AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
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AMERICAN INSTITUTE OF CHEMICAL ENGINEERS (AICHE)
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ENGINEERS FORUM ON SUSTAINABILITY

Forum Highlights Diverse Nature of Sustainability

The presentations at the January 20, 2006 Forum meeting underscored the varied dimensions of sustainable engineering education and practice. The subjects addressed were 1) U.S. Solar Energy Technology and Policies, 2) the Impact of Emerging Contaminants on the Environment, 3) Social Responsibility and Engineering for Sustainable Development, 4) Information and Communications Technology (ICT) and Sustainable Social Services, and 5) Smart Growth Principles and Strategies. All of these presentations are summarized in this issue of the Forum Newsletter. Also included, as other examples of diversity, are stories about WFEO's capacity building and anti-corruption activities, a geo-thermal Congressional briefing, and the Decade of Education for Sustainable Development.

The next meeting of the Forum is scheduled for Friday, May 12, 2006, in the Lecture Room of the National Academy of Engineering in Washington, D.C. The Forum will meet from 9:00 a.m. to noon, and the AAES International Activities Committee will meet in the same room from 1:00 p.m. to 4:00 p.m. Detailed agendas will be e-mailed to you prior to the meetings. We hope you will be able to join us at the Academy on May 12.

Al Grant, Forum Chair

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GOVERNMENT

Interagency Partnership Publishes Ecosystem Approach to Infrastructure Projects

An Interagency Partnership Steering Team, collaborating over a three-year period, has recently published "Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects." The Partners included the Bureau of Land Management (BLM), U.S. Environmental Protection Agency (EPA), Federal Highway Administration (FHWA), National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries Service), National Park Service (NPS), U.S. Army Corps of Engineers (USACE), U.S. Department of Agriculture Forest Service (USDA FS), U.S. Fish and Wildlife Service (USFWS), the Knik Arm Bridge and Toll Authority, and several State Departments of Transportation.

The Steering Team began with a shared vision of an enhanced and sustainable natural environment; combined with the view that necessary infrastructure can be developed in ways that are more sensitive to terrestrial and aquatic habitats. "Eco-logical" encourages Federal, State, tribal and local partners involved in infrastructure planning, design, review, and construction to use flexibility in regulatory processes. Specifically, "Eco-logical" puts forth the conceptual groundwork for integrating plans across agency boundaries, and endorses ecosystem-based mitigation - an innovative method of mitigating infrastructure impacts that can not be avoided.

The Table of Contents includes 1) Advantages of an Ecosystem Approach, 2) Setting the Stage, 3) Integrated Planning - The First Steps Toward an Ecosystem Approach (Addressing Common Challenges with Locally Appropriate Strategies), 4) Incorporating an Ecosystem Approach with Mitigation Decisions (Mitigation Options, Project-Specific Mitigation, Multiple Project Mitigation, Characteristics of Mitigation and Conservation Banks, and Ecosystem-Based Mitigation Agreements), 5) Adaptive Management Through Performance Measures, and 6) What Success Looks Like.

Benefits for the Steering Team Partners have been identified as follows:

BLM - Improved resource conservation during land use plan development
EPA - Greater flexibility to do environmental good
FHWA - Streamlined project development and improved mitigation opportunities
NOAA Fisheries Service - Early application of science for solutions
NPS - Using science to protect natural resources while providing visitor experience
USACE - Finding the balance to keep waters clean and clear
USFS - Stewardship of natural resources and facilitated use of public lands
USFWS - One conservation framework, endless possibilities for partnership

For more information, visit http://www.environment.fhwa.dot.gov/ecological/eco_index.asp

Overview Provided on Smart Growth Policies

Matthew Dalbey, Development, Community and Environment Division, U.S. EPA, provided an overview of smart growth approaches to land development, at the January 20, 2006 Forum meeting. He defined smart growth as development that revitalizes neighborhoods, protects farmland and open space, keeps housing affordable, and provides more transportation choices.

However, current patterns of growth include low density single family housing, separate uses, disinvestment in brownfields and older communities, conversion of farmland, conflict between land used for production and land used for consumption, and decline of small towns. These land use, regional growth and development patterns are affected by many influences, including markets, federal policies, state and regional policies, local laws and practices, actions of developers and lenders, and the public. Mr. Dalbey noted that "It's how and where we are growing that drives our significantly increasing rate of land consumption, not domestic population growth."

He offered the following smart growth principles:

* Mix land uses.
* Take advantage of compact building design.
* Create a range of housing opportunities and choices.
* Create walkable communities.
* Foster distinctive, attractive communities with a strong sense of place.
* Preserve open space, farmland, natural beauty, and critical environmental areas.
* Strengthen and direct development towards existing communities.
* Provide a variety of transportation choices.
* Make development decisions predictable, fair, and cost-effective.
* Encourage community and stakeholder collaboration in development decisions.

The EPA Development, Community and Environment Division (DCED) are building a Smart Growth Network, made up of development, transportation, environment, housing, local government, academic and other interests. Its goal is to identify common ground, share best practices, create a forum for "floating ideas," create partnerships, and speed the dissemination of information among constituencies. Other areas of DCED work include technical assistance to communities, curriculum technical assistance to universities, support for Governors Institute for Community Design, and rural smart growth assistance.

For more information, visit www.epa.gov/smartgrowth

U.S. Solar Technology Policy Addressed

At the January 20, 2006 Forum meeting, Chris O'Brien, Chair, Solar Energy Industries Association (SEIA), discussed the solar energy policy issues in the U.S. He began with a "big picture" question: "Where Will We Get Our Electricity in 2015?", and reviewed the situation today as follows:

Coal -50% today; environmental concerns, even with cleaner combustion.
Nuclear - 20% today; aging plants, siting concerns; share likely to decrease.
Natural Gas - 18% today; supply and price concerns.
Hydro - 7% today; siting concerns; share likely to decrease.
Wind - 0.4% today, abundant regional resource.
Solar - O.01 today, largest resource.

From an environmental perspective, he said that solar has the following advantages: No air pollution, no water pollution, no noise pollution, no solid waste, no radiation risk, no transmission lines, and no cooling water. Further, in terms of a secure energy source, it provides 1) an unlimited domestic energy resource, 2) reduced dependence on dangerous and volatile regions of the world, 3) high reliability, 4) long term stable cost of energy - no fuel price risk, and 5) secure and reliable backup power for critical loads.

As an example of a successful long term solar incentive, Mr. O'Brien used Japan's residential solar energy program, which grew from 539 systems in 1994 to approx. 70,000 in 2005, had a 69% reduction in average installed cost since 1994, and reduced its subsidy from 50% in 1994 to 3% in 2005.

He concluded with the following observations:

* There is strong and growing public support for solar.
* New Federal incentives will accelerate growth; however, 2-year window will hinder investment.
* Policy risks will remain a key factor.
* States will continue to lead market development policies for solar - expect more states to adopt kWh-based incentive structures to address performance concerns and to soften near-term government cash-flow impact.

For more information on solar policies and developments, visit www.seia.org

Overview Presented on Impacts of Emerging Contaminants

Sarah Gerould, Program Coordinator, Contaminant Biology Program, U.S.G.S., presented an overview of the impacts of emerging contaminants on the environment, at the January 20, 2006 Forum meeting. She defined emerging contaminants as 1) new substances, chemicals or their metabolites, or microorganisms, or 2) older chemicals with newly expanded distribution or altered releases, or newly found in the environment and not commonly monitored, or with newly recognized or poorly known effects.

U.S.G.S. has done national reconnaissance of streams (2002), ground water, sources of drinking water, streambed sediment, and endocrine disruption in fish. Most of the environmental contaminant regulations that apply to emerging contaminants are based on

environmental medium (water, air, drinking water, food) or use (pesticides, drugs, industrial applications (e.g. Federal Food, Drug and Cosmetic Act). The regulations rely on a variety of contrasting regulatory strategies, and use a variety of types of assessments, including:

* Quantitative structure activity models (for industrial chemicals)
* Tiered testing (for pesticides)
* Determination of no significant impact (for drugs)
* Assessment of cumulative load (for discharges into water bodies)
* Remediation cleanup levels (for hazardous waste sites)

Dr. Gerould said that engineers can reduce the hazards posed by emerging contaminants by 1) designing products whose lives don't outlive their usefulness, 2) designing products that are easily removed from the waste stream or can be recycled, and 3) by selecting solutions/products to minimize environmental impacts.

As examples of emerging contaminants, she noted the following:

Pharmaceuticals and Personal Care Products (PPCPs) - (Biologically active, endocrine disruption)
Pesticides - New pyrethroids (more persistent and toxic), fipronil, imidacloprid
Industrial/Household Chemicals - perfluoro compounds (e.g. teflon, goretex), perchlorate (rocket fuel), PBDE's (flame retardants), MTBE (gasoline additives), and disinfectant byproducts.
New Materials/Organisms - Biotech (genetically modified organisms), and Nanotech (engineered particles whose size is measured in nanometers)

With respect to nanoparticles, used in consumer products such as detergents, sunscreens, building materials, electronics and medical applications, she noted that their toxicity was not well understood, and they were difficult to measure and purify.

In conclusion, Dr. Gerould raised the following questions for engineers, scientists, and society:

How can we improve our ability to see ahead?
What is the potential for serious environmental losses?
Will monitoring be able to identify the next emerging contaminant issue?
Is regulation adequate to address existing chemical contamination?

INTERNATIONAL

WFEO Promotes Capacity Building and Anti-Corruption Policy

The World Federation of Engineering Organizations (WFEO), together with the Organization of American States (OAS) and the United States Trade Development Agency (USDTA), organized the Engineering for the Americas Symposium, which was held in Lima, Peru, in late 2005. Over 200 participants from 24 member States of the OAS took part in the symposium, including distinguished professionals from diverse sectors linked to engineering capacity building in the Americas: industry, academia, accreditation agencies, professional associations, and government agencies.

The symposium agenda focused on three issues; the needs of the private sector for engineering graduates and capacity building; quality assurance in engineering education; and country planning for financing of upgrades to engineering education. Ideas that achieved the most consensuses include: 1) the knowledge-based economy heralds an era in which the importance of innovation and engineering has surpassed that of capital. Participants saw knowledge as the principal source of wealth and progress. 2) Participants pointed to the importance of a regional approach to capacity building, which would enhance Western Hemisphere countries presence on the world stage and render them less dependent. 3) The notion that the engineer of the 21st century represents a change of paradigm, whereby an engineer today must help to create jobs, rather than just filling a job. For more information on the symposium, visit http://www.oest.oas.org/engineering/

WFEO is also a leader in the drive to eliminate bribery and corruption in the engineering and construction industry around the world, and has created a Task Committee on Anti-Corruption.

WFEO has many strong partners in this effort, including:

* The World Economic Forum and its Partnership against Corruption Initiative actively supported by many of the worlds largest engineering and construction firms.

* The World Bank and its Voluntary Disclosures Program, which provides a confidential way to report corrupt practices related to Bank programs.

* Transparency International, through its increasing stature and influence in the world engineering and construction community resulting from its bold reporting on corruption.

* The United Nations, as evidenced by its Convention on Corruption, and recent adoption of a new Principal on Corruption as part of the UN Global Compact.

* The American Society of Civil Engineers through many activities, including a Workshop on Global Principles for Professional Conduct.

* The Organization for Economic Cooperation and Development (OECD) and its Global Anti-Bribery Convention.

* FIDIC (International Organization of Consulting Engineers) for its 2005 Business Integrity Management Workshop.

More information about WFEO's work in this area can be found at www.wfeo.org.

U.N. Decade of Education for Sustainable Development

The 2002 Johannesburg Summit broadened the vision of sustainable development and re-affirmed the educational objectives of the Millennium Development Goals and the Education for All Dakar Framework for Action. The Summit proposed the Decade of Education for Sustainable Development and the United Nations General Assembly in its 57th Session in December 2002, proclaimed the Decade of Education for Sustainable Development for the period 2005 – 2014.

As the United Nations lead agency in education, UNESCO must play a key role in setting quality standards in education for sustainable development. It needs to reorient its own programs to include the changes required to promote sustainable development. Improving the quality of education and reorienting its goals to recognize the importance of sustainable development must be one of UNESCO's and the world's highest priorities.

Education for sustainable development will aim to demonstrate the following features:
- Interdisciplinary and holistic: learning for sustainable development embedded in the whole curriculum, not as a separate subject;
- Values-driven: it is critical that the assumed norms – the shared values and principles underpinning sustainable development – are made explicit so that that can be examined, debated, tested and applied;
- Critical thinking and problem solving: leading to confidence in addressing the dilemmas and challenges of sustainable development;
- Multi-method: word, art, drama, debate, experience, ... different pedagogies which model the processes. Teaching that is geared simply to passing on knowledge should be recast into an approach in which teachers and learners work together to acquire knowledge and play a role in shaping the environment of their educational institutions;
- Participatory decision-making: learners participate in decisions on how they are to learn;
- Applicability: the learning experiences offered are integrated in day to day personal and professional life.
- Locally relevant: addressing local as well as global issues, and using the language(s) which learners most commonly use. Concepts of sustainable development must be carefully expressed in other languages – languages and cultures say things differently, and each language has creative ways of expressing new concepts.

For more information see United Nations Decade of Education for Sustainable Development

ACADEMIA

Social Responsibility and Engineering for Sustainable Development: A Challenge for Academe!

(Editor's Note: The following remarks are drawn from a paper prepared by William E. Kelly, Professor of Civil Engineering, The Catholic University of America, and his presentation at the January 20, 2006 Forum meeting).

"The profession is ready for a new breed of socially responsible engineer with knowledge of the principles of sustainable development. At this point, graduates of most programs are not prepared academically to meet this challenge. Sustained support and encouragement from professional societies is needed.

Much of what engineering students learn about sustainable development, sustainability and social responsibility must come from the general education component of their curricula. For example, studies of economics and ethics are important to an understanding of the role of technology in society.

George Bugliarello, in a paper entitled "Engineering as a Social Enterprise", listed five guiding principles for social responsibility for engineers. They are: 1) uphold the dignity of man, 2) avoid dangerous or uncontrolled side effects and by-products, 3) make provisions for consequences when technology fails, 4) avoid buttressing social systems that perform poorly and should be replaced, and 5) participate in formulating the "why" of technology.

Most engineering programs in the United States are accredited by ABET (Accreditation Board for Engineering and Technology). ABET criteria exert a very strong influence on engineering curricula. With the great strides being made in the application of sustainability concepts, it is logical to begin to look for principles of sustainability that apply to all fields of engineering. What are some of the basic principles that could be introduced to all engineering students early in their engineering program? In presenting general engineering principles, it would be desirable to define a design paradigm that addresses the constraints called for in the ABET engineering criteria. It would also be desirable to define a systems context for design and metrics that could be used to evaluate degree of satisfaction of the constraints and to compare alternatives.

Sustainability is a broad enough concept to encourage engineering students to consider design in its societal and global context - an ABET requirement. This requires students to think in interdisciplinary ways. Requiring students to do this in the broadest sense is one of the experiences students would gain from taking an introductory environmental engineering and science course open to all university students.

The nature of civil engineering and closely related fields means that issues such as sustainability can be treated explicitly in regular, even required, courses. This is much less the case with areas such as computer engineering. However, in the long run, changes brought about by the move to the information age will have a major impact on sustainable development. Thus, thought needs to be given to how best to expose students in high-tech areas to sustainability and sustainable development.

Social responsibility and engineering for sustainable development is a ready made integrating theme for any undergraduate engineering program. Developing this theme would be a contribution to engineering education for all and help improve the understanding of the role of engineering in modern society."

Cornell Center for the Environment

The Center for the Environment is a Cornell-wide unit which specializes in crafting interdisciplinary collaborations among scientists and professors from Cornell and partnering institutions to apply new knowledge to environmental problems and needs around the world.

Promoting a sustainable relationship between people and the environment as well as ensuring a quality life for people here and throughout the world is what grounds the vision of the Cornell Center for the Environment. Today's most pressing environmental challenges make clear that all aspects of the environment are connected,

sometimes in surprising ways. The CfE specializes in crafting interdisciplinary collaborations among scientists and professors from Cornell and partnering institutions. The CfE also works to apply new knowledge to environmental problems, and to promote Cornell's new methods and information for environmental stewardship needs around the world.

Current research projects address hydrologic sciences, sustainable ecosystem management, market mechanisms for conservations, impact of nanotechnology on the environment, and the study of complex environmental systems. For additional information: www.environment .cornell.edu and email pg3@cornell.edu.

PROFESSIONAL ORGANIZATIONS

IEEE Produces New Video: Doing the Right Thing

Where does engineering begin and end? Should engineers just concentrate on designing products and solving technical problems, or should they also question, why? If engineers are to be held accountable for the work they do, to whom must they answer?
This video, now available through the IEEE, encourages working engineers and students to engage in discourse concerning the social, economic, and environmental impact of technology.
Engineers from industry and academia, attending the 2005 Symposium on Technology and Society (ISTAS) in Los Angeles, discussed ethics and social responsibility and the relevance of sustainability in engineering design.
Interviews with engineers were conducted to gain insights into moral and ethic questions related to their profession. How should loyalty to one's employer be balanced with the obligation of serving society? How should engineers evaluate the uncertainties concerning the impact of technology? To what extent is communicating with the public a professional responsibility? Why should engineers be concerned with ethics? Those interviewed include Gene Moriarty, San Jose State University; Kirstie Bellman, Aerospace Corporation; Brian O'Connell, CCSU; Mary "Missy" Cummings, MIT; Emily Anestad, MIT Lincoln Labs; David Bellington, Princeton University; William Kovacs, Sufficient Technology; Jeffrey Sullivan (student), Cornell University; Joe Herkert, NCSU; Michael Loui, University of Illinois; Ken Foster, University of Pennsylvania; and Philip Chmielewski, Loyola Marymount University, Clint Andrews, Rutgers, The State University of New Jersey.
This program can be viewed through the IEEE web site: www.ieee.org/ieeetv. A DVD version of the program will be available in June, 2006. For more information, contact Peter Wiesner, IEEE Corporate Strategies and Communications <p.wiesner@ieee.org>

NSPE Adds Sustainable Development to its Code of Ethics

The National Society of Professional Engineers (NSPE) has added the following language to its Code of Ethics for Engineers:

III. Professional Obligations

III. 2. Engineers shall at all times strive to serve the public interest.

III. 2. d. Engineers shall strive to adhere to the principles of sustainable development (1) in order to protect the Environment for future generations.

(1) "Sustainable Development" is the challenge of meeting human needs for natural resources, industrial products, energy, food, transportation, shelter and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development.

For more information, visit www.nspe.org

OTHER ORGANIZATIONS AND DEVELOPMENTS

EESI Briefing Highlights Need to Heat Up Federal Support for Geothermal Energy

On March 2, the Environment and Energy Study Institute (EESI) held a briefing at the Capitol on the issue of federal support for the continued development of geothermal energy.

Geothermal resources are defined by the U.S. Geological Survey as "exploitable concentrations of the Earth's natural heat" which are produced, at depth, primarily by the decay of naturally occurring radioactive isotopes that occur in small amounts in all rocks. Large quantities of heat that are economically extractable tend to be concentrated in places where hot or even molten rock exists at relatively shallow depths in the Earth's crust. Such "hot" zones generally are near the boundaries of the plates that form the Earth's lithosphere (the crust and uppermost part of the mantle). These hot zones are the prime target areas for the discovery and development of high-temperature hydrothermal systems capable of producing steam that can drive turbines to generate electricity. Thermal water too cool to produce electricity can furnish energy for direct uses, such as heating buildings. Great potential exists for increased direct use of geothermal energy in the Western U.S., especially if energy prices stay near current levels. Also, research is focused on the feasibility of harnessing energy from geothermal environments characterized by the presence of hot, dry rock or magma with no available water or insufficient permeability.

The briefing was held to examine whether federal and state programs will be sufficient to harness the significant contribution geothermal energy can make to address President Bush's call for increased domestic alternative energy supply. The meeting also noted that the President's 2007 budget request zeros out the core Department of Energy (DOE) geothermal program, a $23.1 million cut. A panel assembled by EESI explored the role of the Intermountain West Geothermal Consortium established by the Energy Policy Act of 2005 and reviewed the January, 2006 report of the Western Governor's Association Geothermal Task Force. This report concluded that, within the next ten years, between eight and 15 gigawatts of electric power from geothermal sources could be brought on line to help meet national energy needs. To achieve this, the Western Governors' task force recommended "a strong, continuing geothermal research effort at DOE that addresses the full range of technical problems encountered in achieving full production from the identified resources and undiscovered resources in the West." The briefing also highlighted state and local efforts supported by DOE's "Geopowering the West" initiative, which has active efforts in eleven Western states and is working in four others.

With continued federal and state support, much more geothermal generation is possible. Accordingly, the Geothermal Energy Association, which represents the industry in Washington, urges the Congress to extend the Production Tax Credit by 3-5 years and to "fund a strong and effective DOE geothermal research program that supports expansion of geothermal power production and development of technology that reduces the risk and cost of accessing the vast U.S. geothermal resource base."

Contact: For further information, contact Theresa Murzyn, Environmental and Energy Study Institute (202-662-1884, tmurzyn@eesi.org or Alyssa Kagel, Geothermal Energy Association (202-454-5261, research@geo-energy.org

ICT and Sustainable Social Services Described

Professor Saifur Rahman, Director, Advanced Research Institute, Virginia Polytechnic University, described how Information and Communications Technology (ICT) supports sustainable social services, at the January 20, 2006 Forum meeting.

He said that having telecom and internet access empower people to cross the digital divide, and provides opportunities for improvements in health, education, economic opportunity, and empowerment and participation. He described his sustainable business model as follows:

* Village level stakeholder groups can be established to encourage local participation.
*Staff and volunteers can be recruited from local people.
*These staff and volunteers can become trainers for others.
*Small fees can be collected from students who wish to register in courses and use computers.
*These revenues can be used to pay the staff and cover operational expenses, thus achieving a self-sustainable model.

As an example of ICT benefits for health, Bangladeshi doctors can use online medical centers to provide better care for the sick, CD-ROMs to show how to better treat patients, and can transmit medical tests to the hub of the capitol city for analysis. Under ICT benefits for education, wireless webs can reach village children and primary school children can be introduced to computers using multimedia CDs. Under ICT for economic opportunity, ICT can contribute to income generation, poverty reduction and better employment opportunities. An example would be providing electronic access to practical information on weather, farming best practices, crop status, and global market prices. And ICT can contribute to fostering empowerment and participation and making government processes more efficient. For example, in the State of Madhya Pradesh in India, an experimental intranet computer network for government services and local information has been introduced, there is faster and more transparent access to government services and farmers can get copies of land titles for 10 cents (previously $100 from corrupt officials).

Professor Rahman noted that there are currently 4 ICT options being deployed in developing countries. They are 1) Plain Old Telephone Service (POTS), 2) Cellular Mobile Telephone Systems, 3) Wireless in Local Loop (TDMA-WLL), and 4) Very Small Aperture Terminals (VSAT). He concluded by stating that for ICT Infrastructure, he recommends WLL for most applications (Entire countries could be covered by a handful of towers). For Educational Content, there is a need to develop a business plan to provide education along with other income generating opportunities to make the whole enterprise self-sustaining.

UPCOMING SUSTAINABILITY EVENTS

Spring Forward with AIChE: April 23-27, Orlando, FL
Get up-to-date research and build your professional network at the AIChE 2006 Spring National Meeting, featuring Sustainability and Environmental Accounting, Process Intensification, Tours of Disney and their sustainability efforts, and the release of case studies on Sustainability and Industry (sponsored by EPA).

Second Annual National Sustainability Expo and Prosperity, Planet, and People Award Competition, May 9-10, 2006 on the National Mall.

Application period for the 2006 Summer School on Green Chemistry is open for the event on June 22-26 in Washington, DC. The program is open to graduate students and post-docs studying in the Americas; the deadline for applications is April 15, 2006. Please see the web site http://chemistry.org/greenchemistry/summer.html for more details.

Advance Registration is now open for the 10th Annual Green Chemistry & Engineering Conference: Designing for a Sustainable Future. To learn more about the conference, and to register online, please visit the conference website: www.greenchem2006.org.

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