Beyond Science:

The Economics and Politics of Responding to Climate Change

The conference will bring together leaders committed to educating the public about the impact of global warming and discuss their experiences in crafting public policy in this area. In particular, we will focus on such issues as the economics of climate change, the costs and benefits of mitigation strategies, the role of emerging technologies, and the politics of international, national and subnational response strategies.

Saturday, February 9, 2008

The James A. Baker III Institute for Public Policy

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Beyond Science:

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About the Conference

The James A. Baker III Institute for Public Policy, the Energy & Environmental Systems Institute and the Shell Center for Sustainability at Rice University are co-sponsoring a climate change, politics and economics conference on Feb. 9, 2008. The conference will bring together leaders committed to educating the public about the impact of global warming and discuss their experiences in crafting public policy in this area. In particular, we will focus on such issues as the economics of climate change, the costs and benefits of mitigation strategies, the role of emerging technologies, and the politics of international, national and subnational response strategies. Support for this event was generously provided by the UK Science and Innovation Section, British Consulate-General Houston.

Organizing Partners

The James A. Baker III Institute for Public Policy

The mission of the Baker Institute is to help bridge the gap between the theory and practice of public policy by drawing together experts from academia, government, media, business and nongovernmental organizations. By involving policymakers and scholars, as well as students (tomorrow's policymakers and scholars), the institute seeks to improve the debate on selected public policy issues and to make a difference in the formulation, implementation and evaluation of public policy, both domestic and international. The Baker Institute is an integral part of Rice University, one of the nation's most distinguished institutions of higher education. The efforts of Baker Institute fellows and affiliated Rice faculty focus on several ongoing research projects, details of which can be found on the institute's Web site, http://bakerinstitute.org.

The Science and Technology Policy Program

The mission of the Science and Technology Policy Program is to provide a space for policymakers and scientists to engage in substantive dialogue. Through this program the Baker Institute sponsors a series of workshops, lectures, research projects and conferences designed to address a broad range of policy issues that affect scientists and their research as well as the application of science for the public good. Issues addressed by the program include space, health and medicine, energy and the environment, national and domestic security, science education, and the federal government's support of science and technology. The program is run by Dr. Neal Lane, senior fellow in science and technology policy, and Dr. Kirstin Matthews, science and technology program manager. Details and descriptions of the projects can be found on the program Web site at http://science.bakerinstitute.org.

The Baker Institute Energy Forum

Located in Houston, Texas, the energy capital of the world, the James A. Baker III Institute for Public Policy has created a multifaceted program designed to promote original, forward-looking discussion and research on the energy-related challenges facing our society in the 21st century. The mission of the Energy Forum is to shed light on important trends — both regional and global — that shape the nature of global energy markets and influence the quantity and security of vital supplies needed to fuel world economic growth and prosperity. The choice of the word "forum" is deliberate. It reflects the group's goal to serve as a focal point for the exchange of ideas on how to improve understanding of the complex political, cultural, religious, economic and social forces that influence open access to energy resources and their equitable distribution.

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The Health Economics Program

Established in 2000, the Baker Institute's Health Economics Program is located in Baker Hall on the campus of Rice University. The Baker Institute is across the street from the Texas Medical Center (TMC), the nation's largest medical complex. Drawing on the expertise of both Rice University and TMC, the Health Economics Program examines health economics, health services research, sociology, global health, public policy and outcomes research. The mission of the program is to study the ways in which economic incentives and government policies influence the quality and costs of health care on both a national and regional basis, focusing on the need to deliver high-quality medical care while controlling expenditures. In recent years, the program has received national acclaim for its research on state regulation of cardiac surgery, as well as for its analysis of regional imbalances in the supply of specialists. Its work has been supported by the National Institutes of Health, the American Cancer Society and other nonprofit organizations.

Rice University Partners

The Energy & Environmental Systems Institute

The Energy & Evironmental Systems Institute (EESI) brings together faculty and students spanning all of Rice's academic divisions in programs of research, education and community service that promote the guardianship of environmental quality and natural resources. The institute fosters partnerships between academia, business, governments, nongovernment agencies and community groups to help meet society's needs for sustainable energy, environmental protection, economic development and public health and safety. EESI activities span Rice University's schools of social sciences, engineering, natural sciences, humanities, architecture and management.

The Shell Center for Sustainability

The Shell Center for Sustainability supports faculty research in a broad area of sustainable development with special emphasis on the Houston area and in the state of Texas. We support the creation of interdisciplinary programs, outreach and education to address actions to ensure the sustainable development of living standards measured broadly to encompass all factors affecting quality of life, including environmental resources. Our work joins the School of Social Sciences with researchers in engineering, natural sciences, architecture, humanities and management within the Rice University community and with other institutions and partners. To date, our efforts have fostered nascent research that has grown into greater work benefiting Houston and reaching as far as China.

Acknowledgements

The Baker Institute would like to thank the following organization for its generous support for this conference and related policy studies:

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Conference Agenda

Welcoming Remarks

8:00am **The Honorable Edward P. Djerejian**
Founding Director, James A. Baker III Institute for Public Policy, Rice University

Keynote Address

8:15 am The Road from Bali: The Future of American Policy on Global Climate Change
The Honorable John Kerry
United States Senator from Massachusetts

Opening Addresses

8:50 am Introduction
Neal F. Lane, Ph.D.
Senior Fellow in Science and Technology Policy, James A. Baker III Institute for Public Policy, and Malcolm Gillis University Professor, Rice University

Address: International Panel on Climate Change 2007 Report and Climate Change Modeling
Timothy L. Killeen, Ph.D.
Director, National Center for Atmospheric Research

Discussion: Confronting Climate Change: The Sigma Xi/UN Foundation Report
Rosina M. Bierbaum, Ph.D.
Dean and Professor, School of Natural Resources and Environment, University of Michigan
John P. Holdren, Ph.D.
Teresa and John Heinz Professor of Environmental Policy, Kennedy School of Government, Harvard University, and Director, Woods Hole Research Center

Break

Morning Addresses: Policy Approaches to Limit Carbon

Moderator: Amy Myers Jaffe, Wallace S. Wilson Fellow in Energy Studies, James A. Baker III Institute for Public Policy, Rice University

10:25 am The California Model for Combating Climate Change
Daniel Sperling, Ph.D.
Professor of Civil Engineering and Environmental Science and Policy and
Founding Director, Institute for Transportation Studies, University of California, Davis

Cap and Trade Systems: The European Experience
Milo Sjardin
Head, New Carbon Finance, North America

A Carbon Tax Swap: An Equitable Tax Reform to Address Global Climate Change
Gilbert E. Metcalf, Ph.D.
Professor of Economics, Tufts University

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Lunch Keynote

12:00 pm

Introduction
Paul Lynch
HM Consul-General, British Consulate-General Houston
Neal F. Lane, Ph.D.
Senior Fellow in Science and Technology Policy, James A. Baker III Institute for Public Policy, and Malcolm Gillis University Professor, Rice University

A Corporate View of Greenhouse Gas Policies
Steven E. Koonin, Ph.D.
Group Chief Scientist, BP p.l.c.

Afternoon Session I – Economic Issues of Climate Change Policy

Moderator: S. Malcolm Gillis, Ph.D., University Professor, Ervin K. Zingler Professor of Economics and former President, Rice University

1:30 pm

The Economic Impact of Climate Change: The Stern Report
Dimitri Zenghelis
Head, Stern Review Team, Office of Climate Change, HM Treasury

Economic Costs of Climate Change
John P. Weyant, Ph.D.
Professor of Management Science and Engineering and Director, Energy Modeling Forum, Stanford University

Reducing U.S. Greenhouse Gas Emissions: At What Cost?
Scott S. Nyquist
Director, McKinsey & Company

Global Climate Change Policy and Energy Security: Two Sides of the Same Coin?
Peter Hartley, Ph.D.
Baker Institute Rice Scholar, George and Cynthia Mitchell Chair and Professor of Economics, and Academic Director, Shell Center for Sustainability, Rice University

Considering Risk and Uncertainty in Designing Climate Change Policy
Mort Webster, Ph.D.
Visiting Assistant Professor, Massachusetts Institute of Technology (MIT)

Break

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Afternoon Session II – Options for Dealing with Climate Change: Costs and Benefits
Moderator: Robert Harriss, Ph.D., President and CEO, Houston Advanced Research Center

4:00 pm

Energy Technology and Greenhouse Gas Emissions Mitigation
James A. Edmonds, Ph.D.
Laboratory Fellow and Chief Scientist, Joint Global Change Research Institute, Pacific Northwest National Laboratory

Coal in a Carbon-Constrained World
Ernest J. Moniz, Ph.D.
Cecil and Ida Green Professor of Physics and Engineering Systems and Director, MIT Energy Initiative, Massachusetts Institute of Technology (MIT)

The Solar Grand Plan
Ken Zweibel
President, PrimeStar Solar

The Dimensions of the Prize: Leverage Technology to Achieve Sustainable Emissions
Cal Cooper, Ph.D.
Science Fellow, ConocoPhillips Technology

Closing Comments

6:00 pm

Introduction
Emil Peña
Executive Director, Energy and Environmental Systems Institute (EESI), Rice University

Gaining Traction Beyond the Science of Climate Change
Eric J. Barron, Ph.D.
Dean, Jackson School of Geosciences, The University of Texas at Austin

Reception
Courtesy of UK Science and Innovation Section, British Consulate-General Houston

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Speaker Biographies

Eric J. Barron, Ph.D., who has served as dean of the Jackson School of Geosciences at The University of Texas at Austin since 2006, began a career in geology as an undergraduate at Florida State University. He earned a master's degree (1976) and a doctorate (1980) in oceanography from the University of Miami. His career turned to climate studies in 1976 with a Cray Supercomputing Fellowship from the National Center for Atmospheric Research (NCAR). Barron then joined NCAR as a postdoctoral research fellow and later became a research scientist in the global climate modeling group. In 1985, he returned to the University of Miami as associate professor. Barron went to Pennsylvania State University in 1986 to direct the College of Earth and Mineral Sciences' newly formed Earth System Science Center (ESSC). Under Barron's leadership, the growth of ESSC resulted in the establishment of the College of Earth and Mineral Sciences' Environment Institute, which included ESSC and a group of other research centers. Barron became the director of this new institute in 1998. He earned the title of distinguished professor in 1999. In 2002, he was named dean of the College of Earth and Mineral Sciences at Penn State. Barron's research interests are in the areas of climatology, numerical modeling and Earth history.

Rosina M. Bierbaum, Ph.D., became dean of the School of Natural Resources and Environment (SNRE) at the University of Michigan in October 2001. Previously, Bierbaum served in environmental science policy leadership positions in both the legislative and executive branches of government, culminating in her post as director of the Environment Division of the White House Office of Science and Technology Policy, a Senate-confirmed position. In that role, she served as the administration's senior scientific advisor on a wide range of national and international environmental issues, including air and water quality, endangered species, biodiversity, ecosystem management, endocrine disruptors, global change, and energy research and development. She led four U.S. delegations to the Intergovernmental Panel on Climate Change. Bierbaum has been elected a fellow of the American Academy of Arts and Sciences and the American Association for the Advancement of Science. Among other awards, she has received the Waldo E. Smith Medal from the American Geophysical Union in recognition of extraordinary service to geophysics and the Climate Protection Award from the U.S. Environmental Protection Agency. Bierbaum received her Bachelor of Science in biology and Bachelor of Arts in English from Boston College, and earned her doctorate in ecology and evolution at the State University of New York, Stony Brook.

Cal Cooper, Ph.D., is a science fellow at ConocoPhillips Technology in Houston where his current focus is leading efforts in carbon capture and storage. He serves on the executive boards of the CO_2 Capture Project (CCP2), the Australian CO_2 Cooperative Research Centre (CO2CRC), and the EU CO_2 Research Monitoring Verification Program (CO2ReMoVe), in addition to various advisory panels of the U.S. Department of Energy, the International Energy Agency and the Society of Petroleum Engineers. His leadership roles in ConocoPhillips have included chief geologist of upstream technology and managing several geosciences organizations. Besides greenhouse gas control, Cooper's research spans from hydrocarbon exploration and basin analysis to folded belts, tectonics, mud volcanoes and seismic processing algorithms. Cooper received a doctorate in geology and geophysics from Rice University, a Master of Science in geology from the State University of New York, Albany, and he earned his undergraduate degree in geophysical sciences at the University of Chicago.

The Honorable Edward P. Djerejian is the founding director of the James A. Baker III Institute for Public Policy. He served both President George H.W. Bush and President William J. Clinton as assistant secretary of state for Near Eastern Affairs and Presidents Reagan and Bush as U.S. ambassador to Syria. He served President Clinton as U.S. ambassador to Israel before completing his foreign service career in 1994. He also served President Reagan as special assistant and deputy press secretary for foreign affairs. He has been awarded the Presidential Dis-

tinguished Service Award, the Department of State's Distinguished Honor Award, and numerous other honors including the Ellis Island Medal of Honor and the Anti-Defamation League's Moral Statesman Award.

James A. Edmonds, Ph.D., is laboratory fellow and chief scientist at the Pacific Northwest National Laboratory's (PNNL) Joint Global Change Research Institute, and adjunct professor of public policy at the University of Maryland at College Park. Edmonds is the principal investigator for the Global Energy Technology Strategy Program to Address Climate Change, an international, public-private research collaboration. His research — in the areas of long-term, global energy economy and climate change — spans three decades, during which time he published several books, numerous scientific papers and made countless presentations. His most recent book, "Global Energy Technology Strategy, Addressing Climate Change," distills more than a decade of research on the role of technology in addressing climate change. Edmonds has served in the capacity of lead author on every major intergovernmental panel on climate change (IPCC) assessment to date and presently serves on the IPCC Steering Committee on New Integrated Scenarios. He serves on numerous panels and advisory boards related to energy, technology, the economy and climate change. He received his doctorate in the field of economics from Duke University in 1975.

S. Malcolm Gillis, Ph.D., was president of Rice University from 1993 to 2004. He is now University Professor and the Ervin K. Zingler Professor of Economics at Rice University. He spent the first 25 years of his professional life teaching economics and bringing economic analysis to bear on important issues of public policy in nearly 20 countries, ranging from the United States and Canada to Ecuador, Colombia, Ghana and Indonesia. From 1986 to 2004, his career was devoted primarily but not exclusively to university leadership. During that period, he continued to publish in his scholarly specialties. Professor Gillis' research and teaching activities fall into two broad categories: fiscal economics and environmental policy. He has published more than 70 journal and book articles. He is author, co-author or editor of eight books, including the widely acclaimed publications "Public Policies and the Misuse of Forest Resources" (1988) and "Tax Reform in Developing Countries" (1989), as well as the leading textbook in the field, "Economics of Development" (fifth edition, 2002), now available in five languages. Gillis remains active in teaching at Rice University, both in the economics department and the Jesse H. Jones Graduate School of Management.

Robert Harriss, Ph.D., is president and CEO of the Houston Advanced Research Center. He was formerly senior scientist and director of the Institute for the Study of Society and the Environment of the National Center for Atmospheric Research, Boulder, Colo. His current adjunct appointments include professor, department of marine sciences, Texas A&M University at Galveston; and principal scientist, the Institute for Oceans and Coasts. Previous appointments include a Harvard University postdoctoral fellowship and faculty appointments at McMaster University (Canada), Florida State University, the University of New Hampshire, and Texas A&M University. He also served as a senior scientist at the NASA Langley Research Center and as science director of the Mission to Planet Earth Program at NASA Headquarters. Harriss obtained a Bachelor of Science in geology from Florida State University and a doctorate in geochemistry from Rice University.

Peter Hartley, Ph.D., is a Rice scholar of energy economics for the James A. Baker III Institute for Public Policy. He is also the George and Cynthia Mitchell Chair and a professor of economics at Rice University, as well as the academic director of the Shell Center for Sustainability. He has worked for more than 25 years on energy economics issues, focusing originally on electricity, but including also work on gas, oil, coal, nuclear and renewables. He wrote on reform of the electricity supply industry in Australia throughout the 1980s and early 1990s and advised

the government of Victoria, Australia, when it completed the acclaimed privatization and reform of the electricity industry in that state in 1989. The Victorian reforms became the core of the wider deregulation and reform of the electricity and gas industries in Australia. Hartley has published research on theoretical and applied issues in money and banking, business cycles and international finance. In 1974, he completed an honors degree at the Australian National University, majoring in mathematics. He worked for the priorities review staff, and later the economic division, of the prime minister's department in the Australian government while completing a master's degree in economics at the Australian National University in 1977. Hartley earned a doctorate in economics at the University of Chicago in 1980.

John P. Holdren, Ph.D., is the Teresa and John Heinz Professor of Environmental Policy and director of the Program on Science, Technology, and Public Policy at the Kennedy School of Government, Harvard University, as well as director of the Woods Hole Research Center. He is also a professor in Harvard's department of Earth and planetary sciences and the immediate past president of the American Association for the Advancement of Science. His research and engagement with policy have focused on energy technology and policy, causes and consequences of global environmental change, and nuclear nonproliferation and arms control. Trained in space science and plasma physics at the Massachusetts Institute of Technology and Stanford, Holdren co-founded in 1973 and co-led until 1996 the interdisciplinary graduate program in energy and resources at the University of California, Berkeley. He is a member of the National Academy of Sciences, the National Academy of Engineering, and the American Academy of Arts and Sciences.

Amy Myers Jaffe is the Wallace S. Wilson Fellow in Energy Studies at the James A. Baker III Institute for Public Policy and associate director of the Rice University energy program. Her research focuses on the subject of oil geopolitics, strategic energy policy, including energy science policy and energy economics. Jaffe is widely published in academic journals and numerous book volumes and served as co-editor of "Energy in the Caspian Region: Present and Future" (Palgrave, 2002) and "Natural Gas and Geopolitics: From 1970 to 2040" (Cambridge University Press, 2006). She served as a member of the reconstruction and economy working group of the Baker/Hamilton Iraq Study Group and as project director for the Baker Institute/Council on Foreign Relations Task Force on Strategic Energy Policy. She was among *Esquire* magazine's 100 Best and Brightest honorees in the contribution to society category in 2005. Prior to joining the Baker Institute, Jaffe was the senior editor and Middle East analyst for *Petroleum Intelligence Weekly*, a respected oil journal. She received her bachelor's degree in Arabic studies from Princeton University.

The Honorable John Kerry is the United States senator from Massachusetts. For decades in public service, John Kerry has been an environmental leader, fighting on citizens' behalf to clean up toxic waste sites, to keep our air and water clean, and to protect the Arctic National Wildlife Refuge and other pristine wilderness areas. He has just returned from Bali, where he represented the United States at the International Climate Negotiations. Kerry has been called the Senate's most outspoken environmentalist and the League of Conservation Voters has called him an "environmental champion." In 1970 he helped organize Massachusetts' first Earth Day, and then led the fight against acid rain in the Northeast as lieutenant governor of Massachusetts. He helped defeat efforts to roll back the environmental accomplishments of a generation, whether in the form of regulatory reform or efforts to drill in national monuments and the Arctic National Wildlife Refuge. Teaming up with John McCain, he stood up to the powerful Washington interests and led an uphill fight to improve fuel efficiency in automobiles. Having represented the United States at global climate change summits, including Rio de Janeiro and Kyoto and The Hague, Kerry led the Senate's effort to make environmental preservation a global priority through comprehensive

treaties and pushing for the inclusion of important environmental protections in free trade agreements. In addition to supporting important environmental initiatives, Kerry has turned a spotlight on powerful Washington interests, their rollbacks of our hard-won environmental gains and their outdated, old-economy notions that clean air, clean water and our national treasures must be sacrificed in the name of short-term profit.

Timothy L. Killeen, Ph.D., is the director of the National Center for Atmospheric Research (NCAR) and a senior scientist at NCAR's High Altitude Observatory. Prior to joining NCAR, Killeen was professor of atmospheric and space sciences at the University of Michigan. During his tenure at Michigan, he also held positions as director of the Space Physics Research Laboratory and associate vice president for research. He is a principal investigator and instrument developer for a space-borne Doppler interferometer on the NASA Thermosphere Ionosphere Mesosphere Energetics and Dynamics (TIMED) spacecraft, and co-principal investigator for a new National Science Foundation (NSF) Science and Technology Center devoted to numerical modeling of space weather. He is president of the American Geophysical Union (AGU), a fellow of the American Meteorological Society (AMS), a former AMS councilor, and is a newly elected member of the National Academy of Engineering. Killeen has served as president of the Space Physics Section of the American Geophysical Union, and on numerous NASA, NSF, AGU and university committees. He served as co-chair of the NASA Sun-Solar System Connection Strategic Roadmap Committee, and is a past editor-in-chief of the *Journal of Atmospheric and Solar-Terrestrial Physics*. Killeen received a Bachelor of Science in physics and a doctorate in atomic and molecular physics from the University College, London.

Steven E. Koonin, Ph.D., joined BP p.l.c in 2004 as group chief scientist. He is responsible for the company's long-range technology plans and activities, particularly those "beyond petroleum." He also has purview over BP's major university research programs around the world and provides technical advice to BP's senior executives on matters on Group significance. He joined the California Institute of Technology (Caltech) professorial faculty in 1975, and served as the institute's vice president and provost from 1995 to 2004. Koonin is a fellow of the American Physical Society, the American Association for the Advancement of Science, the American Academy of Arts and Sciences, and a member of the Council on Foreign Relations and the Trilateral Commission. He has served on numerous advisory bodies for the National Science Foundation, the Department of Defense, and the Department of Energy and its various national laboratories. His research interests have included theoretical nuclear, many-body, and computational physics, nuclear astrophysics, and global environmental science. Koonin was born in Brooklyn, New York, and received a Bachelor of Science in physics from Caltech in 1972 and a doctorate in theoretical physics from Massachusetts Institute of Technology in 1975.

Neal Lane, Ph.D., is senior fellow in science and technology policy at the James A. Baker III Institute for Public Policy, and the Malcolm Gillis University Professor and professor in the department of physics and astronomy at Rice University. Prior to returning to Rice University, Lane served in the federal government as assistant to the president for science and technology and director of the White House Office of Science and Technology Policy (OSTP) from 1998 to 2001, and as director of the National Science Foundation (NSF) and member (ex officio) of the National Science Board from 1993 to 1998. Before his post with NSF, Lane was provost and professor of physics at Rice University, a position he had held since 1986. He first came to Rice in 1966, as an assistant professor in the physics department. In 1972, he became professor of physics and space physics and astronomy. He left Rice from 1984 to 1986 to serve as chancellor of the University of Colorado at Colorado Springs. In addition, from 1979 to 1980, while on leave from Rice, he worked at the NSF as director of the division of physics. Lane received his doctorate, Master of Science, and Bachelor of Science in physics from the University of Oklahoma.

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Paul Lynch is Her Majesty's consul-general for the British Consulate-General in Houston. Prior to coming to Texas in 2007, Lynch held the same position in Osaka, Japan, while simultaneously serving as commercial consul. From 1996 to 2001, Lynch held two first secretary positions with the British Embassy in Tokyo. He worked in the science and technology division for four years before taking one year to engage in full-time Japanese language study. Upon his return to the workforce, he spent the next year as the first secretary for the commercial division. From 1994 to 1996, Lynch worked as the private secretary to the parliamentary secretary for the Cabinet Office. Ahead of his stint with the Cabinet Office, Lynch worked for the Home Office from 1991 to 1994. While there, he was involved in steering through Parliament the Criminal Justice Act of 1994. In addition to his government posts, he worked for the Monbusho Japanese Exchange and Teaching (JET) program on the Kawaguchi City Board of Education in Saitama Prefecture, Japan, from 1988 until 1990. Lynch received his Master of Science in social psychology from the London School of Economics and his Bachelor of Science in psychology from the Hatfield Polytechnic.

Gilbert E. Metcalf, Ph.D., is a professor of economics at Tufts University and a research associate at the National Bureau of Economic Research. Metcalf has taught at Princeton University and the Kennedy School of Government at Harvard University and has served as a visiting scholar at the Joint Program on the Science and Policy of Global Change at Massachusetts Institute of Technology. He has served as a consultant to various organizations including the Chinese Ministry of Finance, the U.S. Department of the Treasury, and Argonne National Laboratory. Metcalf's primary research area is applied public finance with particular interests in taxation, energy and environmental economics. His current research focuses on policy evaluation and design in the area of energy and climate change. He has published papers in numerous academic journals, has edited two books, and has contributed chapters to several books on tax policy. Metcalf received a Bachelor of Arts in mathematics from Amherst College, a Master in Science in agricultural and resource economics from the University of Massachusetts, Amherst, and a doctorate in economics from Harvard University.

Ernest J. Moniz, Ph.D., is the Cecil and Ida Green Professor of Physics and Engineering Systems, director of the MIT Energy Initiative, and director of the Laboratory for Energy and the Environment at the Massachusetts Institute of Technology (MIT), where he has served on the faculty since 1973. Moniz served as undersecretary of the Department of Energy (DOE) from 1997 until 2001. In that role, he had programmatic oversight responsibility for the offices of science, fossil energy, energy efficiency and renewable energy, nuclear energy, science and technology, environmental management and civilian radioactive waste management. He also led a comprehensive review of the nuclear weapons stockpile stewardship program and served as the secretary's special negotiator for Russia initiatives. Moniz also served from 1995 to 1997 as associate director for science in the office of science and technology policy in the executive office of the president. At MIT, Moniz served as head of the department of physics and as director of the Bates Linear Accelerator Center, a DOE user facility. His principal research contributions have been in theoretical nuclear physics and in energy technology and policy studies. Moniz received a Bachelor of Science in physics from Boston College and a doctorate in theoretical physics from Stanford University.

Scott S. Nyquist is a director in McKinsey & Company's Houston office and a leader in McKinsey's energy practice. He joined McKinsey in 1984 and worked in McKinsey's London office between 1985 and 1998. He transferred from London to Houston in January 1998. He has led McKinsey's European petroleum, Americas petroleum, and Texas energy practices. He now co-leads McKinsey's global energy and materials sector. Nyquist has extensive experience in helping private and public sector clients develop and implement strategies and major change programs that significantly improve their performance. Before joining McKinsey, he worked for Exxon Production Research

in Houston, where he was involved in offshore oil platform design. Nyquist graduated from the University of Michigan with a Bachelor of Science in chemical engineering and obtained a Master of Business Administration from the Harvard Business School.

Emil Peña was named executive director of the Energy & Environmental Systems Institute of Rice University on Oct. 15, 2007. Previously, Peña served in the U.S. Department of Energy (DOE) as the deputy assistant secretary for the Office of Natural Gas and Petroleum Technology, Office of Fossil Energy. In this position, he was responsible for administering oil and gas programs including research and development, planning and environmental analysis, and import and export activities. Prior to his appointment to the DOE in March 2000, Peña was president of Emil T. Peña Interests, Inc., a government affairs company representing clients at the state and local levels. From 1981 to 1985, Peña served as assistant director of public affairs field operations at Atlantic Richfield Company (ARCO), where he represented the company before state and local government bodies in an 11-state region and maintained a working relationship with elected officials as well as industry associations. From 1979 to 1981 at Miller Brewing Company, Peña was the government affairs manager, responsible for representing the company in an eight-state area in the Southwest. At LoVaca Gathering Company from 1977 to 1979, Peña was the community relations and public affairs assistant to the director and vice president for public affairs. Peña holds a Master of Arts in environmental management from The University of Texas, San Antonio, and a Bachelor of Arts in political science, history and sociology from Texas A&I University, Kingsville.

Milo Sjardin is head of New Carbon Finance (NCF) in North America, and is a leading expert on carbon market analysis and price forecasting. In this capacity he is responsible for developing and supporting carbon price modeling tools for the emerging North American markets, leading the analysis for the emerging North American markets, and working with major financial and energy sector organizations to help them understand the implications of the climate change legislation in North America. Prior to this role, Sjardin led the development of NCF's quantitative analysis of the European and global Kyoto carbon markets based out of London, and has assisted numerous companies in assessing future carbon prices and trading strategies. Sjardin has an undergraduate degree in physics and a master's degree in energy and resources from Utrecht University and Imperial College London.

Daniel Sperling, Ph.D., is professor of civil engineering and environmental science and policy, and founding director of the Institute of Transportation Studies at the University of California, Davis (UC Davis). He is also associate director of the UC Davis Energy Efficiency Center. In February 2007, the governor of California appointed Sperling to the California Air Resources Board. He also served as co-director of the California Low Carbon Fuel Standard study. In the past 25 years, he has authored or co-authored more than 200 technical papers and 10 books. He was a lead author of the transportation chapter in the 2007 IPCC report, "Mitigation of Climate Change," and a recent member of 11 National Academies committees on energy efficiency, gasoline taxes, hydrogen, transport in China, biomass fuels research and development, sustainable transportation, and related topics. He was founding chair of standing committees for the U.S. Transportation Research Board on Alternative Transportation Fuels (1989-1996), and Sustainability and Transportation (2006-present). He was selected as a national associate of the National Academies in 2004. Sperling has a doctorate in transportation engineering from the University of California, Berkeley, and Bachelor of Science from Cornell University.

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Mort Webster, Ph.D., has been a visiting assistant professor at Massachusetts Institute of Technology (MIT) in the Joint Program on the Science and Policy of Global Change and in the department of Earth, atmosphere and planetary sciences since 2006. From 2001 to 2006, he was an assistant professor of public policy at the University of North Carolina at Chapel Hill. Webster's research program is focused on the role of uncertainty (scientific or otherwise) in policy decisions and in the design of effective environmental policy. At the broadest level, he is interested in exploring the interface between formal quantitative models and the policy process. His work focuses on how to analyze the uncertainty in assessment models of global climate change to produce insights that are useful to the policy community, including addressing the role of learning in the future on today's decision, the effect of uncertainty on multistakeholder negotiations, and better means of communicating results to nonexperts. He received a Ph.D. (2000) in technology, management and policy from MIT and a Bachelor of Science in Engineering (1988) in computer science and engineering from the University of Pennsylvania.

John P. Weyant, Ph.D., is a professor of management science and engineering at Stanford University, where he has been since 1977. He came to Stanford primarily to help develop the Energy Modeling Forum, of which he is director. Weyant was formerly a senior research associate in the department of operations research, a member of the Stanford International Energy Project and a fellow in the U.S.–Northeast Asia Forum on International Policy. He is currently an adviser to the U.S. Department of Energy, Pacific Gas & Electric Company, and the U.S. Environmental Protection Agency. His research is focused on global climate change, energy security, corporate strategy analysis, and Japanese energy policy. He is on the editorial boards of *The Energy Journal* and *Petroleum Management*. His national society memberships include the American Economics Association, Association for Public Policy Analysis and Management, Econometric Society, International Association of Energy Economists, Mathematical Programming Society, ORSA, and TIMS. Weyant received his Bachelor of Science and Master of Science in aerospace engineering and astronautics from Rensselaer Polytechnic Institute (RPI) in 1969 and 1970, followed by a Master of Science in operations research and statistics from RPI in 1971. He obtained his doctorate in management science from the University of California, Berkeley, in 1976 and did a postdoctoral fellowship at Harvard University from 1976 to 1977.

Dimitri Zenghelis heads the Stern Review team at the Office of Climate Change for Her Majesty's (HM) Treasury. Previously, he worked as a senior economist on the "Stern Review on the Economics of Climate Change." Zenghelis was lead author on the costs of mitigation, model analyses and comparisons, "competitiveness" impacts, and a significant contributor to the conceptual, theoretical and ethical framework adopted in analyzing the economics of climate change. He is also the joint-lead in disseminating and presenting the Review post-publication. Since joining HM Treasury in 1999, Zenghelis has provided economic analysis and advice for the British government on European and international economic policy as head of the Economic and Monetary Union Analysis Branch and head of economic forecasting. He has been responsible for the internal and published government macroeconomic forecast using the HM Treasury model and has provided regular briefings to Chancellor Gordon Brown and Prime Minister Tony Blair. Prior to joining HM Treasury, Zenghelis worked as a consultant with Oxford Economic Forecasting, and at the Institute of International Finance, Washington, D.C., on East Asian and Southeast Asia trade and investment flows, and macroeconomic policy. He also worked for Tokai Bank Europe in London. In the early 1990s, Zenghelis was a senior economic advisor for the Liberal Democrats in the House of Commons. His university education was at Bristol University and St. Hugh's College, Oxford University.

Beyond Science:

The Economics and Politics of Responding to Climate Change

Saturday, February 9, 2008

Ken Zweibel is the president of PrimeStar Solar of Golden, Colo., a company founded in June 2006 to develop cadmium telluride thin film photovoltaic (PV) modules for solar energy generation. He worked at Solar Energy Research Institute (SERI) (subsequently, National Renewable Energy Lab (NREL)) in Golden for 27 years on the development of cadmium telluride, copper indium diselenide, and amorphous and thin film silicon photovoltaics. From 1995 to 2006, he was manager of the Thin Film PV Partnership Program, which worked closely with U.S. universities and companies, including First Solar and UniSolar. The Thin Film Partnership shared eight R&D100 Awards with U.S. companies for taking technology from the lab to commercial success. He has published numerous papers and articles, and two books on PV, the most recent being, "Harnessing Solar Power: The PV Challenge." Recently he co-authored the article, "A Grand Plan for Solar Energy," published in *Scientific American*, in January 2008. Besides his involvement with PrimeStar Solar, he is interested in solar policy and solutions to climate change and rising energy prices. Zweibel graduated with a Bachelor of Science in physics from the University of Chicago in 1970.