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Basic Science for a Secure Energy Future

LINDA HORTON, Department of Energy

Anticipating a doubling in the world's energy use by the year 2050 coupled with an increasing focus on clean energy technologies, there is a national imperative for new energy technologies and improved energy efficiency. The Department of Energy's Office of Basic Energy Sciences (BES) supports fundamental research that provides the foundations for new energy technologies and supports DOE missions in energy, environment, and national security. The research crosses the full spectrum of materials and chemical sciences, as well as aspects of biosciences and geosciences, with a focus on understanding, predicting, and ultimately controlling matter and energy at electronic, atomic, and molecular levels. In addition, BES is the home for national user facilities for x-ray, neutron, nanoscale sciences, and electron beam characterization that serve over 10,000 users annually. To provide a strategic focus for these programs, BES has held a series of "Basic Research Needs" workshops on a number of energy topics over the past 6 years. These workshops have defined a number of research priorities in areas related to renewable, fossil, and nuclear energy – as well as cross-cutting scientific grand challenges. These directions have helped to define the research for the recently established Energy Frontier Research Centers (EFRCs) and are foundational for the newly announced Energy Innovation Hubs. This overview will review the current BES research portfolio, including the EFRCs and user facilities, will highlight past research that has had an impact on energy technologies, and will discuss future directions as defined through the BES workshops and research opportunities.