

annual report

academic year
2012 - 2013



building a team, a lab, and leadership for the future



Emily A. Carter
Founding Director

When I think of the monumental challenges facing humanity in finding sustainable sources of energy and protecting the environment, the bright spot is always the talent and dedication of the people working on solutions. Building and supporting the best possible teams of researchers has been a key focus at the Andlinger Center over the past year, as it provides a strong foundation for everything we will do going forward. Since July 2012, the center worked with academic departments to jointly recruit two exceptional junior faculty members, and two other outstanding assistant professors recruited the previous year have now started work on campus. Filling these four new positions surpassed our 2013 faculty recruiting target, and moves us rapidly toward a goal of filling six joint junior positions by 2016 and 10 joint faculty positions total. In the last year, we also brought to campus two terrific visiting faculty members, who broadened the center's expertise in environmental engineering and energy markets. It is a joy to welcome people of such ability and passion to Princeton and to support them in pursuing urgently needed research and teaching.

Even as these new people arrive, the center's activities in research, education, and external partnerships continue full bore. A key piece of foundational work – also in the area of building the best team – has been to appoint two new associate directors of the center: Peter Jaffe, professor of civil and environmental engineering, oversees our research activities, and Niraj Jha, professor of electrical engineering, leads our education activities. I am thrilled and grateful for their work. Peter and Niraj join Lynn Loo as associate directors. Lynn is Princeton's Theodora D. '78 and William H. Walton III '74 Professor in Engineering and serves as the Andlinger Center's associate director for external partnerships.

In addition to outlining our progress in research, education, external partnerships, and beyond, this report introduces a new graphic identity, intended to convey the essence of our vision. We are excited to begin using the logo and graphic system, created by the San Francisco design firm Propp+Guerin, to bring a strong and consistent look to all our communications. As programmatic aspects of the center move forward, construction continues on the center's new home, which is now rapidly taking shape next to Princeton's Engineering Quadrangle. The 129,000 square-foot complex is on track for occupancy in 2015.

None of these advances would have been possible without tremendous generosity not only of our founding donor Gerhard R. Andlinger '52, but also the many others who have continued to pledge their support and make gifts to the center. I am grateful for the support at every turn, as we make decisions about the general operations of the center, outfit its central facilities with state-of-the-art equipment, and facilitate exciting research and teaching opportunities.

Thank you for reading our report. I welcome your participation in the Andlinger Center for Energy and the Environment.

Emily A. Carter
Founding Director

mission and goals

to develop solutions to ensure our energy and environmental future

With opportunities and needs in almost every aspect of the center's work, our planning efforts serve as critical guides, influencing all our decisions and focusing our attention on activities that support our goals.

foster a vibrant, intellectual community that engages people from many academic disciplines

accelerate innovative multidisciplinary research through funding, infrastructure, and intellectual discourse

train the next generation of thought leaders by educating students in their own disciplines and in a broader context

partner with industry, not-for-profit, and government to reach practical technology and policy solutions

become the center that the U.S. government turns to for information and advice

faculty appointments and recruiting



Daniel Steingart

Daniel Steingart was appointed on February 1, 2013, as assistant professor of mechanical and aerospace engineering and the Andlinger Center for Energy and the Environment. He was previously an assistant professor at the City University of New York, with a specialization in energy systems. He received his bachelor's degree at Brown University and his Ph.D. at the University of California, Berkeley, where he also spent a year as a postdoctoral researcher. Previously, Steingart served as chief technology officer of Wireless Industrial Technologies and senior applications engineer at Sentilla Corporation.



Daniel Giammar

Daniel Giammar was the Kenan Visiting Professor in the Department of Civil and Environmental Engineering and the Andlinger Center for Energy and the Environment in 2012-2013. Giammar joined Princeton from Washington University in St. Louis, where he is an associate professor in the Department of Energy, Environmental, and Chemical Engineering. Previously, he was a postdoctoral research associate at Princeton in the geosciences department and a teaching fellow in Princeton's Council on Science and Technology. Giammar created a new undergraduate course CEE 304/ENE 304/ENV 300 that was offered in the spring, "Environmental Implications of Energy Technologies," which will continue to be taught on a regular basis, first by Visiting Professor Michael Schwartz in 2014, and later as a permanent course offering.



Michael Schwartz

Michael Schwartz has been reappointed for academic year 2013-14 as the Gerhard R. Andlinger Visiting Professor in Energy and the Environment. Schwartz began his activities with the center in spring 2013 and teaches graduate and undergraduate courses. He is the CEO of New Wave Energy Capital Partners and has previously held senior management positions at Duke Energy, MidAtlantic Energy Group, Conoco, and Shell Oil. Schwartz received B.S. and M.S. degrees in chemical engineering from Polytechnic Institute of New York University and his Ph.D. in chemical engineering at Princeton. In 2012-2013 he introduced ENE 586/WWS 586H: Greening the U.S. Energy Economy: Meeting the Technology, Policy & Investment Challenge.

faculty appointments and recruiting
(cont'd.)



Barry Rand

Barry Rand was appointed assistant professor of electrical engineering and the Andlinger Center for Energy and the Environment on July 1, 2013. He was previously a senior researcher at IMEC vzw in Leuven, Belgium, and his research interests are in photovoltaics and organic electronics. He received his bachelor's degree from The Cooper Union for the Advancement of Science and Art followed by his Ph.D. at Princeton in 2007.



Claire White

Claire White was appointed on August 1, 2013 as an assistant professor within the Department of Civil and Environmental Engineering and the Andlinger Center for Energy and the Environment. White, a materials scientist whose research focuses on green cement manufacturing and carbon sequestration, previously served as a Director's Postdoctoral Fellow at Los Alamos National Laboratory. She holds a bachelor's degree in civil engineering, a bachelor's degree in physics, and a doctorate in chemical engineering, all from the University of Melbourne.



Forrest Meggers

Searches in 2012-2013 included a joint search with the School of Architecture. **Forrest Meggers**, an expert in sustainable building systems and technology, will join the architecture and Andlinger faculty on February 1, 2014. He will arrive on campus as an associate research scholar in architecture for the fall. Senior energy and environment faculty searches, broadly defined, are ongoing. A senior energy policy/economics faculty search with the Woodrow Wilson School proved unsuccessful in its first year and has been put on hold until 2014-2015. Results of all center searches are considered in relation to our strategic plan and influence searches in subsequent years. We continue towards our goal to fill three senior positions in the coming years in addition to six junior positions.

education



Professor Niraj K. Jha joined the Andlinger Center as associate director for education on March 1, 2013.

The Andlinger Center received approval for the Certificate in Energy Technology and Society (ETS), which it is running in conjunction with Princeton University's Keller Center, as a track within Keller's Program in Technology and Society. The aim of ETS is to provide opportunities to humanities and social science students to learn about energy technologies and to engineering and natural science students to learn about the societal implications of such technologies. The requirements to earn this certificate are a core course, two technology courses, two societal courses, one breadth course, a one-semester independent research project, and presentation of the project/thesis at an annual symposium. There are 47 courses to choose from. ETS is off to a good start after a launch this past spring with eight undergraduates currently pursuing this certificate.

An energy subject code (ENE) was approved for the Andlinger Center. Currently, 26 courses are listed under this code: 23 undergraduate and three graduate courses. Several more are pending approval. The center launched several new courses last year. **Dan Giammar**, who held a Kenan Visiting Professorship in 2012-2013, introduced CEE 304/ENE 304/ENV 304: Environmental Implications of Energy Technologies. It turned out to be a very popular course with an enrollment of 79. **Michael Schwartz**, the Gerhard R. Andlinger Visiting Professor in Energy and the Environment, offered ENE 586/WWS 586H: Greening the U.S. Energy Economy: Meeting the Technology, Policy & Investment Challenge. This course had an enrollment of 17, quite high for an elective graduate course. Finally, this past spring **Dan Steingart** rejuvenated MAE 424/ENE 424: Energy Storage Systems.

The **Peter B. Lewis Fund for Innovation in Energy and the Environment** enabled seven undergraduates in 2012 and five in 2013 to pursue eight weeks of research in the summer (see Seed Funding for details of the projects). Several such projects are expected to become the basis for junior and senior independent projects and senior theses.

Lewis Internship Recipients and Faculty Advisors

Summer 2013

Denisa Buzatu '15

(Sigrid M. Adriaenssens, Civil and Environmental Engineering)

Marcus Lee '15

(Marcus N. Hultmark, Mechanical and Aerospace Engineering)

Collen Leng '14

(Craig B. Arnold, Mechanical and Aerospace Engineering)

Paul Ohno '14

(Steven L. Bernasek, Chemistry)

David Perlman '16

(Andrew B. Bocarsly, Chemistry)

research



Professor Peter R. Jaffe was appointed associate director for research on July 1, 2013.

highlight seminar series

September 17, 2012
Arun Majumdar
 former Acting Undersecretary
 of Energy
*A New Industrial Revolution for a
 Sustainable Energy Future*

October 22, 2012
Yogi Goswami
 University of South Florida
*New and Emerging Developments in
 Solar Energy*

November 19, 2012
James D. Hamilton
 University of California, San Diego
*Oil Prices, Exhaustible Resources &
 Economic Growth*

December 10, 2012
Debra Rolison
 U. S. Naval Research Lab
*Enhancing Electrochemical Energy
 Storage on the Macroscale via
 Architectural Design on the
 Nanoscale*

seed funding

The Andlinger Center awards internal funds to catalyze and support faculty and student research. Applications are peer-reviewed and competitively distributed for individual faculty projects and for those that involve collaboration among faculty members from different departments and disciplines. Student support is provided in the form of undergraduate summer research internships and a graduate student fellowship. These funds fostered a wide variety of innovative research in 2012-2013.

The Addy/ISN North American Low-Carbon-Emission Self-Sufficiency Fund provides funding for research aimed at reducing carbon emissions and creating an energy self-sufficient North America. This year, two faculty projects were awarded up to \$100,000 each for research that will continue into 2014. Professors **Yueh-Lin (Lynn) Loo**, **Michael Celia**, and Research Engineer **Eric Larson** are conducting analyses to evaluate the co-firing of biomass and natural gas to generate transportation fuels while assessing the possibility of storing the generated CO₂ in spent organic shales. Professors **Jean Prevost** and **Craig Arnold** are developing approaches to lengthening the lifetimes of lithium-ion batteries by improving the mechanical properties of their electrodes. Some projects awarded in 2011-2012 continued into 2013 as well. The project abstracts are available at <http://acee.princeton.edu/news/addy-funds-2013/>.

The Andlinger Innovation Fund encourages interdisciplinary collaboration among Princeton scientists and engineers, and allows for the purchase of equipment to support research in energy. In 2012-2013, seven interdisciplinary faculty projects received up to \$100,000 each. Professors **Luigi Martinelli**, **Alexander Smits**, and **Elie Bou-Zeid** are looking at the optimal aerodynamic shapes of wind turbines; Professor **Denise Mauzerall** and Research Engineer **Eric Larson** are researching the potential effect of wind energy penetration on China's air quality and climate; Professors **Sigrid Adriaenssens** and **Axel Kilian** are studying elastic structures for energy efficient architecture; Professors **Yiguang Ju** and **Gerard Wysocki** are researching new multispecies diagnostics and elementary rate constant measurements in biofuel combustion; Professors **Ning Lin**, **Michael Oppenheimer**, and **Jianqing Fan** are exploring tropical cyclone risk assessment with application to a reliable and sustainable energy future; Professors **François Morel** and **Peter R. Jaffe** and Research Scholar **Anne Morel-Kraepiel** are examining a new method for assessing the role of metals as fertilizers for nitrogen fixation in terrestrial ecosystems; and Professors **Daniel Steingart** and **Bruce Koel** are investigating in-situ high-resolution studies of the solid electrolyte interphase layer in batteries. Abstracts and more information about the faculty teams are available on our website at http://acee.princeton.edu/funding_entry/andlinger-innovation-fund/.

research
(cont'd.)

highlight seminar series

February 11, 2013
Maureen McCann
Purdue University
*A Roadmap for Selective
Deconstruction of Lignocellulosic
Biomass to Advanced Biofuels
and Useful Co-Products*

February 25, 2013
Frank Wolak
Stanford University
*Using Economics to Increase the
Intelligence of the Smart Grid*

March 4, 2013
Richard Kauffman
Chair of Energy and Finance
State of New York
*After Solyndra: Financing
Obstacles
to Clean Energy and Some
Policy Recommendations*

April 15, 2013
Arumugam Manthiram
University of Texas-Austin
*Challenges and Opportunities
of Electrical Energy Storage
Technology*

April 29, 2013
Mark W. Verbrugge
General Motors
*Electrified Vehicles for Personal
Transportation, the Role of
Surface Coatings, and the
Use of Thin Films for Electrode
Characterization*

seed funding (cont'd.)

The Peter B. Lewis Fund for Student Innovation supports summer internships for undergraduates. Recipients perform research on campus for a minimum of eight weeks under the guidance of faculty advisors and received stipends and funds for research expenses. In the summers of 2012 and 2013, 12 students received more than \$100,000 in stipends and funds for materials and supplies. The students come from departments within and beyond the School of Engineering and Applied Science and their research projects span a range of topics, including energy consumption in a campus building, slippery liquid-infused porous surfaces as lubricants to improve energy efficiency, the mechanical behavior of lithium-ion batteries, interactions between lithiated graphite and the residual gases present in nuclear fusion reactors, and the pyridinium ion's catalytic role in carbon dioxide reduction. More information about these innovative student projects is available on the center's website at http://acee.princeton.edu/funding_entry/lewis2012. In 2012-2013, the Lewis Fund also supported students who sought greater knowledge and understanding of the world of energy finance and clean energy entrepreneurship through fieldwork and attendance at industry events.

The inaugural **Maeder Graduate Fellowship in Energy and the Environment**, funded by the Paul A. Maeder '75 Fund for Innovation in Energy and the Environment, supported Josephine Elia in 2012-2013. Elia is in the Department of Chemical and Biological Engineering and spent the year continuing her research on supply chains for transportation fuels. During the spring a committee selected the 2013-2014 Maeder recipient from a competitive pool of applications. **Warren Rieutort-Louis**, a graduate student in the Department of Electrical Engineering, received the fellowship, which will cover his tuition and stipend for the 2014 academic year. Rieutort-Louis' work is on solar-powered, mechanically-flexible electronic skins based on thin films of semiconducting materials that can cover large surfaces. Information about the fellowship and these recipients can be found at http://acee.princeton.edu/funding_entry/maeder-fund/.

An **anonymous** research gift administered as a term fund continues to provide three years of support to three faculty projects currently underway. The projects and their faculty teams are:

New Advances in Urban Air Quality Monitoring: A China-Princeton Collaboration
Professors **Claire Gmachl**, **Gerard Wysocki**, and **Mark Zondlo**

Harvesting Sunlight for Electricity and Fuels
Professors **Craig Arnold**, **Emily Carter**, **Bruce Koel**, **Yueh-Lin (Lynn) Loo**, and **Sigurd Wagner**

Water in China
Professors **Elie Bou-Zeid**, **Ignacio Rodriguez-Iturbe**, and **James Smith**

research
(cont'd.)

**return on investment
since inception in 2011**

Total amount awarded: \$1.9 million

Projects supported: 20 faculty,
17 students, and 2 graduate fellowships

Derivative funding: More than \$2 million

Journal publications: 13

Journal submissions pending: 7

Conference presentations: 10

Patent disclosures and applications: 2

return on investment

One way the Andlinger Center tracks the results of its efforts is to monitor the impact that seed funding has on future research activities. While not an inclusive list, the results described below have been aggregated from submissions supplied from our award recipients since the start of our annual seed funding and student research programs. These funds are awarded to Princeton faculty, students, and researchers, and we poll them annually about ways in which funds provided by the Andlinger Center resulted in projects, awards, publications, patent activity, post-graduate student activities, and collaborations.

Many of the awardees are continuing their research in spin-off projects, some with external funding. Andlinger funds have inspired proposals that have been funded by the Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E), the National Science Foundation, Hopewell Wind, the Princeton University Cooperative Institute for Climate Science, the University's Princeton Environmental Institute Grand Challenges Program, and the World Bank STEP B Project.

Researchers have submitted papers to or have been published in the *AICHE Journal*, *American Geophysical Union*, *Computers & Chemical Engineering*, *Energies*, *Energy & Environmental Science*, *Energy & Fuels*, *Environmental Science: Processes and Impacts*, *Industrial & Engineering Chemistry Research*, *Journal of Display Technology*, *Journal of Nanoparticle Research*, *Journal of Physical Chemistry*, and *Physical Chemistry Chemical Physics*. Others have presented at conferences ranging from the *North American Catalysis Society Meeting*, the *American Chemical Society National Meeting & Exposition*, the *Materials Research Society Spring Meeting*, *IFIP Conference on Sustainable Internet and ICT for Sustainability*, and the *International Conference on Emerging Networking Experiments and Technologies*, to the *American Geophysical Union's Fall Meeting*, *American Institute of Aeronautics and Astronautics Applied Aerodynamics Conference*, *American Physical Society Division of Fluid Dynamics Conference*, *The Catalysis Society of Metropolitan New York*, *Princeton Energy and Environment Corporate Affiliates Program Meeting*, and *Princeton's 2012 Summer of Learning Symposium*.

While many students and postdoctoral researchers supported by seed funds are still at Princeton, some have gone on to do post-graduate work and take positions in industry and academia. Undergraduates have been accepted to UC Berkeley (M.S./Ph.D. in mechanical engineering), Northeastern University (Ph.D. in material science), the New Hope School (working in the Korean Student Summer Program), and Imperial College London and the University of Cambridge (Marshall Fellowship); graduate students and postdoctoral researchers have secured positions at Lockheed Martin, Samsung Electronics, and as an assistant professor in the School of Sustainable Engineering and the Built Environment at Arizona State University.

Collaboration is a trademark of many of the Andlinger seed funding opportunities. Indeed, researchers have reported partnerships with IBM, the International Institute for Advanced Systems Analysis (IIASA), Lockheed Martin, National Institute for Standards and Technology (NIST), Norwegian Technical University, Peking University, Tsinghua University, Université Libre de Belgique, and the University of Massachusetts at Dartmouth. Many new inter-departmental and interdisciplinary collaborations within Princeton pair faculty and graduate students among the School of Architecture, the School of Engineering and Applied Science, and the Woodrow Wilson School.



Yueh-Lin (Lynn) Loo

Princeton E-affiliates Partnership aims to enhance collaboration and promote technology transfer between Princeton University and its corporate partners to address global energy needs and environmental concerns. The program is led by Professor **Yueh-Lin (Lynn) Loo**, the Andlinger Center's Associate Director for External Partnerships. In December 2012, **Robin Hauer** joined the program as assistant director to manage its day-to-day activities. Archewild is the most recent member, joining E.I. du Pont de Nemours and Company, Lockheed Martin Corporation, and PSEG, Inc.



Robin Hauer

The E-affiliates inaugural annual meeting was held on November 12-13, 2012. Michel Di Capua, head of U.S. Analysis at Bloomberg New Energy Finance, was the keynote speaker; he analyzed markets for alternative energy technologies before an audience of over 150 people. The annual meeting included faculty talks by Professors **Andrew Bocarsly**, **Stephen Pacala**, and **Warren Powell**; a presentation by **Tod Williams** '65 MFA '67, principal of Tod Williams Billie Tsien Architects, the designers of the new Andlinger Center building; and panel discussions on small modular nuclear reactors and on methane emissions from hydraulic fracturing. A poster session that featured more than 50 students and post-doctoral researchers was another highlight and allowed for extensive interaction among industrial and academic attendees. Planning for the E-affiliates second annual meeting on November 15, 2013 began in spring 2013.

The E-affiliates inaugural request for research proposals in 2012 resulted in two funded projects, each eligible to receive up to \$150,000. The first, led by **Christodoulos Floudas**, Stephen C. Macaleer '63 Professor in Engineering and Applied Science, investigates methods for turning common household garbage into standard liquid fuels such as gasoline, kerosene, and diesel. The team includes researchers from Lockheed Martin Corporation, an E-affiliates partner. The other project is led by **George Scherer**, William L. Knapp '47 Professor of Civil and Environmental Engineering, and investigates measures to lower carbon emissions from concrete manufacturing by using more stone and less cement.

Princeton E-affiliates Partnership hosted a roundtable to examine the valuation of distributed energy on April 26, 2013. PSEG's 2012-2013 Visiting Research Scholar, **Anne Hoskins** MPA '86, moderated the roundtable with a faculty member from Columbia University. The 31 participants included the chairman of the Federal Energy Regulatory Commission; senior administrators at the U.S. Department of Energy; the heads of the public utility boards of Connecticut, New Jersey, and New York; the chief executives of two major public utilities; the CEO of a regional transmission organization; the CEO of a competitive solar energy company; the founder of an energy efficiency company; the presidents of solar industry advocacy groups, consumer and environmental advocacy groups and industry consulting groups; as well as faculty experts from Princeton and Columbia Universities. A report that distilled the discussion was produced, (available online at <http://acee.princeton.edu/e-affiliates/>). Numerous requests from national and international organizations for advice about replicating the roundtable underscore the success of the event.

The E-affiliates Advisory Committee convened twice to determine project funding, draft the 2013 Request for Proposals, plan the next annual meeting, and identify strategies for growth of the program.

The Princeton Energy and Environment Corporate Affiliates Program is now known as the Princeton E-affiliates Partnership. Branding, including a logo, was developed to better represent the program's mission and goals in our efforts to grow the program's visibility. The project was undertaken in collaboration with Princeton University's Office of Communications and the Office of Print and Mail Services.

facilities

building facts

- 129,000 gross square feet
- Designed by Tod Williams Billie Tsien Architects
- Designed to LEED silver standards
- Space for cleanroom, imaging & analysis, and research laboratories
- 200-seat lecture hall, meeting rooms, classrooms
- Faculty, visitor, postdoc, and student space
- Administrative offices and facilities support

building milestones

- Began Construction - February 2012
- Began Tower Construction - February 2013
- Completed Foundations - September 2013
- Complete Structural Steel - October 2013
- Complete Exterior Envelope - June 2014

building

While the center continues to hire faculty and they are granted office and laboratory space in their home departments, the center is planning for the occupancy of the new building at the corner of Olden and Prospect Streets, extending the School of Engineering and Applied Science. The 129,000 gross square foot, state-of-the-art facility was designed by Tod Williams Billie Tsien Architects of New York. **Tod Williams** is a 1965 and 1967 graduate of Princeton's School of Architecture. The building will provide laboratory, classroom, meeting, and office spaces. It began to emerge from below grade during 2012-2013, rising first with concrete stair towers and followed by steel structures that show the shape of the footprint and elevations. Occupancy is on target for spring 2015.

The State of New Jersey's Higher Education Capital Financing Grant Program awarded Princeton \$3.2 million to support the fit-out expenses of an experimental laboratory space and sections of the future micro-nanofabrication lab and imaging center.



facilities



equipment

New tools were purchased in 2012-2013 with gifts made specifically for that purpose, including a UV-vis-NIR spectrophotometer, a spectroscopic ellipsometer, a tunable laser system, a plasma-enhanced atomic layer deposition system, and a metal oxide sputtering system. These tools are currently housed in existing faculty laboratories and will be incorporated into the new building.

The UV-vis-NIR spectrophotometer extends our present capabilities of probing the optical properties of solutions and thin films to near-infrared wavelengths. It is often used in the characterization of electrically and optically active materials and provides a measure of the materials' band gap.

The spectroscopic ellipsometer is engineered to meet the diverse demands of thin film characterization. It offers advanced optical design, wide spectral range, and fast data acquisition. It is currently located in the shared-use Imaging and Analysis Center and is used as part of the Materials Science and Engineering Certificate curriculum.

The tunable laser system consists of a nanosecond OPO laser and a picosecond DPSS laser. This unique system provides the broadest range of wavelength and pulse duration tunability to accommodate the potential needs of different users. It is used in a number of photovoltaic and organic electronics experiments, including the fabrication of transparent conductive oxides and the pulsed laser deposition of bulk heterojunction materials.

The plasma-enhanced atomic layer deposition and sputtering systems were purchased to build advanced research capability in making and employing metal oxide films. Metal oxides are important in a wide range of applications in the generation, transmission, and use of energy.

In the spring of 2013, the Andlinger Center received a commitment from the University's Provost, Christopher Eisgruber, that will enable the center to add, refurbish, or replace tools in the equipment inventory available to faculty, researchers, and students. This new equipment will augment the current inventory in the Princeton Institute for the Science and Technology of Materials (PRISM) facilities and the new Andlinger facilities and will support the cutting-edge research in energy and the environment that is a foundation of our mission. Faculty committees continue to refine prioritized lists of equipment in close collaboration with the PRISM technical staff to ensure that the new building will be outfitted with core research equipment at occupancy and will continue to be expanded in the coming years.

leadership



Andlinger Center

Professor Emily A. Carter
Founding Director

Professor Peter R. Jaffe
Associate Director for Research

Professor Niraj Jha
Associate Director for Education

Professor Yueh-Lin (Lynn) Loo
Associate Director for External Partnerships

Laura E. Strickler
Associate Director for Administration

Robin Hauer
Assistant Director, Princeton E-filiates Partnership

Brenda Mikeo
Business and Communications Manager

Robert Eich
Program and Financial Assistant

Maira Selinka
Administrative Assistant

Advisory Council

A. Paul Alivisatos
Laboratory Director
Lawrence Berkeley National Laboratory

Dwight W. Anderson '89
Principal, Ospraie Management, LLC

Gerhard R. Andlinger '52 P80 P91
Chairman of the Board, Andlinger & Company, Inc.

Merrick G. Andlinger '80
President, Andlinger & Company, Inc.

Yet-Ming Chiang
Kyocera Professor of Ceramics,
Massachusetts Institute of Technology

David W. Crane '81 S86
President and Chief Executive Officer
NRG Energy, Inc.

Francis J. DiSalvo
Director, David R. Atkinson Center for a Sustainable
Future, Cornell University

David Eaglesham
Chief Executive Officer, Pellion Technologies

Ralph Izzo
Chairman, President and CEO, PSEG

Paul A. Maeder '75
Managing General Partner & Founder
Highland Capital Partners

Gregory H. Olsen
President, GHO Ventures, LLC

Mark F. Rockefeller '89
Chief Executive Officer and Founder
Rockefeller Consulting/Insight Capitalists

Timothy Sands
Executive Vice President for Academic Affairs and
Provost, Purdue University

leadership



Executive Committee

Rene A. Carmona

Paul M. Wythes '55 Professor of Engineering and Finance
Professor of Operations Research and Financial Engineering.

Emily A. Carter

Gerhard R. Andlinger Professor in Energy and the Environment
Professor of Mechanical and Aerospace Engineering and Applied and Computational Mathematics
Founding Director, Andlinger Center for Energy and the Environment

Paul J. Chirik

Edward S. Sanford Professor of Chemistry

Christopher F. Chyba

Professor of Astrophysical Sciences and International Affairs, Woodrow Wilson School
Director, Program on Science and Global Security

Peter R. Jaffe

Professor of Civil and Environmental Engineering
Associate Director for Research, Andlinger Center for Energy and the Environment

Niraj Jha

Professor of Electrical Engineering
Associate Director for Education, Andlinger Center for Energy and the Environment

Yueh-Lin (Lynn) Loo

Theodora D. '78 and William H. Walton III '74
Professor in Engineering
Professor of Chemical and Biological Engineering
Associate Director for External Partnerships, Andlinger Center for Energy and the Environment

Guy J. Nordenson

Professor of Architecture and Structural Engineering

Stephen W. Pacala

Frederick D. Petrie Professor in Ecology and Evolutionary Biology
Director, Princeton Environmental Institute

Stewart C. Prager

Professor of Astrophysical Sciences
Director, Princeton Plasma Physics Laboratory

Barry Rand

Assistant Professor of Electrical Engineering and the Andlinger Center for Energy and the Environment

James A. Smith

Professor of Civil and Environmental Engineering
Chair, Department of Civil and Environmental Engineering
Director, Program in Geological Engineering

Daniel Steingart

Assistant Professor of Mechanical and Aerospace Engineering and the Andlinger Center for Energy and the Environment

Claire White

Assistant Professor of Civil and Environmental Engineering and the Andlinger Center for Energy and the Environment

associated faculty



Craig B. Arnold

Professor of Mechanical and Aerospace Engineering
Associate Academic Director, Princeton Institute
for Science and Technology of Materials
Director, Materials Science and Engineering
Certificate Program

Michael A. Celia

Theodora Shelton Pitney Professor of
Environmental Studies
Professor of Civil and Environmental Engineering

Pablo G. Debenedetti

Class of 1950 Professor in Engineering and
Applied Science
Professor of Chemical and Biological Engineering
Dean for Research

Claire Gmachl

Eugene Higgins Professor of Electrical Engineering
Vice Dean, School of Engineering and Applied
Science

Yiguang Ju

Robert Porter Patterson Professor of Mechanical
and Aerospace Engineering
Director, Program in Sustainable Energy

Chung (Ed) Law

Robert H. Goddard Professor of Mechanical and
Aerospace Engineering

A. James Link

Associate Professor of Chemical and
Biological Engineering

Denise L. Mauzerall

Professor of Civil and Environmental Engineering
and Public and International Affairs
Acting Director, Center for Science, Technology
and Environmental Policy

H. Vincent Poor

Michael Henry Strater University Professor of
Electrical Engineering
Dean, School of Engineering and Applied Science

Richard A. Register

Eugene Higgins Professor of Chemical and
Biological Engineering
Chair, Department of Chemical and Biological
Engineering

Ignacio Rodriguez-Iturbe

James S. McDonnell Distinguished University
Professor of Civil and Environmental Engineering

Jorge L. Sarmiento

George J. Magee Professor of Geosciences
and Geological Engineering
Professor of Geosciences
Director, Program in Atmospheric and
Oceanic Sciences

James C. Sturm

William and Edna Macaleer Professor of Engineering
and Applied Science
Professor of Electrical Engineering
Director, Princeton Institute for the Science and
Technology of Materials

Sigurd Wagner

Professor of Electrical Engineering

Associated Faculty are elected by the Executive Committee
based on their significant service contributions to the
Andlinger Center. All members of the Executive Committee
are named Associated Faculty.

supporters

The Andlinger Center for Energy and the Environment is grateful to the following supporters whose gifts help to realize the vision of the center. (Those with an asterisk are new or renewed in 2012-2013).



Gerhard R. Andlinger '52 Founding Gift

Lydia and William M. Addy '82 P14 to establish the *Addy/ISN North American Low Carbon Emission Energy Self-Sufficiency Fund* to support innovative research, equipment, policy development, and teaching

Dwight Anderson '89 to establish the *Anderson Family Professorship in Energy and the Environment*

Anonymous gifts for construction of the Andlinger Center building

Anonymous gift for environmental policy research*

Anonymous gift for equipment

Anonymous gift for the highest priorities of the center, including research, equipment, and a visitors program*

Anonymous gift for research

Anonymous gift to establish the *Parallax Fund for Energy and the Environment* to support faculty and student research

Anonymous gift to establish the *Peter B. Lewis Fund for Student Innovation in Energy and the Environment* to support student projects, particularly field work and laboratory research

Anonymous gift to establish the *Sustainability Fund* to support student research*

Anonymous to establish the *Class of 1983 Fund for Energy and the Environment*

John E. Bartlett '03 to establish the *Dede T. Bartlett P03 Fund for Student Research in Energy and the Environment*

Peter Bartlett '77 and **Erin P. Bartlett P09, P10, P14** for discretionary spending

John E. Cross '72 and **Molly Tiffany Cross** for discretionary spending

Nancy A. Curtin '79 and **John Stafford** to establish the *Nancy A. Curtin '79 and John Stafford Research Innovation Fund*

John O. Dabiri '01 to fund the *John O. Dabiri '01 Family Fund for Excellence in Energy and Environmental Research*

Charlene de Carvalho-Heineken P09 P14 to establish the *de Carvalho-Heineken Family Fund for Environmental Studies* to support faculty and student research

John P. Drzik '83 and **Ann L. Thorsell '83** to establish the *John Drzik and Ann Thorsell Fund for Innovation*

High Meadows Foundation to establish the *Andlinger Center for Energy and the Environment Director's Fund**

Kerry and William F. Holekamp P14 to support equipment purchases

Peter C. Klosowicz '76 to establish the *Peter C. Klosowicz '76 Fund for Energy and the Environment* to support research and teaching*

Paul A. Maeder '75 to establish the *Paul A. Maeder '75 Fund for Innovation in Energy and the Environment* to support a graduate fellowship

Jay P. Mandelbaum '84 P17 to establish the *Laurie and Jay P. Mandelbaum '84 Fund for Energy and the Environment*

Lisa Lee Morgan '76 M.Arch. '79 to support research in renewable energy*

Nicholas G. Nomicos '84 and **Kathleen Connor Nomicos '84** to establish the *Nicholas and Kathleen Nomicos Class of 1984 Fund for the Andlinger Center for Energy and the Environment* to advance public understanding of important issues related to energy and the environment*

Mark F. Rockefeller '89 to establish the *Renee and Mark F. Rockefeller '89 Fund for the Environment* to support faculty and student research

Ernest H. Ruehl, Jr. '85 to establish the *Ruehl Family Fund for the Environment* to support faculty and student research

Mr. and Mrs. Elchin A. Safarov P15 for discretionary spending*

Kent C. Simons '57 to establish the *David P. Simons Fund for Energy and the Environment*

research directory

The Andlinger Center's online research directory (<http://acee.princeton.edu/research/>) lists Princeton faculty whose research portfolios include energy or energy-related environmental issues. It continues to grow with more than 100 entries as of July 2013.

in 2012-2013, the faculty represented in the research directory had a combined total of

- 19 invention disclosures
- 24 patent applications
- 4 patents
- 2 licenses

The faculty members in the research directory, as of this report date, represent the following schools, departments, programs, and centers:

- School of Architecture
- School of Engineering and Applied Science
- Woodrow Wilson School of Public and International Affairs
- Department of Astrophysical Sciences
- Department of Chemical and Biological Engineering
- Department of Chemistry
- Department of Civil and Environmental Engineering
- Department of Computer Science
- Department of Ecology and Evolutionary Biology
- Department of Economics
- Department of Electrical Engineering
- Department of Geosciences
- Department of Mechanical and Aerospace Engineering
- Department of Near Eastern Studies
- Department of Operations Research and Financial Engineering
- Department of Physics
- Department of Politics
- Department of Psychology
- Department of Sociology

- The Andlinger Center for Energy and the Environment
- The Center of Architecture, Infrastructure and Urbanism
- Geophysical Fluid Dynamics Laboratory
- The Institute for the Transregional Study of the Contemporary Middle East, North Africa and Central Asia
- Lewis-Sigler Institute for Integrative Genomics
- Princeton Center for Complex Materials
- Princeton Environmental Institute
- Princeton Institute for the Science and Technology of Materials
- University Center for Human Values
- The Program in Applied and Computational Mathematics
- The Program in Architecture and Engineering
- The Program in Atmospheric and Oceanic Sciences
- The Program in Engineering and Management Systems
- The Program in Engineering Physics
- The Program in Environmental Engineering and Water Resources
- The Program in Environmental Studies
- The Program in Geological Engineering
- The Program in Planets and Life
- The Program in Plasma Physics
- The Program in Population Studies
- The Program in Sustainable Energy
- The Program in Urban Studies

in the news



Faculty associated with the Andlinger Center are often cited in local, national, and international news publications or have their research highlighted in journals and scientific publications. In 2012-2013, 46 faculty listed in the research directory were referenced more than 150 times in sources such as *The Huffington Post*, *NPR*, *The New York Times*, *The Wall Street Journal*, and *The Washington Post*. A few that represent the range of sources and topics are:

Professor **Christodoulos Floudas** discussed how “Synthetic fuels could eliminate entire U.S. need for crude oil” in *R&D Magazine* (<http://www.rdmag.com/news/2012/11/synthetic-fuels-could-eliminate-entire-us-need-crude-oil>).

Professors **Ning Lin** and **Michael Oppenheimer** quoted in an *Atlantic* article “In All Probability: Climate Change and the Risk of More Storms Like Sandy” (<http://www.theatlantic.com/technology/archive/2012/11/in-all-probability-climate-change-and-the-risk-of-more-storms-like-sandy/265402/>).

Director of the Princeton Plasma Physics Lab and Professor **Stewart Prager** wrote as an Op-Ed contributor on “The Way Forward with Magnetic Fusion Energy” (http://dotearth.blogs.nytimes.com/2012/11/19/in-defense-of-sustained-research-on-fusion/?_r=0).

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