

DOE Panel on Advanced Energy Storage Systems Calls for Materials Research

Transformational changes in electrical energy storage are needed to assure a secure energy future, according to panelists in a recent Department of Energy workshop; and basic research in materials, systems design, and modeling will make these changes possible, they said.

Advanced energy storage systems have the potential to reduce the need for reserve power plants and cut the cost of power failure because stored energy can correct for long- and short-term fluctuations in the grid. The systems can also make renewable energy sources, such as wind and solar energy, more efficient by storing their variable power output and distributing this energy as needed. Another important application is in hybrid electric vehicles.

Population growth, increasing energy demand, and a better understanding of the environmental impacts of current means of energy production make it imperative to create advanced energy storage systems, according to the panelists. And, the panelists said, recent progress in battery and capacitor technology give reason to hope that such systems can be developed to make energy use more efficient and environmentally friendly.

More than 100 experts on batteries and electrochemical capacitors met in the Washington, DC area at the beginning of April for the workshop. They spent a concentrated three days identifying the basic research needs and opportunities underlying chemical and capacitive electrical storage devices as part of *Basic Research Needs for Electrical Energy Storage*, a workshop sponsored by the Department of Energy's Office of Basic Energy Sciences (BES).

Engineering alone cannot take electrical energy storage systems from their present performance levels to the levels required for efficient and affordable systems, said workshop chair John Goodenough of the University of Texas–Austin. Revolutionary advances are needed—advances that he and the other participants believe will only come about through focused basic research.

One of the recurring themes during the workshop was the need for more extensive materials characterizations and new materials. For example, a panel on chemical storage, led by Steven Visco from Lawrence Berkeley National Laboratory and Stan Whittingham from Binghamton University, called for more data on the thermodynamic and kinetic properties of materials commonly used in battery design.

The panel cited other needs such as cells of higher voltage, storage capacity, and service life without compromising safety. Exploration of the special properties of nanomaterials, elucidation and control of the chemistry of electrode/electrolyte interfaces, and replacement of dead-weight constituents with multifunctional materials are some of the highest priority research needs. To meet these challenges, the panel concluded, materials need to be pushed to the edge of their stability.

A panel on capacitive storage science, led by Bruce Dunn from the University of California–Los Angeles and Yury Gogotsi from Drexel University, cited similar needs. Some of the needs they highlighted were the ability to create charge storage materials by design and the investigation of new materials for pseudocapacitors and hybrid devices.

Both groups discussed the importance of creating accurate models of the storage system components and of utilizing emerging experimental techniques to obtain transport and structural data in real time during the charge and discharge of a storage system. A cross-cutting panel addressed the potential of new computational and experimental techniques to address these critical issues.

The workshop participants were primarily from national, university, and industry laboratories and included a number of international scientists. Workshop activities included opening and closing plenary sessions, but the majority of the three days were spent in panel discussions on chemical storage science, capacitive storage science, and cross-cutting science.

Each panel was responsible for identifying the major roadblocks to success in their area, the science and technology challenges that need to be overcome, and the research directions that should be given the highest priority in the near future.

This workshop was part of a series of “Basic Research Needs” workshops hosted by BES. Past workshops have included Basic Research Needs for the Hydrogen Economy and Basic Research Needs for Solid-State Lighting, among others. The goal of this series, according to BES, is “to identify the basic research needed to assure a secure energy future.”

The results from previous BES workshops have been instrumental in bringing attention and funds to the basic research needs highlighted in the reports. Electrical energy storage is likely to see an increased investment as well, especially since efficient and environmentally friendly energy-producing techniques have been high on President Bush's agenda.

A thorough report on the outcome of the workshop will be made available on the BES Web site, www.er.doe.gov/bes/BES.html.

KENDRA RAND

United States and Japan Sign Joint Nuclear Energy Action Plan to Promote Nuclear Energy Cooperation

U.S. Department of Energy Secretary Samuel W. Bodman and Japan's Ministers Akira Amari, Bunmei Ibuki, and Taro Aso presented the United States–Japan Joint Nuclear Energy Action Plan to U.S. President George W. Bush and Japanese Prime Minister Shinzo Abe at the end of April. The Action Plan—a product of extensive negotiations between the United States and Japan—provides a framework for increased collaboration in nuclear energy. It builds upon the significant, longstanding civilian nuclear cooperation between the two nations and will contribute to increasing energy security and managing nuclear waste, addressing nuclear nonproliferation and climate change, and advancing goals put forth in President Bush's Global Nuclear Energy Partnership (GNEP) initiative, according to the U.S. Department of Energy.

“By strengthening our joint cooperation in civil nuclear energy, the United States and Japan will also strengthen our strategic interests,” Secretary Bodman said. “This Action Plan is an historic agreement and provides the additional foundation for our two nations to align efforts to support the global expansion of nuclear energy, and ultimately a nuclear renaissance. Not only can nuclear energy serve as a cornerstone of sustainable economic development, but as a reliable, viable and emissions-free source of power, it offers enormous potential to help meet the world's increasing demand for energy in a safe and proliferation-resistant manner.”

Completed and signed by all parties by April 18, 2007, the Action Plan fulfills the commitment made by Secretary Bodman and Minister Amari during their meeting in Washington, DC, on January 9, 2007, to develop an action plan for nuclear energy cooperation. According to DOE, this Action Plan establishes the necessary framework to coordinate activities designed to promote the expansion of safe and secure nuclear power in the respective countries, and globally. It also formalizes an agreement between the two countries—leading nuclear technology countries—to collaborate in four main areas, and provides the additional foundation for the United States and Japan to align efforts in sup-

port of global expansion of nuclear energy, according to DOE.

The four main areas outlined in the Action Plan are

1. Cooperation of nuclear energy research and development under GNEP;
2. Collaboration on policies and programs that support the construction of new nuclear power plants;
3. Establishment of a nuclear fuel supply assurance mechanism; and
4. Joint collaboration to support the safe and secure expansion of nuclear energy in interested countries while promoting non-proliferation, consistent with GNEP.

Implementation of the Action Plan will begin immediately. Its execution will be overseen by a Steering Committee, co-chaired by the United States and Japan. Both countries will establish GNEP research and development working groups in the following areas, to benefit from each other's expertise and implement areas of cooperation identified in the Action Plan:

- Fast Reactor Technology;
- Fuel Cycle Technology; Simulation and Modeling;
- Small and Medium Reactors;
- Safeguards and Physical Protection; and
- Waste Management.

The United States and Japan share the objectives of establishing a global framework to expand nuclear energy use and minimize proliferation risks while enabling the benefits from the peaceful uses of nuclear energy. Both countries support the development of a global nuclear energy infrastructure as envisioned in GNEP to develop innovative nuclear reactor and fuel cycle technolo-

gies. GNEP seeks to bring about a significant, wide-scale use of nuclear energy worldwide, and to take actions that will allow that vision to be achieved, while decreasing the risk of nuclear weapons proliferation and effectively addressing the challenge of nuclear waste disposal.

EU-Funded Project Drafts Roadmap for Electronics Production

A pan-European research project dedicated to encouraging the continued integration of the European electronics sector recently produced a roadmap that will help firms navigate future challenges. The roadmap highlights potential pitfalls players may face in coming years and drafts tenable solutions for the European electronics sector. The roadmap is the culmination of a three-year-long research initiative by the European Lead-Free Soldering Network, or ELFNET. The network was designed as a platform to streamline communication and networking among stakeholders in the electronics sector to focus on long-term sustainability and ensure, among other things, compliance with strict environmental standards at European level.

The recently published roadmap, "The Future of European Electronics Interconnection," synthesizes data collected from different markets across Europe to present a pan-European perspective on the future of the sector. It details how key factors such as lead-free soldering, sustainability, and miniaturization are impacting the interconnection supply chain, materials, and processes critical to the market. It highlights 50 specific challenges players can expect to face in the coming years that will need to be addressed through dedicated research and development (R&D) efforts. ELFNET recommends which direc-

tion researchers in the sector should take to help navigate a future market characterized by increased competition and regulatory challenges.

Jeremy Pearce, ELFNET coordinator, commented on the need for a concerted effort on the part of the research community to address such challenges. "The ELFNET roadmap is a major deliverable from the ELFNET project. It is an important step forward in focusing European research on investment toward collectively agreed high priority topics," he said. "With this tool, ELFNET has met its key objective, addressing the challenges of fragmentation, disjointed funding mechanisms, and poor communication in the European research environment."

Two European Directives, the European Union Waste Electrical and Electronic Equipment Directive (WEEE) and the Restriction of Hazardous Substances Directive (RoHS), are designed to secure the European Union's position at the forefront of sustainable and environmentally sound production practices. As a result, industry is forced to adapt through innovative research programs, and ELFNET has come together to help business through the radical shift to lead-free soldering, which is expected to drastically reduce the use of lead in the electronics industry.

"It is clear from the roadmap that there is a vast amount of work needed to address current business drivers, environmental, and consumer pressures," Pearce said. "From the perspective of lead-free soldering, there remain major unsolved issues. Urgent concerns over a lack of knowledge in reliability issues have to be addressed and are a focus for high reliability applications, such as aerospace and defense." □

Register Today for MEETING SCENE...

a FREE electronic newsletter covering MRS meetings from around the world

DON'T MISS A MINUTE OF THE ACTION.

Register today at www.mrs.org/alerts and let MRS bring the world of materials to your desktop!

Coverage for 2007 includes summaries of technical presentations and events by on-the-spot reporters at:

International Conference on Materials for Advanced Technologies (ICMAT 2007)

Singapore • July 1-6

XVI International Materials Research Congress

Cancun, Mexico • August 19-23

10th IUMRS-ICAM

Bangalore, India • October 8-13

VI SBPMat - 6th Brazilian MRS Meeting

Natal, Brazil • October 28 - November 1

2007 MRS Fall Meeting and Exhibit

Boston, USA • November 26 - 30, 2007