy crops for biofuels production

As the United States prepares to become more energy independent, biofuels have become attractive as direct alternatives to traditional fossil fuels. Currently, corn is the main source of the ethanol produced for transportation fuel applications. However, corn is unsustainable as a fuel source, necessitating an alternative, reliable source of biomass. Researchers at Purdue are working to alter the genetic makeup of trees so that the newly transformed tree will accumulate biomass faster than its non-transformed counterpart. The technology has previously been demonstrated in annual, herbaceous species but not yet in fast-growing poplar trees. The transformed trees are expected to be sterile and more easily degradable, making them a reliable, dense source of biomass. Contact Vicky Montenegro, Purdue Research Foundation, mvmontenegro@prf.org; Richard Meilan, Forestry and Natural Resources, rmeilan@purdue.edu

Low-cost manufacture of solar thin films

Agrawal’s technologies are related to photovoltaic solar cells that enable scalable manufacturing of thin film solar cells. Two main proprietary technologies enable a high-throughput and low-cost manufacturing process, namely nano-crystal ink technology and rapid selenization technology. These technologies will dramatically reduce the manufacturing cost of modules over competing thin film technologies. Contact Jon Gortat, Purdue Research Foundation, jdgortat@prf.org, 765-588-3485; Rakesh Agrawal, Chemical Engineering, agrawalr@purdue.edu

Lithium-Ion Battery Cathodes for Optimized Performance

The development of lithium-ion batteries with high energy density and very fast charge rates are essential to their use in transportation, energy storage and portable electronics applications. It is well known that the major flaws of lithium iron phosphate are low conductivity and low lithium diffusion constant. Fisher has found one solution with a promising lithium-ion material, which yields a 10 percent improvement in weight to energy density and a 20 percent improvement in volume to energy density over the standard lithium cobalt material. Contact Eric Lynch, Purdue Research Foundation, eslynch@prf.org, 765-588-3477; Timothy Fisher, Mechanical Engineering, tsfisher@purdue.edu
High-efficiency heat pump research

In regions with frequent subzero temperatures, heat pumps need supplemental systems to keep pace with home energy needs. Those backups are expensive to operate, but a new technology on the horizon may reduce their operating costs in the future, thanks to a partnership between Purdue University, Emerson and Carrier. With $1.3 million in funding from the Department of Energy, James Braun, Eckhard Groll and Travis Horton are striving to improve the coefficient of heat pump performance by 50 percent in cold climates, such as that found in Minnesota. The project, which builds on previous work that began around five years ago at Purdue’s Herrick Laboratories, involves two different methods to improve the compression process using single-stage scroll compression technology. Contact James Braun, Mechanical Engineering, jbraun@purdue.edu, 765-494-9157

Network for Photovoltaic Technology

Purdue University is leading a new research center to improve photovoltaic solar cells as part of a national effort to bring alternative energy technologies to the marketplace. The Network for Photovoltaic Technology is led by Ashraf Alam, professor of electrical and computer engineering, and Mark Lundstrom, the Don and Carol Scifres Distinguished Professor of Electrical and Computer Engineering. The work, which is being funded by the Semiconductor Research Corporation, addresses performance, cost, reliability and manufacturing challenges of photovoltaic cells, which convert sunlight into electricity. Participating Industry leaders include ABB, Applied Materials, Bosch, First Solar, IBM and Tokyo Electron. Contact Mark Lundstrom, Electrical and Computer Engineering, lundstro@purdue.edu, 765-494-3515

John Zink Company scholarships

Purdue University’s Energy Center and the John Zink Company are collaborating on three $5,000 interdisciplinary graduate research fellowships focusing on combustion. Based in Tulsa, the international company operates three separate test facilities, to create one of the combustion industry’s largest research and development operations. Its emissions-control and clean-air technologies are used in industries such as hydrocarbon and chemical processing, biofuels, automobile manufacturing, food processing, pulp and paper, and waste management. Contact Pankaj Sharma, Energy Center, Discovery Park, sharma@purdue.edu, 765-496-7452

Cummins Super Truck program

Purdue University is engaged with Cummins Inc. in a Department of Energy Super Truck program designed to improve heavy duty vehicle freight efficiency by 50 percent (ton-miles per gallon). Trucks and buses consume nearly 25 percent of petroleum used in surface transportation and Class 8 line haul trucks consume over two-thirds of fuel consumed by truck classes in the US. Essential elements of technology development include significant improvements in heavy duty engine efficiency and aerodynamic drag and reduction in auxiliary loads. Contact Gregory Shaver, Mechanical Engineering, gshaver@purdue.edu, 765-494-9342