

# ENERGY SCIENCES COALITION

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## Statement for the Presidential Transition

**Strong support of the U.S. Department of Energy Office of Science will enhance energy security, build the economy, and restore America's competitive edge in science and technology.**

The Energy Sciences Coalition (ESC) is a broad-based coalition of organizations representing scientists, engineers and mathematicians in universities, associations, industry, scientific societies and national laboratories who are committed to supporting and advancing the scientific research programs of the U.S. Department of Energy (DOE) Office of Science.

For more than half a century, the federal government has pursued a strategy of investing in fundamental research on the principle that the United States benefits broadly from this investment over time. The Energy Sciences Coalition urges the new administration to make an early commitment to strongly support the DOE Office of Science to advance the nation's technological leadership and economic competitiveness. Specifically, we recommend:

- **prioritize investment in basic research sponsored by the Office of Science to spur innovation and grow the U.S. economy,**
- **support the next generation of American scientific talent,**
- **continue to build and fully leverage world-class scientific tools and facilities,**
- **support the network of DOE National Labs to solve important energy, environmental, and national security challenges, and**
- **expand U.S. international leadership in science.**

The DOE Office of Science is an established leader among federal agencies that enables scientific advancements and pushes forward the frontiers of knowledge to advance our nation's energy, economic and national security interests. It is currently the nation's largest federal sponsor of basic research in the physical sciences and it has played an especially important role in recent decades. DOE Office of Science curiosity-driven research has yielded the knowledge necessary to, among other things, develop high-energy storage capacity lithium batteries, energy efficient superconducting wires, DNA sequencing technology, improved medical imaging technology, and detectors to identify concealed nuclear weapons and land mines. The impact the Office of Science has had on U.S. industrial growth is also often unappreciated. For example, Office of Science high performance computers have helped U.S. small, medium, and large-scale businesses bring new products to market faster and at lower cost, such as more fuel-efficient engine designs and jet engines, and basic research investments in chemistry have led to the world's first 3D printed lithium ion batteries. For these reasons, the DOE Office of Science has broad bipartisan support and is recognized as a leader in securing our nation's energy future.

### **Increase the budget for all DOE Office of Science programs:**

The DOE Office of Science plays a critical role in ensuring U.S. leadership in many scientific fields, both in pursuit of fundamental discovery and to advance science for cleaner energy production, storage and transmission. The Office of Science is the primary government sponsor for research in high energy and nuclear physics, heavy-element chemistry, plasma physics, magnetic fusion, and catalysis. It is also a leading research sponsor for advanced materials, biological sciences, and computing relevant to a broad range of energy applications. Strong and sustained funding is required to advance U.S. leadership in these long-term research-intensive disciplines that are critical to both our energy security and our national security.

Basic and fundamental research and related scientific facilities are critical to our economic growth, energy security, national security and global competitiveness. ESC recommends no less than a four percent annual increase in the Office of Science over the next five years. The United States' research enterprise is at a critical inflection point. With many nations increasing their research investments in order to stimulate economic growth and the United States' investments remaining flat, we risk losing our competitive edge. China, India, South Korea, the European Union and others are mirroring our approach to innovation and are expanding their investments in scientific research and facilities. A recent study (Global Innovation Index 2016) ranks the United State fourth among world leaders in innovation, and the U.S. has fallen to tenth place in dollars invested in research as a percentage of GDP.

Additionally, many U.S. companies rely on the advancements created by the fundamental, curiosity-driven research funded by the DOE Office of Science. As noted by the American Academy of Arts and Sciences in its 2014 report *Restoring the Foundation: The Vital Role of Research in Preserving the American Dream*, "There is a deficit between what America is investing and what it should be investing to remain competitive, not only in research but in innovation and job creation." The report recommends at least four percent real annual increases in funding for key federal research agencies, including the DOE Office of Science. This level of funding was endorsed in June 2016 by more than 500 businesses, universities, scientific societies and national organizations in a national call to action – *Innovation: An American Imperative*. CEOs of major corporations such as John Deere, Northrop Grumman, Merck, Lockheed Martin, Boeing, Novartis, and Microsoft signed the *Innovation Imperative*.

### **Harvest the fruits of our scientific investment for U.S. economic growth:**

In the 20<sup>th</sup> century, the United States became the world's most outstanding example of a nation that profited from its national investment in science. While the economic impact of this investment is difficult to calculate, some estimates show that science-driven innovation in the U.S. has fueled half of the nation's economic growth since World War II. Today, the growth of our economy and American leadership around the globe depends on technological innovation more than ever before – and the DOE Office of Science is one of the leading federal drivers of the science that helps meet that need.

Over the last decade, the DOE Office of Science has made key science investments to advance U.S. leadership in energy technologies. For example, fundamental research in nanostructured cathode materials led to the production and deployment of high-energy lithium ion batteries used by car companies for electric vehicles; better understanding of the chemistry of sprays of diesel fuel led to the design of a new, more energy-efficient diesel engine for Cummins, which is used in all Dodge Ram pickup trucks; and interest in how organic films harvest invisible light and generate electricity resulted in the commercialization of a thin film that uses solar energy to power tablets, digital signage, wearable devices, and even buildings as a type of window coating. New investments in subsurface science will inform carbon capture and storage technologies, reduce the cost of environmental remediation, and reduce the footprint and cost of oil and gas extraction.

Recommendation: Take full economic advantage of the progress achieved through past federal investments by continuing fundamental scientific research in the Office of Science that helps American industries become more competitive, through the infusion of new ideas and technologies into the marketplace.

#### **Support the next generation of American scientific talent:**

The DOE Office of Science supports a diverse portfolio of research at colleges and universities nationwide. It sponsors half of all university physics research and more than 24,000 Ph.D. scientists, engineers, graduate students, undergraduates and technical personnel at more than 300 institutions through competitively awarded grants. DOE-funded research and education programs strengthen our nation's scientific knowledge base and prepare the next generation of scientists and engineers by providing hands-on experience for students. Without adequate support for these programs, our students will not be properly trained for the demands of technology-intensive industries.

Recommendation: Continue to invest in the future of the American technical workforce, by supporting programs that train students to be the kind of skilled workers tomorrow's U.S. industries will require.

#### **Continue to build world-class scientific tools and facilities:**

The DOE Office of Science supports the operation of the largest collection of major scientific user facilities in the world, which are too large and costly for any one institution or company to build or operate on its own. Located at national laboratories and universities around the country, these open-access facilities include particle accelerators, experimental reactors, high-precision instruments, synchrotrons and light sources, leadership-class supercomputers and high-resolution mass spectrometers. Annually, more than 30,000 researchers from U.S. industry, universities and federal agencies from all 50 states rely on these facilities to support their scientific and engineering needs. Nearly half of the DOE facility users are university and federal investigators working to answer fundamental science questions. More than fifty Fortune 500 companies and 150 small businesses use these facilities to do the underlying research required to develop new technologies and products that drive the economy. U.S. industry has used Office of Science scientific facilities to develop a broad range of new products, such as lifesaving new drugs, such as KALETRA (for treating HIV), ZELBORAF (for treating melanoma) and Votrient (for treating renal cell carcinoma); better fuel injector designs for more energy-efficient engines; new instruments to examine the size of pores in gas-producing shales for more economical natural gas extraction; and advanced microprocessors for the computing industry. Industry pays to use these federally-funded facilities for proprietary work; but if not for DOE, U.S. researchers would have no access to these vital scientific tools or would have to look overseas to find the tools needed for their research.

Recommendation: Commit to continued support for the tools and facilities that enable innovation both in fundamental discovery science and in industry, big and small.

#### **Maintain robust support for the DOE National Labs:**

The DOE Office of Science is also responsible for stewarding a system of ten national laboratories. The government-owned, contractor-operated (GOCO) operation model used for U.S. Federally Funded Research and Development Centers (FFRDCs) is based on the success of the Manhattan Project, which was a government-university-industry partnership model that combined the most sophisticated academic research talent with the best industry engineering and management expertise to solve the most compelling national problems. The same cooperative enterprise that was used to build the atomic bomb and win World War II, is now employed by the national laboratories to bring together multidisciplinary teams of scientists and engineers and steward one-of-a-kind scientific research facilities to secure American access to abundant, clean, cheap, and reliable energy, strengthen its economic competitiveness, and deter the use

and prevent the spread of nuclear weapons and materials. The national laboratories work together to deliver scientific discovery and innovation and serve the national interest, and their impact has been profound. Since 1999, more than 80 Nobel Prizes and 542 R&D 100 Awards have been awarded to DOE national laboratory scientists.

Recommendation: Continue supporting our nation's unique, multidisciplinary national laboratory system, which has a distinguished record of advancing basic science and applied technology to serve America's economic, energy, environmental and national security interests.

**Expand U.S. leadership internationally in science and technology:**

Strong and sustained funding for DOE Office of Science programs is vital to the U.S. retaining its competitive edge. Countries in Europe and Asia are aggressively investing in the physical sciences in an effort to challenge U.S. dominance and are building state-of-the-art facilities to attract the best researchers and scientists from around the world. In some instances, the U.S. benefits from international cooperation. Science is becoming increasingly global. The U.S. cannot afford to build all state-of-the-art scientific facilities on U.S. soil, but it can participate in international collaborations to advance scientific discovery. For example, the Large Hadron Collider (L.H.C.) – best known for the discovery of the elementary particle, the Higgs boson, in 2012 – is located in Switzerland, cost \$10 billion to construct and includes an accelerator ring 17 miles in circumference, straddling two nations. The U.S. joined this international collaboration, is a large contributor to the project, and now sends the largest contingent of scientists to use the facility. In other cases, the U.S. must invest in new facilities to maintain U.S. leadership and cannot afford to sit on the sidelines while the next generation of large-scale, scientific facilities are constructed and operated by other nations. For example, the U.S. should capitalize on the first-ever large-scale international investments in science on U.S. soil, such as for the Long Baseline Neutrino Facility, to guarantee continued U.S. leadership in high energy physics and other areas of fundamental scientific exploration. Knowledge knows no international boundaries, and the U.S. needs to remain a leader so that our scientists and engineers can capitalize and leverage the best ideas wherever they emerge.

Recommendation: Continue the U.S.'s historic commitment to international leadership in science and technology, which is vital to our national security and our economic well-being.

The Energy Science Coalition looks forward to working with the new Administration in support of the DOE Office of Science.

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## ESC Membership

Agronomy, Crop and Soil Science Societies  
American Association for the Advancement of  
Science  
American Astronomical Society  
American Chemical Society  
American Geophysical Union  
American Geosciences Institute  
American Institute of Physics  
American Mathematical Society  
American Physical Society  
American Society for Engineering Education  
American Society of Agronomy  
American Society of Mechanical Engineers  
American Society for Microbiology  
American Society of Plant Biologists  
Arizona State University  
Association of American Universities  
Association of Public and Land-grant  
Universities  
Battelle  
Binghamton University  
Biophysical Society  
Boston University  
Case Western Reserve University  
Clemson University  
Coalition for Academic Scientific Computation  
(CASC)  
Columbia University  
Computing Research Association  
Cornell University  
Cray Inc.  
Crop Science Society of America  
Duke University  
Federation of American Societies for  
Experimental Biology  
Florida State University  
Fusion Power Associates  
General Atomics  
Geological Society of America  
George Mason University  
Georgia Institute of Technology  
Harvard University  
IBM  
IEEE-USA  
Iowa State University  
Jefferson Science Associates, LLC  
Krell Institute  
Massachusetts Institute of Technology  
Materials Research Society  
Michigan State University  
Michigan Technological University  
Northern Illinois University  
Northwestern University  
Oak Ridge Associated Universities (ORAU)  
Pace University  
Pennsylvania State University  
Princeton University  
Purdue University  
Rensselaer Polytechnic Institute  
Rutgers, The State University of New Jersey  
Society for Industrial and Applied Mathematics  
Soil Science Society of America  
South Dakota School of Mines  
Southeastern Universities Research  
Association  
Stanford University  
Tech-X  
The Ohio State University  
The Optical Society (OSA)  
University of California System  
University of Chicago  
University of Colorado Boulder  
University of Delaware  
University of Iowa  
University of Maryland, College Park  
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University of Missouri System  
University of North Texas  
University of Pennsylvania  
University of Southern California  
University of Texas at Austin  
University of Wisconsin-Madison  
Vanderbilt University  
Washington State University  
Washington University in St. Louis  
West Virginia University