NRC recommends optics and photonics research priorities

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A report from the US National Research Council, *Optics and Photonics: Essential Technologies for Our Nation,* identifies research priorities and grand challenges in the areas of optics and photonics that have the potential to advance the economy of the United States and provide visionary directions for future technology applications. The report recommends that the federal government develop a "National Photonics Initiative" to bring together academia, industry, and government to steer federal research and development funding and activities.

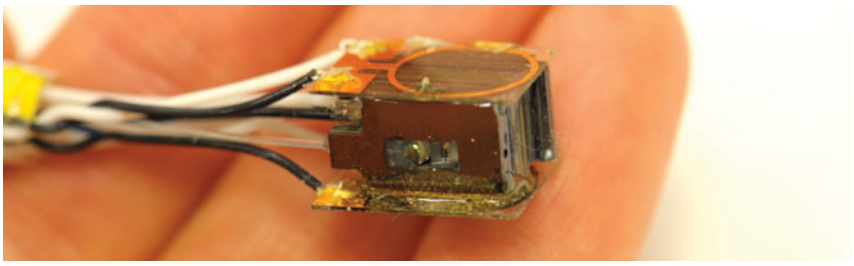
"Much is unknown when pursuing basic optical science and its transition to engineering and ultimately to products, but the rewards can be great," said Alan Willner, professor of electrical engineering at the University of Southern California and co-chair of the committee that wrote the report. "There are a number of opportunities that could change our daily lives."

"People do not think of Google as an optics company, but a typical Google data center has more than a million lasers in it," said Paul McManamon, technology director of the Ladar and Optical Communication Institute at the University of Dayton and committee co-chair. "The Internet example is only one case where work in optics and photonics may be a small part of the money invested in research, but is a critical enabler for high-tech businesses and jobs."

The committee named five grand challenges facing the country that can be addressed with advances in optics and photonics technology. The first is to keep up the pace of technological achievement established in previous decades. Others include improved military surveillance and missile defense, achieving cost parity for solar power versus fossil fuel-based power across the country's electrical grid, achieving seamless integration of photonics and electronics at the chip level, and developing optical sources and imaging tools to support increased resolution in manufacturing.

Eight particular areas of technological application are discussed in separate chapters: communications, information processing, and data storage; defense and national security; energy; health and medicine; advanced manufacturing; advanced photonic measurements and applications; strategic materials for optics; and displays. Each chapter reviews progress that has occurred since the 1998 National Research Council report, *Harnessing Light: Optical Science and Engineering for the 21st Century,* as well as the technological opportunities that have risen from recent advances in optical science and engineering. The report recommends actions for the development and maintenance of global leadership in photonics-driven industries, including both near-term and long-range goals, likely participants, and responsible agents of change.

A National Photonics Initiative will help manage the breadth of rapidly expanding applications of photonics technologies, the report says, allowing both government and industry to form coherent strategies for technology development and deployment. The recommended initiative should also spearhead a collaborative effort to improve the collection and reporting of research, development, and economic data in this sector.



This atom-based magnetic sensor measures human brain activity. Inside the sensor head is a container of 100 billion rubidium atoms (not seen), packaged with micro-optics (a prism and a lens are visible in the center cutout). The light from a low-power infrared laser interacts with the atoms and is transmitted through the gray fiber-optic cable to register the magnetic field strength. *Credit: Knappe/NIST*

Global uranium supply ensured for long term

www.oecdbookshop.org

Uranium resources and production are on the rise with the security of uranium supply ensured for the long term, according to a new report by the Organisation of Economic Co-operation and Development Nuclear Energy Agency (OECD/NEA) and the International Atomic Energy Agency (IAEA).

Uranium 2011: Resources, Production and Demand, commonly referred to as the "Red book," shows that total identified world uranium resources have grown 12.5% since 2008. However, the costs of production have also increased, leading to reductions in lower cost category resources. These figures, which reflect the situation as of January 1, 2011, mean that total identified resources are sufficient for over 100 years of supply based on current requirements.

Global uranium mine production

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increased by over 25% between 2008 and 2010 because of significantly increased production in Kazakhstan, currently the world's leading producer. The increased resource base has been achieved due to a 22% increase in uranium exploration and mine development expenditures between 2008 and 2010, which in 2010 totaled over $2 billion.

Demand for uranium is expected to continue to rise for the foreseeable future. Although the Fukushima Daiichi nuclear accident in Japan has affected nuclear power projects and policies in some countries, nuclear power remains a key part of the global energy mix. Several governments have plans for new nuclear power plant construction, with the strongest expansion expected in China, India, South Korea, and the Russian Federation. The speed and magnitude of growth in generating capacity elsewhere is still to be determined.

By the year 2035, according to the joint NEA-IAEA Secretariat, world nuclear electricity generating capacity is projected to grow from 375 GWe net (at the end of 2010) to between 540 GWe net in the low demand case and 746 GWe net in the high demand case, increases of 44% and 99%, respectively. Accordingly, world annual reactor-related uranium requirements are projected to rise from 63,875 tons of uranium metal (tU) at the end of 2010 to between 98,000 tU and 136,000 tU by 2035. The currently defined uranium resource base is more than adequate to meet high-case requirements through 2035 and well into the foreseeable future, according to the report.

Although ample resources are available, meeting projected demand will require timely investments in uranium production facilities. This is because of the long lead times (typically on the order of 10 years or more in most producing countries) required to develop production facilities that can turn resources into refined uranium ready for nuclear fuel production.

With uranium production ready to expand to new countries, efforts are being made to develop transparent and well-regulated operations similar to those used elsewhere to minimize potential environmental and local health impacts. Although not the primary focus of the "Red Book," activity updates on the environmental aspects of the uranium production cycle are included in the national reports in this edition.

While the status of supply and demand is considered from the perspective of technologies currently in use, the deployment of advanced reactors and fuel cycle technologies can also positively affect the long-term availability of uranium, conceivably extending the time horizon of the currently defined resource base to thousands of years.

These are some of the findings in *Uranium 2011: Resources, Production and Demand,* a joint study by the OECD/NEA and the IAEA, carried out in cooperation with their member countries and published in July 2012. This is the 24th edition of this periodic assessment (currently every two years), which has been published since the mid-1960s. The report can be ordered at website www.oecdbookshop.org. □

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