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### EPA Science Advisory Board Expresses Concern over R&D Cuts in FY07 Budget Proposal

M. Granger Morgan, chair of the Science Advisory Board of the Environmental Protection Agency (EPA), told Congress that proposed cuts to the EPA's Office of Research and Development (ORD) in the FY07 budget request would significantly affect the agency's research efforts, adding that the board is "deeply troubled" by the proposed cuts. Morgan told the House Subcommittee on Environment, Technology, and Standards in a hearing on March 16 that between 2004 and the proposal for 2007, "the inflation-adjusted budget for EPA's Office of Research and Development has declined.... Yet, the environmental challenges that face the agency have grown, and EPA will face increasingly complex and difficult science challenges over the coming decades."

Morgan's concern over ORD funding cuts was echoed by the other nongovernment witnesses at a subcommittee hearing examining the FY07 science and technology budget request for the EPA. Under the budget proposal, funding for ORD would be cut by 6% to \$557 million—the lowest level of funding the office has received in more than a decade, in real dollar terms.

"Every year at our EPA science budget hearing, I have pointed out the importance of science and technology at EPA," said Vernon Ehlers (R-Mich.), chair of the subcommittee. "And, who could disagree? EPA's Office of Research and Development has been at the forefront of every one of the agency's major regulatory actions. It conducts the research on what we know about the health and ecological effects of mercury and other contaminants. It prepares the scientific underpinnings of all of the agency's clean-air rules on particulate matter and ozone. It has helped develop and commercialize better environmental technologies to clean up hazardous wastes. And it is always looking for the next scientific advance or revolution that may help us better understand the environment or threats to it, and how to counter those threats.

"That is why I come to this hearing very concerned about what I see happening to EPA's science budget," said Ehlers. "The 6% proposed reduction in the ORD's budget for fiscal year 2007 is troubling, but not as much as the trend in the budget over the last few years—which would be down 14% since 2004. This trend, together with the rapid growth in spending on homeland security research, which alone accounts for almost 12% of the science budget, seems to be making it harder for ORD to continue producing the valuable

scientific knowledge I just mentioned. I say all of this mindful of the significant constraints we face in the discretionary budget. But just as we can't afford to spend too much, we can't afford to spend too little."

Morgan, who is Lord Chair Professor in Engineering and Head of the Department of Engineering and Public Policy at Carnegie Mellon University, said, "If EPA does not continue to invest in a significant amount of basic environmental science, we will likely find ourselves making costly regulatory mistakes in the future. We also run the risk of paralyzing innovative industries, like nanotechnology, uncertain about the regulatory rules that they will face."

George Gray, EPA assistant administrator for research and development, said at the hearing, "EPA shares in the responsibility of being good stewards of tax dollars. This budget fulfills presidential environmental commitments and maintains the goals laid out in EPA's strategic plan, while spending tax dollars more effectively."

Gray said that the budget "reflects a continued focus on emerging issues, as well as on our body of base work....In areas where the major science and technology questions have been answered and where additional spending would not be cost-effective, we scale back or even cease work."

### U.S. National Science Board Releases Science and Engineering (S&E) Indicators 2006

Citing a "changed world" in the global picture for science and technology (S&T), the U.S. National Science Board released its biennial report, *Science and Engineering (S&E) Indicators 2006*, on February 23. In doing so, the members of the board appearing in a Capitol Hill briefing said that the "potential" often cited in past reports to describe global S&T competition is now real. Against this backdrop, the panelists expressed concern that U.S. K-12 students in science and mathematics are not improving their learning relative to their international peers.

Addressing a gathering of the media, congressional staff, and other interested individuals at the Longworth House Office Building, Steven C. Beering, who heads the board's Subcommittee on Science and Engineering Indicators, said that while *S&E Indicators 2006* concludes that the United States still maintains its strong global position in research and innovation, he was concerned over the country's future ability to keep up with global enterprise because of continued

inconsistency in the performance of U.S. students in K-12 science and mathematics.

On the topic of new international capabilities, Beering said that the rising influence of some Asian countries, especially China, by virtue of their growing S&T investments and focus on innovation, has changed the competitive international landscape. While heightening the U.S. need to meet its educational challenges, it also can be a positive step, he said, toward increased opportunities for international collaboration and cooperation in science and engineering research that will bring future innovations.

*S&E Indicators 2006* reports that international spending on research and development (R&D) is growing rapidly: from 1990 to 2003, R&D expenditures, adjusted for inflation, have grown worldwide from \$377 billion to \$810 billion. The United States alone spent an estimated \$292 billion in national R&D in 2003. China reported R&D spending at almost \$85 billion in 2003, representing a sixfold increase since 1991, which places China third in the world in R&D expenditures.

The report also reveals that from 1990 to 2003, China tripled the percentage of its high-tech manufacturing component, from 6% to 18% of its total output, while the United States raised its high-tech output from 12% to 30% of its total during the same period. China surpassed Japan during the period, so that by 2003, China accounted for 12% of worldwide high-tech manufacturing. Europe and Japan lost market share during this period.

U.S. patent applications from the Asia-8 nations (South Korea, Indonesia, India, Malaysia, Philippines, Singapore, Taiwan, and Thailand) are growing rapidly. While Japan continued to file patents at high rates in the early part of this century, by 2003, the Asia-8 and China combined accounted for one-fifth of all non-U.S. patent applicants, *S&E Indicators 2006* reports. These countries' scientific expertise has increased as well, with their share of published scientific articles rising from less than 4% of the world total in 1988 to 10% in 2003.

Despite yearly declines recorded for four straight years in U.S. doctoral degrees awarded in science and engineering, the numbers nudged upward in 2003, according to the report, and enrollments in graduate S&E programs continued to climb, even during a temporary sharp drop in non-U.S. student visas following the Sept. 11, 2001, tragedy. Hitting a low point in 2003, student visas, too, have begun to recover. Between 2003 and 2004, non-U.S. graduate enrollments in U.S. universities in S&E fields increased by about 2.4%.

Members of the National Science Board also released their accompanying education policy report, *America's Pressing Challenge—Building a Stronger Foundation*. The recommendations of the report were numerous, but a few directed emphasis to specific areas such as encouraging higher-education leaders to strengthen K–8 teacher education programs to reach the youngest students with enhanced content to keep students' interest. Board members also said that equal time, in K–8 classrooms especially, should be devoted to science, math, and reading during the school day.

The National Science Board is an independent 24-member body of advisors to the president and Congress on matters of national science and engineering policy. *S&E Indicators* is updated every two years by the board to advise the president on the current status of the country's science and engineering enterprise.

### IEA Releases Report on Renewable Energy

"Renewable energy technologies are a crucial element in achieving a balanced global energy future; renewables can make major contributions to the diversity and security of energy supply and to economic development," said Claude Mandil, executive director of the International Energy Agency (IEA) on February 14 in Paris, at the launch of a new publication, *Renewable Energy: RD&D Priorities, Insights from IEA Technology Programmes*.

"Furthermore, considerable attention has been drawn to their potential for mitigating climate change," Mandil said of renewable energy technologies. He said that in 2005, IEA ministers had called for a clean, clever, and competitive energy future, and stated that renewables, as part of a balanced energy mix, will need to play a significant role in this future.

"We need to use public funds as effectively as possible in achieving this," Mandil said. "Countries must improve their market deployment strategies for renewable energy technologies and above all, increase targeted renewables RD&D [Research, Development & Demonstration]—simultaneously ensuring continued cost-competitiveness. There is much at stake."

The publication recommends priorities for this effort, drawing on studies, analy-

ses, and technology programs carried out by the IEA's technology network. It also reviews the trends in government RD&D spending and lists RD&D policies in IEA member countries.

Government energy RD&D budgets in IEA member countries increased sharply after the increase in oil prices during the 1970s. By 1987, however, the budgets had declined to about two-thirds of their peak level and thereafter stagnated until 2003. The share of renewable energy technologies in total energy RD&D spending remained relatively stable, averaging 7.6% for the whole period.

Among renewable energy technologies, the shares in global funding of biomass, solar photovoltaic, and wind have increased, while those of ocean, geothermal, and concentrating solar power have declined. The report found that United States, Japan, and Germany are the largest total spenders on energy technology RD&D, although Switzerland, Denmark, and the Netherlands are the leaders on a spending per capita basis.

The purpose of the IEA publication is to assist governments in prioritizing their RD&D efforts for renewable energy. RD&D activities have played a major role in the successful development and commercialization of a range of new renewable energy technologies in recent years, the agency reported.

The agency said that to be successful, RD&D programs need to be well focused and should be coordinated both with industry efforts to promote commercialization and competitiveness in the market and with international programs. In addition, the programs must reflect national energy resources, needs, and policies. They also need to have roots in basic science research. Issues of public acceptability, grid connection and adaptation, and managing intermittency are common to a range of renewable energy technologies and need to be addressed in government RD&D programs.

But renewable energy RD&D should not be left solely to government, said the report. Industry can be expected and should be encouraged to play a major role in the development of all technologies, whether or not they are commercially available yet.

Energy security, climate, and environmental concerns are strong drivers of

national energy policies. This was underlined by the May 2005 IEA ministerial meeting and the July 2005 G8 Gleneagles Summit. The agency reported that renewables must take on these challenges.

Each country has its own RD&D priorities based on its particular resource endowment, technology expertise, industrial strengths, and energy markets. Recent IEA analysis demonstrates the consensus that RD&D in renewable energy must be strengthened but with a caveat that priorities must be well selected in order to address policy objectives, especially as they relate to prospective cost-effectiveness. Intelligent choice of such priorities will invariably facilitate market deployment of new and improved technologies, including renewables, said the report.

### NSERC Offers "Idea to Innovation" Funding to Educators

Suzanne Fortier, president of the Natural Sciences and Engineering Research Council (NSERC) of Canada, announced in February that faculty from eligible community colleges, CEGEPs (a higher education network in Quebec), and institutes of technology can now apply as principal applicants for funding from NSERC's Idea to Innovation (I2I) program. Previously, college faculty could apply only as co-applicants with a university researcher.

The objective of the I2I program is to accelerate the development of technology and promote its transfer to Canadian companies.

"We recognize that colleges play an increasingly important role in advancing innovation and helping industry adopt new technology," said Fortier, who announced the change at an Association of Canadian Community Colleges (ACCC) symposium. "Because colleges are closely linked with local industry, they are well positioned to work in technology development and proof-of-principle research projects."

To help college faculty prepare their applications, NSERC has produced a CD describing the program and its application and evaluation procedures. NSERC staff will also be available to answer questions and provide feedback on draft applications. More information, and the I2I CD, can be obtained at tel. 613-947-9485, e-mail I2I@nserc.ca, and Web site www.nserc.ca. □

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