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INITIATIVES IN ENERGY and the ENVIRONMENT

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Alliance for Global Sustainability: Expanding the Research Vision

On November 17-19, 2002, the Alliance for Global Sustainability (AGS) convened at the Massachusetts Institute of Technology (MIT) for a technical meeting to explore a number of options for proposed research partnerships. 124 participants, mainly from academia and also representing businesses, government, and nongovernmental organizations, participated in the three-day event. The purpose of the technical meeting was to explore opportunities to build holistic research partnerships that are needed to address multi-faceted issues in sustainable development.

In his keynote address, Dr. Paul Tebo, CEO of DuPont, echoed Martin Luther King, Jr.'s "I have a dream" for racial equality, saying that sustainability is also an achievable dream. Dr. Tebo participated in the 1993-94 discussions that led to the founding of the AGS. "Sustainability is an exciting concept," he said, pointing to DuPont's partnership with the AGS. "The 21st century will be about values—The 20th century was about technology," said Tebo. He noted that DuPont has an ethicist on its biotech advisory panel addressing the company's "zero policy"—a push for elimination of its environmental footprint. Another goal of his company is to help wean the world from fossil fuel dependency.

Dr. Tebo also observed that "sustainability cannot be legislated"—hence, partnerships with government are not feasible; but his company has found that it is valuable to work with university groups such as the AGS, and with nongovernmental organizations like Greenpeace, all of which have "lots of bright people with the freedom to explore and develop ideas." Tebo observed that many unforeseen benefits can come from partnerships. For example, DuPont worked with former US President and 2002 Nobel Peace Prize recipient Jimmy Carter at the Carter Center in devising a nylon filter to combat Guinea worm disease, with the result that the disease has been virtually eradicated, a major medical success story for the developing world.

AGS Faculty Coordinator Professor David Marks, Director of MIT's Laboratory for Energy and the Environment, noted that some 200 students are involved in AGS work. He said "technology has caused many environmental problems, but not all AGS research areas are technical." To date, AGS projects have been bottom-up, but, "with the initiative to coordinate

continued on page 2

CALENDAR

march 24-26

"Science, Industry and Society: Partnership for Sustainable Development." The Alliance for Global Sustainability Annual Meeting 2003, Tokyo, Japan; March 24-26, 2003. For further information contact Ms. Karen Gibson, 617-258-6368 (Email: kgibson@mit.edu).

april 30

"Cambridge, MIT, and Climate: A University-Community Partnership Model," Dr. Amanda Graham, LFEE Brownbag Seminar, MIT, April 30, 2003, 12 noon-1:30 pm. Location TBA. For further information contact Ms. Karen Luxton, 617-253-3478 (Email: kkluxton@mit.edu).

july 12-26

Youth Encounter on Sustainability (YES), Multidisciplinary, multicultural, and interactive approaches to sustainability. First Session: July 12-26, 2003, Hotel Alpenblick, Braunwald, Switzerland. Contact: Dr. Amanda Graham, tel.: 617-253-8995. (Email: agraham@mit.edu).

august 9-23

Youth Encounter on Sustainability (YES), Multidisciplinary, multicultural, and interactive approaches to sustainability. Second Session: August 9-23,2003, Hotel Alpenblick, Braunwald, Switzerland. Contact: Dr. Amanda Graham, tel.: 617-253-8995. (Email: agraham@mit.edu).

All events are held at MIT unless otherwise noted. For the most current listings, see the LFEE website: http://lfee.mit.edu/

Please send MIT sponsored event listings to Dr. Richard St. Clair, stclair@mit.edu, phone 617-253-9871.

Dr. Paul Tebo, CEO of DuPont and Keynote Speaker

research partnerships," he said that the process will additionally "become top-down, to offer incentives for people to come together in very large programs."

Noting the importance of research partnering, MIT Chancellor Phillip Clay emphasized that the task of AGS research is "to generate new knowledge and also to serve as an honest broker between stakeholders who otherwise might find it difficult to collaborate with each other."

The AGS, founded in 1996, is a research partnership among four leading technical universities—MIT, the University of Tokyo (UT), the Swiss Federal Institute of Technology-Zürich (ETH-Z), and Chalmers University of Technology (Chalmers) in Gothenburg, Sweden. The technical meeting served as a springboard for the AGS annual meeting to be held at UT, March 23-26, on the topic of "Science, Industry and Society: Partnership for Sustainable Development." (See announcement, back cover.)

The AGS research approach was praised by guest dinner speaker, Dian Ying Gao, Deputy Director of the Guangzhou Development Planning Commission in China. Said Mr. Gao, "This year, Guangzhou received an award for 'Best Practice of Residential Environmental Improvement' from the United Nations. All these honors have to be attributed to the efforts of the [AGS] research team."

Four categories of research partnerships were considered at the November meeting: (1) New materials for sustainable development, (2) Tools for managing the mega-cities, (3) Mountain waters: Resource and risk, and (4) Strategies for changing course, a brainstorming session to address issues in corporate and public sector strategic responses to environmental and sustainability issues. (A workshop two days earlier addressed "Carbon management: Social and political aspects of carbon

Workshop on "Changing Course"

sequestration technologies.")

The technical meeting got underway with an examination of four key issues in building a sustainable future: (1) An update on climate change: what this means for corporations, by Prof. Jeffrey Steinfeld (MIT Department of Chemistry, AGS Education Coordinator at MIT and Director of the Education Program of MIT's Laboratory for Energy and the Environment); (2) Technology and the future of sustainable development: some lessons earned from the AGS, by Prof. Lawrence Susskind (MIT Department of Urban Studies and Planning); (3) Institutions: the implications of cross-national variation in regulations, by Prof. Kenneth Oye (Director, Political Economy and Technology Policy Program, MIT Center for International Studies); and (4) Innovation: the role of R&D in promoting sustainable corporations, by Prof. Eleanor Westney (MIT Sloan School of Management).

Green innovation demands changes in a multi-layered institutional infrastructure.

Professor Susskind described Public Entrepreneurship Networks (PENS), a concept by which innovation can bring about green technology, although such innovation will have to be immense in order to achieve sustainable development. "Green innovation demands changes in a multi-layered institutional infrastructure," said Prof. Susskind, who described five roles people can play in PENS—as pioneers, venture capitalists, superintendents, mediators, and stewards. Breakthrough research teams can be led by corporations, civil society, or government. This new way of thinking will be presented in detail in a book planned for the AGS book series, Susskind said.

Incentives are needed to force step changes.

Professor Oye noted examples in which regulations have created new market segments and incentives. "Things don't happen by themselves," he said, "Incentives are needed to force step changes." He cited the ban on CFCs and how the potential passage of the Montreal Protocol of 1987 provided incentives to market DuPont's substitutes for CFCs. He noted that the European Union has done more than the United States to change light-duty vehicles to reduce emissions, even though the EU's NO_X standards are less stringent than those of the US. In addition to considering the effects of regulations on firms, said Prof. Oye, British Petroleum has taken the initiative and done some remarkable things in advance of regulations to market cleaner fuels.

It is necessary to develop a portfolio of networks.

Professor Eleanor Westney spoke on the research strategies of the boundary-crossing technologist. "Getting great technology into use," she said, "is difficult and requires networks," and much will develop in corporations. Networks are "social capital" in which the element of trust is just one part. She characterized research, development and evaluation (RD&E) as a boundary-crossing function, while R&D is a human capital function. Since the 1990s, the extended enterprise has networked across the boundaries of the firm and deals. "It is necessary to develop a portfolio of networks," said Prof. Westney, adding that the "marriage of doing good and doing well" is important, as is the balance of human and social capital.

Information tools and instrumentalities are mechanisms to help reduce the dangers of disconnects throughout society.

In the closing plenary session, Professor Nazli Choucri (MIT Department of Political Science), representing the workshop on tools for managing the mega-cities, commented on the necessity of capturing the lessons of the

Plenary Panel: MIT Professors Lawrence Susskind, Kenneth Oye, Eleanor Westney, and Jeffrey Steinfeld

Professor Takashi Mino, University of Tokyo, AGS Education Coordinator

20th century and defining opportunities for the 21st century. Said Prof. Choucri, "We've defined our project, purpose, and goals as follows, mainly to examine the needs resulting from the world's mega-cities to build bridges between management, methodologies in mega-cities, and advances in applications in information technology." She also noted, "We think of information tools and instrumentalities as mechanisms to help us reduce the dangers of disconnects throughout society—disconnects in information, communication, access; disconnects in foundations of decisions; and also disconnects among different facets of mega-cities' components."

Responses to the technical meeting from participants were varied, constructive, and enthusiastic. One participant said, "The AGS provides an excellent forum for collaborative research and cross-fertilization of ideas. I wish the initiative every success and look forward to remaining involved with its efforts." Another participant said the topics "certainly were [of interest]. I think sustainability issues confronting the developing world, particularly the high mountain areas, which are extremely vulnerable to global warming and global changes should be given greater attention in the future."

Another workshop participant said, "I found the topic of sustainable consumption very interesting and the AGS participants highly qualified and motivated. I would have enjoyed talking to them more. In light of the 'Johannesburg Plan for Implementation' (JPI), which calls for a 10-year program on sustainable consumption and production, this topic is very pertinent and needs more attention."

Summaries of the research projects currently supported by the AGS are available on the AGS website at http://www.globalsustainability.org.

Developing a Vision: AGS Education Workshop

The Alliance for Global Sustainability (AGS) held an interactive workshop on the AGS education agenda during the organization's annual technical meeting at the Massachusetts Institute of Technology (MIT), November 19, 2002. (See related story, cover.) With this workshop, AGS education coordinators began to engage the broader AGS community in crafting a strategic vision for the future direction of the AGS' educational efforts.

Education Program Manager of the MIT Laboratory for Energy and the Environment (LFEE), Dr. Amanda Graham organized and chaired the meeting. She represents MIT on the AGS education committee along with MIT Chemistry Professor Jeffrey Steinfeld, Director of the LFEE Education Program. In the workshop, participants examined the AGS' potential for leadership in international sustainability education. One feature of the AGS education portfolio is its ties to the new knowledge generated in the research areas. The education committee was established to translate AGS research results on sustainability into education.

One project of the committee seeks to pilot test the development of a focused set of web-based educational resources from selected AGS research projects. This new effort has already begun to generate empirical lessons about the process of incorporating research findings into the educational context, as well as suggesting questions in education research for future exploration.

Dr. Joanne Kauffman, AGS Co-Executive Director

Small discussion groups were asked to consider three questions:

> How can the AGS, with its unique skills and capabilities, fulfill its educational mission?
> How should we approach this challenge?
> What sort of direction might you suggest that we take?

Workshop participants responded by generating a wealth of ideas addressing a broad range of sustainability education needs and initiatives in terms of problem statements, areas of needed activity, and specific project suggestions.

Three overall educational goals for the AGS emerged from the discussion:

(1) to improve the capacity of students to respond to present and future sustainability challenges: Participants noted that confronting these challenges is not limited to the technological and scientific dimensions of sustainability, which also encompass social, multidisciplinary, multilingual, and multicultural dimensions;
(2) to improve the capacity of faculty to act as leaders in the creation, implementation, and dissemination of model sustainability education forums: The AGS should develop the capacity of faculty to design, implement, evaluate, and improve outstanding sustainability learning experiences; and
(3) to broaden awareness of and participation in the AGS community by enhancing its visibility among students and faculty within the four AGS partner universities and thereby build stronger investment in the AGS community.

Participants highlighted the importance of achieving these three goals within the AGS community, in the developing world, and in the developed world outside the AGS. Prioritization and refinement of these goals and of the scope of their implementation is an important task for AGS education coordinators and leadership as the full AGS education agenda continues to take shape.

The AGS supports the sustainability education initiative known as the Youth Encounter on Sustainability (YES; formerly Youth Environmental Summit). YES has engaged over 170 students from more than 50 countries and a wide array of disciplines in intensive sustainability studies since 2000. It is held annually in two consecutive sessions late in the summer. YES is an example of how AGS researchers and highly motivated students can come together and interact on a wide range of sustainability issues of concern to both developed and developing countries around the world.

LFEE Post-doc, Adriana Diaz-Triana; AGS Co-Executive Director, Roger Baud; LFEE Education Program Manager, Amanda Graham

An ongoing challenge of the AGS is translating its portfolio of research into the education of the next generation of leaders. Preparing the students of today to capably and successfully lead society in an increasingly sustainable relationship with the environment is a defining component of the AGS mission.

A participant of the education workshop, post-doctoral researcher Dr. Adriana Diaz-Triana of the LFEE at MIT and a former participant in YES, observed that teaching and learning within the interdisciplinary, multicultural environment that characterizes sustainability education are complex endeavors that themselves require special skills and energies. Said Dr. Diaz-Triana, "I have serious thoughts about developing a career in the academic world...on the issues of sustainability. It's very hard to

find a career path. There is no one that can be your tutor, your advisor. Maybe there is a way that AGS could pick students from the YES courses or...students from their universities that would like to pursue a career as professors in issues of sustainability and...help them with other topics, social issues, philosophy—other ways of thinking about sustainability—and not necessarily just the technical aspects."

AGS researchers and teachers present at the workshop acknowledged that, as they continue to accumulate experience working in sustainability education, it is critically important to document and share lessons and questions such as: How do we bring all levels of education into learning about sustainability? What age level should AGS sustainability education target—primarily undergraduate and graduate school, or also including primary and secondary schools? Who should participate in an international conference on this subject? What are key topics for discussion? And how can the AGS, with its unique skills and capabilities, fulfill its educational mission?

Summing up the workshop, AGS Co-Executive Director Dr. Joanne Kauffman (MIT) noted two underlying assumptions that guide development of the AGS education agenda. First, behavioral change in society is essential to achieving sustainable development. Sustainable societal change will fundamentally require an enhanced educational effort. Second, education and research are integrated at a very basic level within the AGS: The process of inquiry at its best is itself an educational endeavor. The integration of sustainability education and sustainability research is a strong foundation on which to build. Given the maturity of a number of AGS research initiatives, the time is ripe, said Dr. Kauffman, to leverage findings from AGS research into the educational process.

AGS Co-Executive Director Dr. Roger Baud (Swiss Federal Institute of Technology-Zürich) emphasized that sustainability education must bridge the traditional boundaries that structure much of the academic learning endeavor. Baud said education must help train students to work at the borders of their respective disciplines and in the creative overlap between them and other related disciplines.

Said Dr. Amanda Graham, "Hopefully, this workshop is just the beginning of a broad conversation within the AGS. Education coordinators from each school will continue to work together to advance discussion and action on the AGS education agenda." For further information, questions, or comments on the education workshop, contact Dr. Graham at agraham@mit.edu (tel. 617-253-8995).

"[E]nvironmental issues are complex and diverse. We will not be able to teach people how to act in all different situations. However, we may be able to let people think about sustainability by themselves on any occasion. Each of us must act in our own capacity. As long as environmental deterioration is concerned, our road will lead to ruin if we should fail to achieve a 'sustainable world.' I believe that the interdisciplinary and multicultural environmental education scheme under the sustainability concept should play a key role in achieving our goals in the AGS."

—Prof. Takashi Mino (UT),
AGS Technical Meeting,
November 19, 2002

MIT's LFEE and DOF Launch Photovoltaic Project

Last fall, the Laboratory for Energy and the Environment (LFEE) at the Massachusetts Institute of Technology (MIT) and MIT's Department of Facilities (DOF) Utilities Group were awarded a grant for the MIT Community Solar Power Initiative by the Massachusetts Renewable Energy Trust. The purposes of the initiative are (1) to encourage acceptance of photovoltaic (PV) technology that can reduce dependency on fossil fuels at MIT and in selected neighboring communities, and (2) to foster the development of Massachusetts' renewable energy industry.

This PV installation project reflects MIT's support for renewable energy research, and it uses MIT's own buildings and personnel to test the feasibility, effectiveness, and consumer acceptance of PV power generation. This project will contribute to reducing installation costs of PV systems by increasing the effectiveness of installation and maintenance and by providing valuable feedback to designers and manufacturers.

Through participation and exposure in this project, MIT students will become aware of the potential and challenges of solar power, while participating towns will integrate this power source into their conventional systems and will gain experience in the performance of PV technology.

Dr. Edward Kern, a Research Engineer in LFEE, and Ms. Laxmi Rao, a Senior Project Manager in MIT Utilities, will direct the project. Mr. Peter Cooper, Director of MIT Utilities, will provide the expertise, personnel, and access to MIT facilities. The grant provides funds for the project to place 80 kilowatts of solar installations, distributed both on the MIT campus and on public schools, homes, and businesses in Cambridge, where MIT is located, as well as in the nearby communities of Watertown, Arlington, Lexington, and Waltham (Massachusetts).

PV systems produce their rated power only when the sky is clear and the sun's rays are perpendicular to the surface of the PV panel. Since that does not happen at night and during overcast or rainy weather, the typical annual numbers for PV in New England are about 15% of capacity under ideal conditions. Thus, when installed, a kilowatt (1 kW) of PV in typical conditions will produce about 1500 kilowatt-hours (kWh) of electricity per year, equal to about two months' demand for a typical home.

Through their participation in this project, members of the MIT community will help not only to promote innovations of the technology and increased application of solar power, but also to support awareness of the benefits of solar power technology in the towns where they live. Their leadership is also intended to encourage their neighbors to incorporate PV power into their energy choices.

Orientation and potential shading of the PV panels, the cost of support structures to hold them in place, the cost of wiring, and aesthetics are all factors in selecting system locations. A team of two students in MIT's Undergraduate Research Opportunities Program (UROP) is developing a PV "rover" unit to be used in the initial phase of the project to find the best places on the MIT campus to install the PV panels. The rover units are equipped with sensors that will record conditions at trial locations and transmit the data over the MIT wireless network for display on the Web. The UROP team represents a partnership among the LFEE, DOF, and MIT's Edgerton Center, the latter of which provides hands-on educational experiences for MIT undergraduates in engineering and science.

MIT will finance PV installations on its own campus buildings. Installations on the homes of MIT faculty and staff will be subsidized by the grant. Evergreen Solar, a rapidly growing PV manufacturer in Massachusetts, will provide complete system packages to MIT for all the installations. MIT will make these packages available to individual participants in the project at a cost significantly reduced from market levels. The Conservation Services Group, which develops markets nationally for environmentally conscious electric power, will handle transactions for MIT faculty and staff and other project participants. Participants wishing to sell the renewable energy credits generated by their systems will do this through the Conservation Services Group.

LFEE and the DOF conducted a seminar series during MIT's Independent Activities Period in January to promote and explain the program to potential participants. Installations of the PV systems will begin in spring, 2003. For further information on the program, see the MIT Community Solar Power Initiative website at http://solarpower.mit.edu.

Implementing Climate Protection Locally: MIT Students Join with City Officials

This January, the Laboratory for Energy and the Environment (LFEE) at the Massachusetts Institute of Technology (MIT) co-sponsored a month-long seminar given at MIT on implementing the Cambridge (Massachusetts) Climate Protection Plan. MIT graduate and undergraduate students and faculty along with officials of the City of Cambridge and business representatives met to review the results of the seminar at its concluding session. Throughout the month-long course, MIT students were afforded an unprecedented opportunity to work directly with Cambridge City officials in devising specific strategies to help implement the plan.

The Climate Protection Plan, adopted by the Cambridge City Council in December, 2002, is an ambitious venture that seeks to reduce greenhouse gas emissions in the City of Cambridge by 20% from its 1990 levels by the year 2010, or a reduction of 494,000 tons of airborne carbon dioxide, the greenhouse gas which is widely thought to be most responsible for global warming. Cambridge, where MIT is located, is a city with a population of 95,000, situated across the Charles River from Boston.

Commenting on the MIT-Cambridge collaboration, Henrietta Davis, Vice-Mayor of Cambridge and member of the Cambridge City Council, said, "This high-powered collaboration shows how the city and the university can be a powerhouse for climate protection." Davis is chairwoman of the Cambridge City Council's Health and Environment Committee.

Along with the LFEE, the seminar was co-sponsored by MIT's Department of Political Science and the City of Cambridge, with support from the MIT Public Service Center and the MIT President's Office of Government and Community Relations.

Students participating in the seminar developed proposals to reduce greenhouse gas emissions in Cambridge using a methodology called Community-Based Social Marketing (CBSM), a set of strategies specifically targeted to promote action by individuals. In the concluding session, the students presented the results of their work in the form of two proposals to the City of Cambridge: (1) a green power campaign, and (2) a hybrid and low emission vehicles campaign.

The MIT seminar was part of the institute's Independent Activities Period (IAP), which occurs in January each year between the fall and spring semesters. For over 30 years IAP has provided MIT students, faculty and staff with a unique opportunity to organize, sponsor, and participate in a wide variety of activities, including how-to sessions, forums, and lecture series.

In the summer of 2002, Dr. Amanda Graham, Education Program Manager for LFEE, met with John Bolduc and Rosalie Anders of the City of Cambridge Community Development Department. The MIT IAP seminar was an outgrowth of those meetings.

Dr. Graham noted that the Cambridge-MIT collaboration is "an ideal partnership, a practical learning experience with usable outcomes, making proposals to the city on concrete potential solutions." Paul Parravano, Co-Director of the MIT President's Office of Government and Community Relations, said, "This is a stellar event" harnessing "energy and enthusiasm combined with knowledge about how we travel and live our lives."

In the first week of the seminar, the students were intensively briefed on climate change science, policy, and action by fifteen local experts and practitioners of climate change initiatives. Among these, Anders and Bolduc, co-authors of the Cambridge Climate Protection Plan, were seminar instructors. Instructors from MIT were Jeffrey Steinfeld, Professor of Chemistry, Stephen Meyer, Professor of Political Science, Amanda Graham, and Beth Conlin, Education Program Coordinator for LFEE.

> *The green power team says that a 20% adoption of green power in Cambridge would result in a reduction of 193,000 tons of carbon dioxide by 2010, or nearly 40% of the total targeted reduction in the Cambridge Climate Protection Plan.*

Green power is a community-based social marketing campaign promoting energy sources with little or no emissions of carbon dioxide. Green power includes energy produced by the sun, by the wind, and by water (hydroelectric). Students on the green power team were Sean Fay, a senior majoring in computer science; Anna Holt, a sophomore in neuroscience with a minor in political science; Steven Lenard, a first-year graduate student in the Department of

Back Row: Prof. Jeffrey Steinfeld, LFEE and Dept. of Chemistry; Vice-Mayor Henrietta Davis, City of Cambridge; Rosalie Anders, City of Cambridge Community Development Dept.; Diana Cheng; John Bolduc, City of Cambridge Community Development Dept.; Anna Holt; Matt Alvarado; Amanda Graham, LFEE; Beth Conlin, LFEE. Front Row L-R: Steven Lenard, Sean Fay, Shan Riku, Amelia Ravin.

"This high powered collaboration shows how the city and the university can be a powerhouse for climate protection."

—Henrietta Davis, Vice-Mayor
of the City of Cambridge, Mass.
MIT, January 30, 2003

Urban Studies and Planning (DUSP); and Amelia Ravin, also a first-year graduate student in DUSP.

In the US nationally, only 2% of consumers with green power options have made the switch to using green power. But the green power team says that a 20% adoption of green power in Cambridge would result in a reduction of 193,000 tons of carbon dioxide by 2010, or nearly 40% of the total targeted reduction in the Climate Protection Plan. They recommended that the City of Cambridge run a 12-month program to encourage residents to choose green power when that option becomes available in the city. The plan tackles real barriers to the acceptance of green power as well as coming up with real solutions providing incentives for using green power, including targeting new renters of apartments.

The other group of students presented the hybrid and low emission vehicle campaign. They were Matt Alvarado, a first-year graduate student in the Department of Earth, Atmospheric, and Planetary Sciences; Diana Cheng, a junior majoring in applied mathematics; and Shan Riku, a freshman from Japan who is interested in environmental issues from both the scientific and political viewpoints.

Hybrid cars combine traditional gas engines with an electric motor and can reach a fuel efficiency of up to 68 miles per gallon, as opposed to the national average of 20 mpg for passenger cars. But the Cambridge-MIT collaboration also recognizes the value of promoting cars that have a fuel efficiency of 30 mpg and higher, even if they use traditional internal combustion engines only. The Cambridge Climate Protection Plan has two goals, to increase fuel efficiency of cars to 40 mpg citywide and generally to reduce the actual vehicle miles traveled wherever possible.

Among barriers to the adoption of hybrid cars are price—the cost is $1500 - $4000 more than a comparable gas engine car—as well as size: most hybrid cars tend to be small and thus not useful for larger families. However, US carmakers are already planning and are soon to market larger hybrid cars to target that class of consumers.

The seminar also came up with a variety of strategies to keep the two campaigns alive after the seminar ended. One strategy is to keep the Public Service Center at MIT informed of Cambridge opportunities on environment. Local and higher education collaboration on a broader scale was suggested. MIT has recently set up a website called Environment at MIT (http://web.mit.edu/environment/), which can serve as a central online clearinghouse for compiling opportunities for environmental research and education collaborations with local communities.

Another follow-up was the suggestion that MIT students working with the City of Cambridge interact directly with power companies towards implementation of green power. But foremost was the imperative to keep students involved in these and other practical environmental endeavors. Professor Jeffrey Steinfeld, Director of the LFEE Education Program, said at the conclusion of the seminar, the Cambridge-MIT collaboration "should serve as a model for communities elsewhere."

MIT Takes Lead in Development by Design Conference

Development by Design (dyd02), the Second International Conference on Open Collaborative Design for Sustainable Innovation, was held in Bangalore, India on December 1-2, 2002. The conference followed the first Development by Design workshop (dyd01), which was held at the Media Lab of the Massachusetts Institute of Technology (MIT) on July 22, 2001. About 300 researchers, practitioners, and students from countries as far apart as Brazil, Finland and Botswana attended the December conference. Representing MIT as keynote speaker was Phillip L. Clay, Chancellor of MIT and Professor of City Planning.

Conceived as a response to the gross imbalance of the quality of life among communities around the world, the conference aimed to establish a critical dialogue towards open collaboration in sustainable technology, design, and development by encouraging perspectives from a diverse group of stakeholders from academia, industry, nonprofit organizations, and independent innovators. The conference was organized so as to help attendants interact closely and contribute in workshops in order to deliver guidelines and comments on specific topics of design.

The lead conference sponsor was Media Lab Asia. Other sponsors included MIT's Laboratory for Energy and the Environment (LFEE); the Alliance for Global Sustainability at MIT (MIT/AGS); the Srishti School of Art, Design, and Technology in Bangalore, which hosted the conference; and Infosys Technologies, which generously offered their state-of-the-art conferencing facility.

LFEE sponsored four MIT graduate students who presented papers at the dyd02 conference: Ms. Prasanga D. Hiniduma Lokuge, MIT Department of Mechanical Engineering and winner of MIT's Lemelson International Technology Award for 2002; Ms. Prerna Sood, MIT Department of Architecture, and Ms. Heather Lukacs, lecturer in MIT Department of Civil and Environmental Engineering, whose papers focused on passive incubators for premature infants, household water treatment systems, and novel learning approaches for underserved children; and Ms. Rebeca Eun Young Hwang, MIT Department of Civil and Environmental Engineering and winner of MIT's IDEAS prize. In all, 20 MIT students from Computer Science, the Media Lab, Civil and Environmental Engineering, Mechanical Engineering, Chemical Engineering, Technology and Policy Program, and Architecture presented papers.

Water was an important topic for Ms. Hwang, who helped Heather Lukacs run a pre-conference workshop on the topic and later coordinated the discussions and delivered their conclusions to the rest of the conference attendees. "The idea of helping the poorest get access to safe water has stimulated me to work on a six-months-long project in Nicaragua," said Ms. Hwang. "Therefore, I was thrilled to attend the conference to find out what experts both on the field and on the theoretical considerations had to say on design for development." However, she noted that some projects may end up harming more than helping by generating unpleasant and irreversible side effects: "Development doesn't have a single definition, and therefore design for development cannot be a magical recipe to be followed in all circumstances. A true change of attitude on our mistaken role as the 'owners of superior knowledge' has to be witnessed in order to achieve really sustainable solutions for many problems."

Arvind Lodaya, visiting professor at the Srishti School of Art, Design, and Technology, said, "Given the rich variety of participants at the conference—stakeholders present included students, researchers, development professionals, practitioners, government planners and venture capitalists—there was rich scope for networking and cross-discipline collaborations." In order to channel the energy and excitement generated at the conference, said Prof. Lodaya, three working groups were created to determine specific outcomes—the first, in the area of continuing projects; the second, to propose a re-positioning of design and the designer in the context of development; and the third, looking at the remarkable Bhoomi project of India and finding ways to strengthen it.

Ela Bhatt, the founder and chairperson of the Self Employed Women's Association (SEWA), the largest organization of self-employed women in the world, was the inaugural speaker. She challenged technologists to find answers to the many "invisible" problems that are nevertheless critical to the quality of life of millions of working women.

Nearly 60 participants from around the world presented papers at this conference, all peer-reviewed by an international program committee of over 35 domain experts as well as the general public in an online digital library hosted on ThinkCycle.org, created especially for the conference. Some of the environmental issues presented were clean water, energy efficiency, energy and temperature control, sustainable household water treatment technologies for use in

Poonam Bir Kasturi leads a panel session on the role of designers in the Infosys presentation hall December 1, 2002. Photo by Ananth Chikkatur (used with permission).

developing countries, and corporate environmental sustainability.

The conference co-chairs were Geetha Narayanan, Director of Srishti School of Art, Design and Technology; and Professor Alex (Sandy) Pentland, Toshiba Professor of Media Arts and Sciences, MIT Media Lab and founding director of Media Lab Asia. Among the program co-chairs involved in the technical review and selection of the papers was Nitin Sawhney, one of the co-founders of the conference, who developed the online peer-review system on ThinkCycle and recently completed his doctoral dissertation at the MIT Media Lab. Mr. Sawhney helped establish the conference to provide a legitimate international forum for tackling critical challenges in sustainable design and technology with an emphasis on multidisciplinary research, pedagogy, participatory design, and critical understanding of social outcomes.

Said presenter Heather Lukacs, MIT graduate student and lecturer in the Department of Civil and Environmental Engineering, "I think it is our job as part of the future generation to spread the word about what is going on in the world and to get more MIT students thinking about these issues that may not influence their everyday lives but that are so prevalent in the lives of billions of other people in our world." Continued Lukacs, "The conference left me with a bit of a daunting feeling, and indeed, there is so much that needs to be done in order to get closer to providing everyone in the world with the basic human right of drinking water. Yet, what gives me hope is that there are so many people—young and old, western and eastern—who are taking the step to actually do something about these issues."

"Having dealt with sustainable design in an academic setting, the conference was a great chance to see the real world implications of this issue and to meet with people who have spent a lifetime working on this. The real world challenges associated with sustainable design, as with any other noble cause, are large."

Ms. Prasanga D. Hiniduma Lokuge, MIT Department of Mechanical Engineering, dyd02 presenter

MIT graduate student Prasanga Lokuge observed, "Having dealt with sustainable design in an academic setting, the conference was a great chance to see the real world implications of this issue and to meet with people who have spent a lifetime working on this. The real world challenges associated with sustainable design, as with any other noble cause, are large. The most important aspect I took away from the conference was the untapped wealth of knowledge that exists in many rural communities. From learning to re-use every scrap of waste material to designing healthy solutions to existing challenges, I came away with a sense that perhaps there was more the West could learn from them, to help us achieve our goals."

The conference website (http://www.thinkcycle.org/dyd02) provides access to all papers submitted, and a printed proceedings will be published in the coming months.

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AGS Annual Meeting 2003— Science, Industry and Society: Partnership for Sustainable Development

The Alliance for Global Sustainability (AGS) will meet March 23-26, 2003 at the University of Tokyo to explore the ways in which multi-disciplinary research can advance world-wide goals of sustainable development. For over five years, since its inception in 1997, the AGS has brought together world-class scholars and practitioners to address the challenges of sustainable development—and in particular to develop tools and methods that are aimed at helping societies meet their goals for the provision of water, energy, and mobility for their own and future generations. The AGS recognizes that research that is solutions-oriented requires the participation of affected and interested parties from all sectors of civil society. In this context, it seeks to expand its partnership with these other sectors from the formulation of research to the implementation of results. Over the course of three days, leading scholars, the Presidents of the AGS member universities, and thought leaders from around the world will meet in Tokyo to examine how the integrated research paradigm developed by the AGS is bringing about change in their own institutions and contributing to sustainable development around the world.

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