INAUGURAL
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YEAR · 1998

INITIATIVES IN ENVIRONMENT and SUSTAINABILITY

a quarterly publication of MIT's Center for Environmental Initiatives

inside:

Consortium research

TO FOCUS ON

"integrated assessments"

The Consortium on Environmental Challenges (CEC) will hold its first Advisory Committee meeting at MIT on October 15-16, 1998. The CEC was established in 1997 to improve the environmental decision-making process through the better use of scientific, technical, and socioeconomic understanding. The Advisory Committee consists of sponsors and partners from industry, government, non-government organizations and other academic institutions in the United States and abroad. The Committee is actively involved in helping the Consortium formulate its research topics.

The CEC is starting its first full program year in 1998-99 under the management of MIT faculty leaders Professors Larry Bacow, David Marks, and Mario Molina and Dr. Joanne Kauffman. The Consortium provides the research and communication infrastructure needed to enable different stakeholders to work collectively towards credible, informed, and knowledge-driven processes for understanding and assessing the nature and scope of major environmental problems. Further, through multi-party collaboration, the Consortium promotes the development of effective policy options.

CEC Advisory Committee members include Peter Beardmore, Michael Kaericher and Irv Salmeen of the Ford Motor Company. Ford, in conjunction with its overall investment of $20 million over five years, provided $6 million/year in start-up capital to MIT for the CEC starting in October, 1997. The Advisory Committee also includes representatives of CEC sponsor companies: Even Bakke (Senior Vice President, Technology Planning, Group Research, Development and Technology) of Asea, Brown, Boveri (ABB) in Switzerland; Trygve Refvem (Executive Vice President) and Dr. Bjorn Sund of Norsk Hydro, Norway; Susan Sonnenberg (Policy Analyst) and James Katzer (Vice President for Technology) of Mobil Corporation, U.S.A.; David Sigman (Chief Attorney, Environmental Affairs) of Exxon Corporation (U.S.A.). Dr. Jack Gibbons (former Director of the U.S. Office of Science and Technology Policy), and affiliates Dieter Imboden (Swiss Federal Institutes of Technology), Prof. Granger Morgan (Carnegie Mellon University), Dr. T. Clarence Davies (Director of the Risk and Regulation Program, Resources for the Future), Dr. Arnold Howitt (Kennedy School of Government, Harvard University), Prof. David Levy and Sandra Rothenberg (Harvard University) will also participate in the meeting.

During this first meeting, Advisory Committee members will hear progress reports on ongoing research and will consider two proposed Integrated Assessment research projects— the first, an

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CALENDAR

october 20

"Response of environmental and occupational regulatory system to major societal change: Lessons from Poland," Prof. Halina Szejnwald Brown, Clark University. ETP Speaker Series, 4-5:30 pm, Building 1-150. For information contact Helena at (617) 253-5724 (lenas@mit.edu).

october 22

"The 21st century: Will science and technology contribute to society, or scuttle it?" Dr. Jack Gibbons, Karl Taylor Compton Lectures,4:00 pm, Wong Auditorium, Building E51-115. Story, page 10.

november 10

"Market failure and the economic strategies of firms: The microeconomic roots of corporate environmental policy," Prof. Forest Reinhardt, Harvard Business School. ETP Program Speaker Series, 4-5:30 pm, Building 1-150.

november 30

"Governance of Science and Technology: Theory, Myths, and Reality." Dr. Jack Gibbons, Karl Taylor Compton Lectures,4:00 pm, Wong Auditorium, Building E51-115. Story, page 10.

december 1

"Eco-industrial Parks Reconsidered." Marian Chertow, Director & Lecturer, Industrial Environment Program Yale School of Forestry and Environmental Studies. ETP Program Speaker Series, 4-5:30 pm, Building 1-150.

january 18-23

Alliance for Global Sustainability (AGS) National Meeting in Tokyo. For information contact Karen Gibson, tel. 617-258-6368 (kgibson@mit.edu).

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

Please send MIT sponsored event listings to Dr. Richard St. Clair, stclair@mit.edu, tel. 617-258-6368, fax 617-258-6099.

continued from cover

analysis of local, regional, and global effects of air pollution in Mexico City (see page 3), and the second, an analysis of the implications of sustainability for a world-wide industry—in particular, the automobile industry. The Advisory Committee will also be briefed on the CEC's project on the use of scientific and technical knowledge in environmental decisionmaking (see page 8).

During the startup phase, the Consortium management team organized research activities, established the Strategic Faculty Workshops at MIT with faculty and research associates participating from across the Institute, and sponsored the Center for International Studies' research on the use of science in environmental decision-making. Through these initiatives, the Consortium defined the following goals:

To assess global environmental challenges and their impact on ecosystems, economic development and health
To identify and contribute to the knowledge needed to meet those challenges
To improve policy making through use of unbiased scientific, technological and socioeconomic knowledge.

The multi-disciplinary faculty workshops allow individuals from across MIT to share research and exchange ideas, facilitating the development of cross-cutting themes and research questions which can be incorporated into the research agenda. In the first set of workshops, the following questions were raised:

How can science influence the framing of important policy questions?

What determines the willingness of different decision-makers to act in the face of uncertainty?

What characterizes decision-making processes that are adaptive and responsive to knowledge?

How can we develop the institutional capacity to put current knowledge to better use?

What would a theory of clean paths to economic development look like?

How do we organize and manage a truly integrated environmental assessment?

The projects being launched at MIT this Fall aim to address these questions.

Prof. David H. Marks, CEI Director and Co-manager of the Consortium on Environmental Challenges

CREDIBLE EVIDENCE *and environmental policy*

A central question of MIT's Consortium on Environmental Challenges is, how does scientific evidence get integrated into environmental policy-making? What data are considered credible, how are they used and by whom? The pervasive uncertainties in the process of generating and evaluating new data create parallel questions of scientific credibility: Which studies, scientists, and institutions should be believed, and why?

To address these key issues, the CEC and MIT's Program on Regulation and the Environment sponsored a national conference September 24-25 at the American Academy of Arts and Sciences in Cambridge, Massachusetts. More than 80 experts from industry, government, NGOs and academia wrestled with the difficult questions that concern decision-makers in an arena that is characterized by uncertainty in scientific debates. The conference grew out of research undertaken by Professor Harvey Sapolsky at MIT and supported by the CEC.

Two panels looked at the current scientific evidence and policies for heavy metals such as lead and mercury. Both metals are severe neurotoxins at high doses, but the available studies conflict in predicting the health effects from today's markedly reduced exposures. Over two decades, for example, average blood lead levels in the population have fallen from 20 to 3 micrograms of lead per deciliter of blood. A spirited discussion followed centering on how to structure studies of low-dose effects so as to bear directly on decision-making processes and how to modify decision-making processes in the face of current uncertainty over low-dose effects.

A third panel with Rona Birnbaum of the U.S. EPA, Dallas Burtrow of Resources For the Future, Alejandro Cano-Ruiz of MIT, and James Foster of MIT compared the results of EPA's program for reducing sulfur dioxide emissions. Relative to expectations at the start of the program, emissions have declined more sharply, compliance costs have been lower, and net benefits, including human health effects, have been greater than expected. The panel noted that emissions trading fostered flexibility, but that implicit property rights associated with the system may now preclude modification of quotas to reflect unanticipated benefits.

Several panelists, including a former EPA Deputy Administrator, described the pressures for regulators to put too much trust in existing data in setting policies while downplaying all the uncertainties behind an often summary figure. Once the regulation based on the data is in place, it gets "set in concrete" and is difficult to change. Other panelists, including a current EPA official described recent cases where the EPA has modified guidelines and regulations in response to changing evidence.

Several sessions probed how the legal system has been grappling with scientific expertise. Marcia Angell, Executive Editor of the *New England Journal of Medicine,* reviewed the history of breast implant cases. At the time the first lawsuits were brought, the industry had never done any major studies of the relationship between implants and systemic disease in the rest of the body. Fifteen major studies have now been completed. None of these has established such a relationship, yet some $4 billion in damages are expected to be awarded anyway. Ms. Angell lamented such an outcome, arguing that science-intensive policy and legal debates should be decided by evidence.

Many scientists find that the intense advocacy roles in the courtroom distort the actual balance of the available evidence. In response, judges are now taking a more active role in deciding which scientific studies are relevant and credible. In several high profile cases the judges have even appointed their own experts to review the evidence. But it is not easy to find knowledgeable scientists who have never taken a position on the issues.

A panel also looked at how the media interprets scientific studies on health and the environment. Magazine journalists sometimes have the time and experience to interview widely and establish for themselves how a scientific consensus has evolved. But daily journalists are more likely to rely on scientific sources they have used in the past, as well as their own instincts. Television journalists often have the least time and experience of all, though they may have the most impact on the public.

There were also presentations on groups that seek to act as scientific "honest brokers" for policy-makers. The National Academy of Sciences and the Health Effects Institute perform useful but highly pressured roles. They have to assemble the needed expertise in a timely fashion and then reassure numerous constituencies about their own credibility on the issue.

A working paper, "The Search for Credibility," has been prepared by Prof. Harvey Sapolsky and Center for International Studies Consultant Dr. Larry McCray, MIT Program on Regulation and the Environment, 16 Sept., 1998.

Methyl Bromide/CFCs: a question of science in the international arena

Dr. Joanne Kauffman, Associate Director of the Center for Environmental Initiatives and Co-manager of the Consortium on Environmental Challenges

Despite relatively straightforward consensus on the part of the scientists, the political will to ensure early banning of methyl bromide is not present.

Scientists have known for some time that bromine and its compounds are even more serious ozone depleters than chlorine and its compounds—and methyl bromide is the largest source of bromine in the Earth's atmosphere. The Montreal Protocol to reduce stratospheric ozone depletion has been taken by many environmentalists, scientists and political leaders as a potentially "new paradigm" in international environmental negotiations—one where scientific evidence supposedly kept politics at bay. But this optimism is largely based on the analysts' focus on the phaseout of chlorofluorocarbons (CFCs), ignoring the greater difficulties encountered in dealing with methyl bromide (MeBr)—a bromine-based chemical that is widely used in agriculture as a soil fumigant. Delay in its phaseout is a major trouble spot in the Montreal Protocol.

Researchers at MIT's Center for International Studies have made an analysis of how the Montreal Protocol negotiations process has dealt with CFCs as compared with methyl bromide. In addition to showing the limitations of the "Protocol paradigm" itself, this study also reveals much about the limitations of the role of science in environmental politics. The study also points to the significance of other policy drivers in environmental politics. Some of these policy drivers are commonly understood, but there are more subtle problems of entrenched short-term economic interests, domestic regulatory politics, the role of the media, and public understanding and resonance on the issues.

Sense of urgency missing

To those concerned about ozone depletion, the treatment of methyl bromide in the Montreal Protocol negotiations is puzzling. Many scientists engaged in atmospheric research agree that to avoid any surprises or shocks in a sudden worsening of ozone depletion, it is important to keep the peak of chlorine as low and of as short a duration as possible, and to bring equivalent chlorine and bromine levels back to a low level as early as possible. Yet, despite relatively straightforward consensus on the part of the scientists, the political will to ensure early banning of methyl bromide is not present. This uncertainty opened the opportunity for other political issues to enter the debate. Part of the reason for the controversy surrounding a phaseout of methyl bromide is due to disagreement over the sources and sinks (both natural and man-made) of this compound.

The comparative case raises a cautionary note: While scientific knowledge is necessary to identify problems deserving public attention and correction, it is not a policy driver per se, much as some would like it to be. Scientific knowledge is one among many factors that must be taken into account in societal decisions about what we choose to consume and how we do so. Another is economics.

MeBr and CFC phaseout costs differ

The MIT study found that the aggregate economic costs of a CFC phaseout were low compared to those projected for methyl bromide, the distributional effects more manageable, and market effects actually advantageous to the dominant CFC producers who developed effective substitutes for the chemicals to be phased out.

In the case of methyl bromide, the distributional effects of a phaseout are potentially inequitable, and since there is no single substitute for it, market effects are uncertain. Conventional wisdom aside, the Montreal Protocol breakthrough in 1987 was due less to enlightened response to hard scientific evidence than it was to a fortunate confluence of political and economic interests with strong scientific evidence of the need for action.

The case of methyl bromide underscores the limitations of the search for a definitive scientific answer to a policy question. In the absence of clear political and economic gains from action, scientific uncertainly has become a polarizing influence in the debate.

and infrastructure. And while there has been a lot of international attention on global climate issues, most local decisionmakers do not take into account the relationships between urban, regional, and global pollution in order to design the most cost effective strategies to address the common causes that underlie these interrelated problems.

Professor Gregory McRae,
MIT Dept. of Chemical Engineering

"Faculty at MIT are experts in a wide variety of different fields," notes Prof. Gregory McRae. "By pooling this expertise in an integrated assessment endeavor we could potentially play a role in addressing some large-scale problems, while also establishing a framework for integrated assessment in general."

Air pollution involves technically complex issues of atmospheric physics and chemistry. However, addressing the serious problem of air pollution requires not just an understanding of the science but also how to balance economic, social, and technological factors, and how to make decisions in the presence of uncertainty. The Mexico City Case Study will undertake research of the basic science of the air pollution problem in Mexico City, as well as the design and analysis of control options to address local as well as regional and global air pollution problems.

What MIT researchers learn doing the Mexico City Case Study will lay the groundwork for developing broader guidelines and materials to support integrated assessments for improved environmental decisionmaking in developing countries. Improving the environmental decisionmaking process through the better use of scientific, technical, and socioeconomic understanding is the central goal of the CEC.

MIT faculty plan to disseminate research findings, integrated assessment guidelines, and related data and models through outreach and education targeted at public and private sector decisionmakers, nongovernmental organization leaders, the media, and the public.

First Wallenberg Fellows arrive from Sweden

MIT's Program for Environmental Education and Research (PEER) announced the recent and impending arrival of six doctoral candidates and post-doctoral researchers from Sweden. The researchers will work with selected MIT Faculty during the academic year through the new Wallenberg Fellowship in Environment and Sustainability Studies.

The program, funded by the Knut och Alice Wallenberg Stiftelse, will be inaugurated during a visit to MIT by Dr. Peter Wallenberg, Executive Director of the Foundation. Its purpose is to bring outstanding young Swedish scholars to work in research groups at MIT, addressing complex interdisciplinary issues relating to the environment and sustainable development. In particular, the program is designed to advance knowledge in areas of interest to Sweden, while providing an experience for the Fellows that will promote a broad awareness of environmental challenges.

Dr. Nils Göran Broström (Ph.D., Gothenburg University, 1997) is aiming to develop a convincing mechanistic understanding of how an ecosystem responds to a changing climate, with attention to the North American and North Atlantic ecosystems. Dr. Erik Kjellström (Ph.D. in Atmospheric Chemistry, Stockholm University) is pursuing the connection between atmospheric chemistry and climate—specifically, the description of the atomospheric sulfur cycle in the general circulation model (ECHAM) developed at the Max-Planck Institute. Dr. Thomas Blomberg of Lund University has been researching heat, moisture and airflow processes in buildings, developing analytical tools to create energy-efficient sustainable housing.

Dr. Patrik Söderholm (Ph.D. in Economics, Lulea University of Technology, 1998) is examining public policies encouraging recycling of paper and aluminum in relation to industry practice. Mr. Gunnar Granberg, a Ph.D. candidate in Forest Ecology at the Swedish University of Agricultural Sciences in Umea, is developing analytical and mechanistic models to enable correct decisions on wetlands management in accordance with the Kyoto protocol. Due to arrive at MIT in January, Ph.D. candidate Elisabeth Corell of Linköping University plans to pursue postdoctoral research on expert monitoring of international environmental treaties, her goal being to improve environmental education at Swedish universities.

"The collaboration between MIT and Mexican researchers presents a great opportunity to have a positive impact on the way air pollution problems are addressed in Mexico City and in other megacities." --

Mario Molina,
Dept. of Earth, Atmospheric
and Planetary Sciences, MIT

"Mega-cities" collaborative project on air pollution

MIT faculty interdisciplinary project will focus on Mexico City

Air pollution is a persistent and pervasive environmental problem that imposes significant health and economic costs. The problem of rapidly growing cities with severe air pollution problems is global. Cities such as Mexico City, São Paolo, Los Angeles, Bangkok, and Beijing all experience similar, and serious, air pollution problems. The number of cities with very poor air quality continues to grow as many cities in developing countries swell with people and with a variety of transportation vehicles, creating a critical need for better tools for designing and implementing cost effective strategies to improve air quality.

MIT faculty from a variety of departments have a great deal of experience researching the science, economics, and policy issues involved in different aspects of air pollution. A newly planned project, led by Professor Mario Molina of the Department of Earth, Atmospheric, and Planetary Sciences and Professor Gregory McRae of the Department of Chemical Engineering, in collaboration with Mexican researchers, would bring their respective disciplines together to perform an integrated assessment of Mexico City's air pollution problem and the policy options to control it. The project, which is being carried out under the auspices of the CEI's Consortium on Environmental Challenges (CEC), will increase understanding of sustainable growth in the burgeoning urban centers of the developing world.

Mexico City epitomizes the types of environmental problems experienced by megacities around the globe and the common obstacles to solving them. There is insufficient understanding of the connection between the scientific, economic and social issues underlying the air pollution problem, and difficulty in comprehensively addressing the problem given limited personnel, resources,

Mario Molina, Dept. of Earth, Atmospheric and Planetary Sciences, and Co-director of the MIT Consortium on Environmental Challenges.

MIT holds forum on chemicals and society

On June 11-12, 1998, MIT's Technology, Business, and Environment Program (TBE) held a conference entitled, "Forum on Chemicals and Society: A New Look at Persistent Concerns." The goal of the conference was to explore questions about managing chemicals in a socially and environmentally acceptable way. Eighty-five people participated, from the chemical industry, public interest groups, government and academia.

The conference investigated driving public concerns and negative perceptions about chemicals, why public opinion of the industry is low despite efforts by the U.S. Chemical Manufacturers Association (CMA) to improve industrial performance, and an assessment of testing procedures currently in use—how they are changing, and what types of testing procedures might strengthen public trust in the industry.

The conference organizers asked three academic scholars—Prof. Sheila Jasanoff (Cornell University), Dr. John Ehrenfeld (Director of MIT's TBE program), and Dr. Ellen Silbergeld (University of Maryland) — to prepare critical papers on the three areas of inquiry. They invited representatives of government, industry, and environmental organizations to review the papers in advance of the conference and present their response at the meeting. Three breakout workshops addressed the conference themes which then reported back to the final plenary session.

Prof. Jasanoff said, "The scattered facts we know about the environment can rearrange themselves all at once into a wholly new pattern — dazzlingly self-evident once it is before our eyes, though unsuspected moments before." She argued for use of the precautionary principle, that "when confronted by large unknowns, policy-makers have a duty to act in ways that prevent irreparable damage." One respondent said that the precautionary principle has not been applied to chemicals that have been on the market for more than ten years and will not be because of the huge economic benefits that the companies making these products are earning.

Dr. John Ehrenfeld delivered a paper co-authored with Ms. Jennifer Nash (Associate Director of MIT's TBE), saying that, if the chemical industry wants to show that it is worthy of the public's trust, it must prove that it keeps its promises. Promises are not the same as intentions: Intentions are only broad statements with no specific target or deadline. "Responsibility is a way of acting, not speaking," Ehrenfeld said. In a breakout workshop, participants responded strongly and affirmatively that Responsible Care needs to include specific promises. Two chemical plant managers said that Responsible Care needs to make promises that are both "tangible and verifiable."

Dr. Ellen Silbergeld argued that chemicals cannot be responsibly regulated without information about their risks, yet U.S. regulatory policy discourages the development and sharing of information. The result, according to Silbergeld, is that we are "drowning in ignorance." Over 75,000 industrial chemicals are in commercial use, nearly 3,000 of which are high production volume (HPV), exceeding a million pounds (100 metric tonnes) per year. 2,000 new chemicals are introduced each year, yet few have been adequately tested for toxicity. The Chemicals Program of the U.S. Organization for Economic Cooperation and Development (OECD) has adopted a screening policy on all HPV chemicals. One participant said that the OECD's screening "is not a substitute for risk assessment and risk management." Another participant said that the U.S. EPA's Endocrine Disruption Screening and Testing Group was a model of the type of process that he thought should be adopted for chemical testing.

There was agreement that Responsible Care represents a significant milestone in the chemical industry's struggle to satisfy public concerns about chemicals, but the CMA must make specific promises about the environmental performance of its members and give the public the tools it needs to observe whether those promises are being met.

There was a consensus that risks posed by chemicals on the market today represent a challenging area that neither government nor industry has appropriately addressed. A resounding theme from the conference was the need for greater openness on the part of the chemical industry. The industry's negative image will improve only when the public is able to directly observe changes in performance. Many suggestions were offered for public accountability. The bottom line: The public needs to be involved as an equal partner.

For a detailed report on the conference contact Ms. Jennifer Nash (jnash@mit.edu), Associate Director, Technology, Business & Environment Program, Center for Technology, Policy, & Industrial Development. MIT, Building E40-251, 77 Massachusetts Avenue, Cambridge, MA 02139-4307.

It is recognized that an adaptive strategy approach to environmental policy-making poses particularly demanding requirements on capabilities for program monitoring, data collection and evaluation. The fact that these functions have not been performed well in the past obscures the fact that command-control rules and technology standards have the virtue of conceptual simplicity. Process, technology, and design standards generally are easier to articulate and implement than the alternatives. They are certainly easy to monitor.

Environmental regulation: Analyzing patterns of policy-making

James L. Foster of MIT's Center for International Studies (CIS) undertook a broad review of the historical record of environmental regulation in the United States to identify systematic patterns of policy-making behavior changes which may produce more desirable outcomes. One such dominant pattern is reflected in the current environmental policy debate—the lack of attention to the tasks of policy evaluation and adaptation of existing regulations to exploit new scientific and technical information or to account for changed economic or other circumstances.

"Front-end" focus of current policy-making process

The many proposals for changing the current regulatory policy-making system emphasize the shortcomings of existing regulations, yet those proposals for change rarely address the potential benefits of changing existing regulations. The current policy debate is almost exclusively focused on the "front end" of the policy-making process and on prospective regulatory decisions. The concern with how initial decisions are made focuses attention on methods of risk assessment and cost-benefit analysis; the participation of stakeholders in the rule-setting process; the choice of policy instruments; and the delegation of enforcement authority (*e.g.,* greater state autonomy). This front-end focus addresses the special interests and concerns of entities directly affected by new regulations as well as the more general interests of those wanting to rationalize the policy process.

The historical record clearly documents the difficulties in modifying existing environmental regulations. Resistance to such change appears to operate in spite of new scientific information undercutting extant policy, clear evidence of diminishing returns to current policy, new technology offering more cost-effective policy alternatives, and even the appearance of regulatory alternatives clearly beneficial to some key stakeholders.

One clear reason for the lack of adaptability in environmental regulation is the lack of a natural political constituency for adaptive change.

For its part, EPA has generally been loathe to reopen basic regulatory programs in light of the protracted and expensive process

required for setting new regulations. Change is a highly uncertain path to take in a political system where there are so many points of opportunistic entry by many competing interest groups. Environmental groups generally act to preserve hard-won gains in the face of the uncertainty involved in reopening past decisions. And whatever the attitudes by industry prior to decision, once regulations are established, industry adapts to the regulation, establishes advantages within the changed context, and finds it unattractive to change again.

Fixed regulations at least eliminate one major uncertainty for industry in making their long-term product-market and investment decisions. Industry has consistently shown a preference for the certainty of even very stringent regulation to the uncertainty of contingent regulation, and it often becomes the strongest advocate of maintaining regulations.

Adaptable regulation

The concept of adaptable regulation is particularly relevant to the issue of the role of science in environmental regulation. The major potential benefits of adaptation include efficiencies that follow from the systematic ability to incorporate new scientific knowledge and technical information into policy review. Critics of the current regulatory process emphasize the need to "get better science" into the process, but their primary concern is improved risk assessments at the front end of the process. In truth, regulations are often formulated before highly credible supporting scientific evidence is available. Time and experience—the natural scientific experiments of regulatory trials—can reveal new technical opportunities, new definitions of the regulatory problem, and new regulatory approaches.

In a world where environmental problems are becoming more complex both scientifically and politically, uncertainties may be greater than in the past.

Policy reassessment system critical

If actions will be taken on the basis of the "precautionary principle" in the face of high uncertainty, then regulations should be open to revision in the face of new information. However, regulations established on a "trial-and-error" basis will be politically feasible and justifiable only if an effective policy reassessment system is in place and is both expected and accepted by key stakeholders in decisions.

The historical record suggests the potential benefits of an approach to environmental policy-making based on the expectation of and preparation for mid-course corrections — or even reversals — in regulatory policies.

The underlying assumptions of this approach begin with the recognition of extraordinarily large and irreducible uncertainties surrounding key environmental issues. Given the uncertainty problem, this approach accepts that a highly confident definition of the environmental "problem" demanding regulation is no more possible than is a highly confident prediction of the specific kinds and levels of health effects that will accrue over specific time periods and at predictable costs for a particular regulatory rule.

Necessity of avoiding policy "lock-in"

Change is expected as time and experience reveal the true dimensions of the environmental risk, the effectiveness of initial corrective measures—including their possibly undesirable side effects—and allows exploitation of new technologies and new scientific knowledge. Therefore, in contemplating the initiation of new regulations, the dominant concerns should be to avoid policy "lock-in" that may be the result of bureaucratic, technical or financial constraints to subsequent change.

In anticipation of the need to adapt policies to new information, the initial policy selection criterion is "robustness," a policy which can be effective across a broad range of the uncertainty in the driving scenario. The strategy should avoid potentially large stranded investment, focus on data collection and analysis that may refute the accepted health effects and economic scenario underlying the policy, and emphasize scientific research to provide more options if and when adaptive policy change is required.

Regulators at the local level know what they are looking for—the criteria are either met, or they are not.

If the regulatory system has generally failed to perform evaluation functions well even in the context of the simplest possible regulatory regime, how is it supposed to improve performance in a much more innovative and open-ended regime? In any case, how is it possible to determine whether current regulations are necessary and effective or whether new alternatives will be more effective without a satisfactory capability for evaluating performance?

"How to better educate stakeholders about the implications of the research, how to transfer analytic tools to the outside—It's valuable to improve how we bridge extensive technical analyses and try to communicate fundamental issues of research to outside stakeholders."

Stephen Connors,
former Peace Corps volunteer and
director of the MIT Energy Lab's
Electric Utility Program

MIT environmental education and research guide

Environmental Studies at MIT describes environmental activities at MIT and shows the breadth of the Institute's environmental education and research. The guide is published by the MIT Council on the Environment and the Center for Environmental Initiatives. The subjects offered at MIT address environmental issues from strict disciplinary, as well as interdisciplinary, perspectives.

Specific areas of research emphasis include: Air Quality, Business in the Environment, Energy, Environmental Planning and Management, Environmental Technologies, Global Climate Change, Green Design, Human Health, International Initiatives, Policy and Political Economy, and Water in a Sustainable Environment.

Guides are being distributed by the Program in Environmental Education and Research (PEER). To obtain a copy, contact Debra Fair, MIT, Room 6-227, Cambridge, MA 02139, USA. Telephone: (617) 252-1486.

AGS "Brown Bag" lunch series continues at MIT

The "AGS Brown Bag Lunch Series," initiated in the 1998 Spring Term by the Alliance for Global Sustainability (AGS) at MIT, resumed this Fall with two spirited presentations—an overview of the AGS research portfolio by the CEI's Associate Director, Dr. Joanne Kauffman, and a discussion by Dr. Allen Hammond of the World Resources Institute on his book, *Which World? Scenarios for the 21st Century.*

The weekly meetings are 12:00-1:30 pm in the MIT Energy Lab's large conference room, Building E40-496, on Tuesdays or Wednesdays (see schedule, *L.*). Beverages and cookies are provided.

The informal lunch series was established to offer a forum in which MIT faculty and researchers in AGS projects can share their research in sustainability-related activities with interested colleagues and students. Though targeted for AGS-affiliated faculty and students, the lunches are open to all. In addition to sharing their findings, researchers can gain valuable feedback and insights from the multidisciplinary audience on fine-tuning their topics, attuning them to other sustainability issues, adopting novel research methods, or finding other ways to communicate their results. If you would like to make a presentation to this group, please contact Mr. Stephen Connors (617-253-7985, connorsr@mit.edu) or Dr. Joanne Kauffman (617-253-0769, jmkauffm@mit.edu).

AGS "Brown Bag" Luncheon Calendar

october

Tuesday 6, Dr. John Ehrenfeld (MIT, TBE Program)
Wednesday 14, Mr. Stephen Connors (MIT)
Wednesday 21, Prof. Karen Polenske (MIT)
Wednesday 28, Prof. Janos Beer (MIT)

november

Tuesday 3, Prof. Jeffrey Steinfeld and Prof. Vicki Norberg-Bohm (MIT)
Tuesday 10, (TBD)
Wednesday 18, (TBD)

december

Tuesday 1, Prof. William Thilly (MIT)
Tuesday 8, Prof. Peter Stone (MIT)
Tuesday 15, Preparations for AGS Annual Meeting

All meetings at Bldg. E40-496, 12 noon - 1:30 pm. For further information contact Karen Gibson (617) 258-6368. (email: kgibson@mit.edu)

1998-99 Martin Fellows announced in second year of sustainability fellowship

MIT Martin Fellows for 1998-99. Back row, L-R: Prof. Rafael Bras, Michael Lenox, Saleem Ali, Ian Sue Wing, Paul Fricker, Rolf Reichle, Yves A. Mantz; Front row, L-R: Veronique Bugnion, Barclay Gibbs, Mak Saito, Guiling Wang, Nicole Gasparini, Jennifer Jay, Maybeth Long, Donald Lucas, Xudong Yang. (Not shown, Jared Goldstone)

Sixteen graduate students at MIT have been named Fellows for 1998-99 in the Martin Family Society of Graduate Fellowships for Sustainability: Saleem Ali, Veronique Bignion, Paul Fricker, Nicole Gasparini, Barclay Gibbs, Jared Goldstone, Jennifer Jay, Michael Lenox, Marybeth Long, Donald Lucas, Yves A. Mantz, Rolf Reichle, Mak Saito, Guiling Wang, Ian Sue Wing, and Xudong Yang.

The Martin Fellows are overseen by Professor Rafael Bras, head of the Department of Civil and Environmental Engineering and a member of the MIT Council on the Environment. The Council is co-chaired by MIT Chancellor Lawrence Bacow and by Professor David H. Marks, professor of Civil and Environmental Engineering and Director of the Center for Environmental Initiatives at MIT.

Generous funding from The Martin Foundation, Inc., founded by Lee and Geraldine Martin, supports the Fellowship program. Under its support, the MIT Council on the Environment inaugurated the Martin Family Society of Graduate Fellows for Sustainability in 1997.

The 1997 gift, which endows eight new Martin Fellowships over an 8-year perior, augments the earlier grant in 1992 establishing the Martin Fellowship in Environmental Issues and the Lee and Geraldine Martin Professorship in Environmental Studies. Part of the 1997 gift augments the fund for the Molina Fellowship in Environmental Sciences established by Professor Mario Molina, who holds the Martin chair. Professor Molina won the Nobel prize in 1995 for demonstrating the link between man-made atmospheric chlorofluorocarbons (CFCs) in the atmosphere and their concomitant damage to the ozone layer.

The Martin Family Foundation lives up to its name, spanning three generations. The original benefactors in 1953 were MIT alumnus Lee Martin (SB, 1942), his parents, and his wife, Geraldine. Lee and Geraldine Martin's daughter, Elizabeth, is the president of the Foundation, which also funded the establishment of MIT's Martin Center for Engineering Design in the Department of Mechanical Engineering.

Twenty-four graduate students formed the first year's Society of Graduate Fellows for Sustainability, an honor society of graduate students who meet regularly to discuss their research and explore multi-disciplinary aspects of it, and to participate in events sponsored by the Alliance for Global Sustainability, coordinated by MIT, the Swiss Federal Institutes of Technology (ETH) and the University of Tokyo.

Initiatives in Environment and Sustainability is published by MIT's Center for Environmental Initiatives. For more information about the Center, please see the Center's website: http://curricula.mit.edu/CEI/ or contact the center staff at:

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Jack Gibbons TO GIVE *Compton Lectures*

MIT is honored to host Dr. Jack Gibbons as Karl Taylor Compton Lecturer for 1998-99. Dr. Gibbons was Science Advisor to President Clinton from the beginning of his term until early this year. Prior to joining the Administration, Gibbons was Director of the Office of Technology Assessment in the U.S. Congress for thirteen years. An accomplished nuclear physicist, Dr. Gibbons worked earlier at Duke University and Oak Ridge National Laboratories, where he did pioneer work in energy conservation research and development.

Fall Lecture Schedule:
Thursday, October 22, 1998: **"The 21st Century: Will science and technology contribute to society, or scuttle it?"**;
Monday, November 30, 1998: **"Governance of science and technology: Theory, myths, and reality."**

Lectures start at 4:00 pm in Wong Auditorium, Building E51-115. A reception will follow each lecture. For further information, contact Ms. Grace Mitchell of the MIT Political Science Department. Tel.: (617) 253-5262.

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