

### National Energy Policy Highlights R&D in Nuclear Power

The Bush administration released its National Energy Policy in May. As expected, the policy focuses on oil and gas production. However, in speeches about the policy, President George W. Bush emphasized the need to diversify sources of energy and especially promoted research and development (R&D) in nuclear energy.

Sen. Pete Domenici, R-N.M., who serves on the Senate Committee on Energy and Natural Resources, favored the policy, which is likely to increase research at Sandia and Los Alamos National Laboratories in the fields of nuclear energy and nuclear waste disposition. Earlier this year, Sen. Domenici introduced the Nuclear Energy Electricity Assurance Act of 2001 (S.472), aimed at fostering greater use of nuclear energy.

According to the administration, nuclear energy produces 20% of the electricity used in the United States, and it does not emit greenhouse gases or carbon dioxide. The policy calls for "the safe expansion of nuclear energy by establishing a national repository for nuclear waste." Sen. Frank H. Murkowski, R-Ala., who chaired the Energy and Natural Resources Committee when the policy was released, said that solving the problem of nuclear waste "has been more of a political problem than a technical one."

To modernize conservation, the policy calls for increased funding for renewable-energy and energy-efficiency R&D programs. In order to modernize the energy infrastructure, the administration wants to expand R&D on transmission reliability and superconductivity.

On the House side, when the policy was announced, Rep. Sherwood Boehlert, R-N.Y., chair of the Science Committee, praised the proposals for R&D in alternative energy and their strengthening of energy-efficiency programs. "However, I do continue to have concerns about how it [the Policy] will be carried out," he said. For example, he said, shortly before releasing the policy the administration announced its intention to roll back new standards for air conditioners. "Arguably the most potent energy-efficiency standard," Rep. Boehlert said.

Sen. Joseph Lieberman, D-Conn., corroborated the House's concerns. He said that while the policy calls for investment in renewable-energy sources, the administration has cut funding for research in its current budget. This budget setback has complicated Sen. Lieberman's plan to double non-defense R&D funding in the physical sciences in the next 10 years.

The recent change in the Senate leadership is expected to affect the priorities stated in the energy policy.

### NMAB Reviews Future Materials Needs for Defense

Among new materials concepts that may be required to meet U.S. defense needs well into the 21st century are bio-inspired materials, self-assembling polymers, novel magnetic materials, and self-healing materials, according to preliminary findings by a National Materials Advisory Board (NMAB) committee.

The Committee on Materials Research for Defense-After-Next has been studying future U.S. defense materials research and development (R&D) needs at the request of the Pentagon. Initial work began in late 1999. The committee recently released an interim report on its progress to date.

According to the report, next-generation defense systems will rely heavily on "smart" materials, which are defined as materials that are self-healing; capable of interacting independently with the local environment; and capable of monitoring the health of a structure, component, or system during operation. Smart materials will act as the host for evolving technologies such as embedded sensors and integrated antennas. Advanced materials will be called upon to deliver high performance for structures; protect against corrosion, fouling, or erosion; provide fire protection; control fractures; and act as fuels, lubricants, and hydraulic fluids. Promising composite materials and technologies to meet such needs will include carbon nanotubes, electron-beam curing, recyclable composite materials, and health-monitoring sensors.

"Most of these areas are not expected to come to fruition for at least 15 to 20 years," said Arul Mozhi, NMAB's associate director. "They represent priority areas of opportunity for DoD [Department of Defense] research investments." These areas will be necessary, Mozhi said, citing the interim report, because defense performance, life span, and maintainability goals will double in the next 20–25 years. Likewise, requirements for fabrication, cost, and availability will be twice as demanding as they are today.

The committee report states that future defense materials will have to be able to perform unique functions or combinations of functions. Such new materials include:

- lightweight materials that retain their functionality,
- materials that enhance protection and survivability,
- stealth materials,

- electronic or photonic materials for high-speed communications,
- sensor materials,
- high-energy-density materials, and
- materials for improved propulsion technologies.

The materials must possess properties such as multifunctionality, the ability to be self-healing or self-diagnosing, low cost, low maintenance, high reliability, and environmentally friendly. In addition, the materials must address several "crosscutting issues," including design, tailorability, influence on development and deployment costs, availability of commercial alternatives, risk management, manufacturing, and life cycle.

To achieve these goals, the committee expects that a combination of breakthroughs in both long-established and new materials will be necessary. Toward that end, NMAB has set up five technical panels, each of which will explore "in-depth opportunities in a given materials research area." The panels include Structural and Multifunctional Materials, Energy and Power Materials, Electronic and Photonic Materials, Functional Organic and Hybrid Materials, and Bio-Derived and Bio-Inspired Materials.

Although the committee expects "substantial commercial funding" to be available for research in telecommunications and computing, in other technical areas, DoD may have to bear the funding burden directly. "Logic dictates that in these special areas, considerable funding for fundamental research will be necessary, not only for identifying critical new materials, but also for accelerating their progress through development to applications," according to the committee report.

Mozhi said the recommendations for future materials research needs are not supposed to be tied to defense funding issues because those recommendations cover a time frame too far into the future to merit speculation about funding availability. He also said that the committee is only making recommendations to DoD and that it is up to the department to accept or reject those recommendations. "If DoD accepts them," he said, "then they could be affected by funding issues."

The final NMAB report is scheduled to be released in October 2002. Copies of the interim report, "Materials Research to Meet 21st Century Defense Needs: Interim Report (2001)," are available from NMAB, 2101 Constitution Avenue, NW, Washington, DC 20418, USA. It is also available online at <http://books.nap.edu/books/NI000333/html/index.html>.

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