DOE aims to overcome energy-storage challenges

http://energy.gov/hubs

Over the next five years, the US Department of Energy (DOE) will invest up to $120 million in a new large-scale, collaborative effort to accelerate the pace of energy-storage research and development. Focused on the areas of transportation and the electrical grid, DOE is establishing an Energy Innovation Hub for Batteries and Energy Storage in fiscal year 2012. The hub will be a center for multidisciplinary research and engineering aimed at overcoming the technological barriers to progress in energy storage, many of which are deeply rooted in materials chemistry and structure. The selection of institutions for this hub will be made later this year.

"The Batteries and Energy Storage Hub will pursue cutting-edge research to improve electrochemical energy-storage technology, as well as explore entirely new materials, architectures, and approaches for transportation and utility-scale storage," said Linda Horton, director of the Materials Science and Engineering Division within the DOE Basic Energy Sciences program.

Hubs are composed of teams of scientists and engineers from many disciplines that work together under one roof toward a specific end, modeled in part after highly collaborative programs such as the Manhattan Project and AT&T Bell Laboratories. Energy Innovation Hubs support high-risk, high-reward research and development efforts in critical energy areas, in order to lower the risk enough for private industry to take over.

The Batteries and Energy-Storage Hub will be managed by the DOE Basic Energy Sciences (BES) program in close cooperation with relevant DOE technology offices, and will be funded at a level of $20 million for fiscal year 2012. BES will award the Hub based on a peer review of applications that are currently being developed by a lead institution, or set of institutions. The Batteries and Energy-Storage Hub applications will propose the infrastructure, management structure, and research goals, and will define how the hub will create a culture of innovation.

Although specific priorities will be defined by the lead institution, overarching challenges include improving the lifetime and range of vehicle batteries and better integrating renewable energy sources into the electric grid. The characterization, creation, and control of materials will play a key role in meeting these challenges, as discussed in the report *Basic Research Needs for Electrical Energy Storage (EES)*, based on a 2007 BES workshop.

"Revolutionary breakthroughs in EES have been singled out as perhaps the most crucial need for this nation's secure energy future," reads the report. "Recent advances have provided the ability to synthesize novel nanoscale materials with architectures tailored for specific performance; to characterize materials and dynamic chemical processes at the atomic and molecular level; and to simulate and predict structural and functional relationships using modern computational tools. Together, these new capabilities provide unprecedented potential for addressing technology and performance gaps in EES devices."

Creating an Energy Innovation Hub focused on batteries and energy storage is one avenue by which DOE is addressing these large technological challenges, but the approach is multifaceted. Other avenues include

- fundamental research awards from core BES programs made to single and small groups of researchers;
- Energy Frontier Research Centers (EFRCs), which address fundamental research related to the grand challenges identified in previous BES workshops, involving 12–20 researchers and led by universities, national laboratories, nonprofit organizations, or industry;
- ARPA-E awards made to a single investigator, small groups, or small teams for high risk but potentially transformation research; and
- developmental research and technology demonstration awards from the Energy Efficiency and Renewable Energy (EERE) program and the Office of Electricity made to research teams working in conjunction with industry.

In collaboration with these efforts, the Batteries and Energy-Storage Hub could lead to next-generation electrochemical energy-storage systems that could greatly enhance the capabilities of the electrical grid and electric vehicles, thereby reducing US dependence on foreign oil. According to Horton, this hub will link fundamental science and engineering research to technology and end-users in a way that is likely to lead to rapid and meaningful advances.

In total, five Hubs received funding for fiscal year 2012. The Batteries and Energy-Storage Hub and the Critical Materials Hub, another new hub that will be managed by EERE, each received $20 million for fiscal year 2012 and up to $25 million per year for the following

ActaCell, a US-based corporation formed in 2007 by exclusively licensing Li-Ion technologies developed at the University of Texas at Austin Material Sciences Program, created a Power Cell that is 3.5 times more powerful than the battery used in the Toyota Prius.

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four years, pending Congressional appropriations. Three hubs established in 2010 each received $24 million: Fuels from Sunlight, Energy Efficient Systems Design, and Modeling and Simulation for Nuclear Reactors.

For detailed information on the Battery and Energy-Storage Hub and the Fuels from Sunlight, both of which are managed by the DOE Basic Energy Sciences program, visit http://science.energy.gov/bes/research/doe-energy-innovation-hubs/. General information about all of the hubs is available on the DOE website http://energy.gov/hubs.

Kendra Redmond

EC releases report analyzing strategic energy technologies
http://ec.europa.eu/dgs/jrc

A new edition of the European Commission (EC) Strategic Energy Technologies review has been published. This "2011 Technology Map," produced by the EC's in-house science service, the Joint Research Centre (JRC), provides a European and worldwide analysis of 15 low-carbon energy technologies, energy efficiency in industry, energy performance of buildings, and electricity storage in the power sector. Compared with the 2009 Technology Map, the steep increase of wind and solar (photovoltaics) generation capacity in the European Union (EU) and worldwide is highlighted. On a global scale, hydropower continues to be the technology most widely used, providing 88% of electricity generated from renewable sources.

The study provides data covering the full spectrum of the energy system, allowing policymakers and the research community to identify potential opportunities and gaps to achieve the transition to a low-carbon society. A necessary condition for the timely market rollout of some of these technologies is an acceleration of their development and demonstration.

Among the updated data are findings that show that the wind sector has seen significant changes in 2010 as compared to 2008, with deployment growing 29% in the EU to 84.3 GW of installed capacity and 65% globally (to 200 GW), largely driven by China.

Photovoltaics electricity-generation capacity worldwide has continued its growth rate, almost tripling from 14 GW in 2008 to 39 GW in 2010 (and 70 GW at the end of 2011). With a total installed capacity of almost 30 GW in the EU, the Member States have made a significant step toward the target of 84 GW they committed in the National Renewable Energy Plans for 2020.

Since the adoption of the EU Renewables Directive in 2009, the development of advanced biofuel production processes has rapidly gathered pace. Major oil companies are now involved in large-scale demonstration projects in Europe and North America using non-food, waste, and lignocellulosic feedstocks, mainly to produce bioethanol. The EU National Renewable Energy Action Plans predict that advanced biofuels will contribute 2.7 Mtoe to the transport sector by 2020, approximately 11% of the total biofuel contribution.

Hydropower is the most widely used form of renewable energy with 3190 TWh generated worldwide in 2010. This corresponds to 16% of the global gross electricity generation and 88% of electricity from renewable resources. Moreover, the global hydropower potential is considered to be around 7500 TWh/y. In the EU, hydropower accounts for 11.6 % of gross electricity generation. Nevertheless, the European hydropower potential is already relatively well exploited and expected future growth is limited.

About 37% of final energy consumption is taken by the building sector (households and services), with roughly two-thirds used for space conditioning (temperature and ventilation), and the remaining one-third is mostly electricity used for installations and appliances. The requirement of nearly zero energy buildings from 2018 to 2020, as mentioned in the EU directive on energy performance of buildings, requires the development of new design approaches, supported by short- and long-term research activities, focusing more on the energy flows in, to, and from the buildings. The JRC is supporting European legislation by assessing technical requirements for standardization in relation to energy performance of buildings.

Power storage technologies have gained increased interest in the light of developments in renewables and distributed generation. Also, a new chapter in the 2011 Technology Map looks at the energy efficiency and CO_2 emission reduction measures being undertaken in the cement, iron and steel, and pulp and paper industries. □

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