ENERGY SCIENCES COALITION

December 17, 2020

Dear Dr. Arun Majumdar and DOE Transition Team Members:

The Energy Sciences Coalition (ESC) thanks you for your public service. As you prepare policy and funding recommendations for the incoming Biden Administration, ESC urges you to prioritize investments in the Department of Energy (DOE) Office of Science. The DOE Office of Science is critical to advancing the fundamental science and early-stage energy technologies necessary to achieve ambitious net-zero goals; developing Industries of the Future and emerging technologies; and maintaining the highly skilled science and technology workforce that is essential for the United States to compete globally.

Scientific breakthroughs and energy technology innovation are still necessary to decarbonize the U.S. economy and mitigate the worst effects of climate change. Office of Science-supported fundamental research forms the foundation for future energy technologies. The current imperative—energy systems that meet our energy security, economic, and environmental challenges—requires continued, robust investments in all areas of fundamental research to advance all energy systems, including energy storage, negative emission technologies, advanced nuclear, hydrogen, fusion, renewables such as wind and solar, carbon capture, storage and utilization, and next-generation fuels. We encourage you to bring the programs, capabilities, and expertise of the Office of Science to bear in all these areas and to better integrate its work with the applied energy offices to accelerate progress.

Bold new investments in fundamental research are needed to stay ahead of international competition, maintain U.S. competitiveness, and create American jobs of the future in key energy sectors as well as new technology areas such as high-performance computing, artificial intelligence, biotechnology, and quantum information science. Given the current competitive landscape, ESC recommends significant increases in funding for the DOE Office of Science in the fiscal year 2022 President's budget request. Specifically, this funding is needed to:

- grow core research at national laboratories and research universities in the physical sciences, biological sciences, advanced materials, geosciences, computing and engineering to help develop future energy technologies and fully utilize new and updated world-class facilities and cutting-edge instrumentation, especially with ambitious goals to achieve net-zero emissions economy-wide no later than 2050;
- prepare the next generation of American scientific and engineering talent through competitively awarded grants and significantly expand existing education programs, such as the DOE Office of Science Graduate Fellowship and Computational Sciences Graduate Fellowship, while also creating new programs to address the nation's growing workforce needs in STEM and energy industries as well as meaningfully tackle issues of diversity, equity, and inclusion;

- accelerate the construction and upgrades of world-class scientific user facilities and maximize operations to support the more than 36,000 researchers from academia, industry and federal agencies that rely on these facilities for their science and engineering pursuits;
- advance new, strategic investments in innovative high-risk, high-reward research areas, such as quantum science and technology, genomics and engineering biology, microelectronics, next-generation communications, accelerator and laser systems, and artificial intelligence and scientific machine learning, and
- maintain and grow multi-disciplinary centers focused on addressing scientific grand challenges, such as Energy Frontier Research Centers, Bioenergy Research Centers, Energy Innovation Hubs, and national quantum information science research centers as well as artificial intelligence co-design and microelectronics research centers.

To help guide these investments, ESC strongly recommends following the advice on research priorities and infrastructure investments of the six DOE Office of Science federal advisory committees. Since their inception, the Office of Science advisory committees have provided valuable, independent advice on complex scientific and technical issues and they have been essential for engaging the scientific community in open and transparent processes related to user facility planning, assessment, ranking and prioritization. They also help establish consensus across the scientific community on research priorities and goals. Recent examples include the fusion energy and plasma science long-range plan and recommendations on a future U.S. domestic high-performance reactor-based research facility for materials research and other applications.

DOE Office of Science is unique among federal science agencies, supporting the network of 17 DOE national laboratories—the crown jewels of the nation's research and innovation ecosystem— and directly stewarding ten of them. The DOE Office of Science also builds and operates the most sophisticated, world-class scientific user facilities used by research universities, industry and most federal agencies.

Another unique feature is science at scale. The DOE Office of Science has a long history of combining the talent and capabilities of the national laboratories' unique science facilities, the country's leading research universities, and industry to bring together multi-disciplinary teams to tackle fundamental science, energy, and national security grand challenges. The most recent examples are the national quantum information science research centers and the nation's response to COVID-19.

The DOE Office of Science will continue to play an important role in the COVID-19 response as well as future pandemics and should receive continued support. The DOE Office of Science established multi-disciplinary teams from all 17 national labs to address critical needs, such as improving capabilities for and ensuring effective detection of infection; expediting discovery of therapeutic drugs, including antibodies and antivirals, to complement vaccine development; providing epidemiological and logistical support to Federal, state and local decision-makers to more accurately forecast disease transmission; addressing supply chain bottlenecks for PPE, test kits, and ventilators; and understanding the spread of the virus in buildings and public spaces to assist in reopening the economy. Having demonstrated significant impact, investments in the DOE Office of Science should be sustained for ongoing response to COVID-19 and for improved preparedness and science-based understanding to address future biological events.

ESC again urges you to prioritize funding for early-stage research and demonstrate to our global counterparts that the United States has no intention of ceding its leadership in science and technology. To maintain this leadership and support proposed energy and climate change Earthshots, better transfer of knowledge and early technology development from the Office of Science to the applied energy offices is also essential to take full advantage of demonstration and technology commercialization efforts.

The United States must maintain its leadership in science, technology and innovation, and the DOE Office of Science plays a pivotal and leading role in addressing this country's energy, national security, and environmental challenges. We look forward to working with you in advancing the critical missions of the DOE Office of Science.

Sincerely,

Christopher Carter
Co-chair
610-216-5656
ccc317@lehigh.edu

Leland Cogliani
Co-chair
202-289-7475
Leland@lewis-burke.com

Enclosed:

- Appendix I: Additional information on the unique DOE Office of Science role in fundamental research, energy technology development, and maintaining a highly skilled workforce.
- Appendix II: List of ESC members endorsing this statement.

APPENDIX I. DOE OFFICE OF SCIENCE CONTRIBUTIONS

Below is additional information on the important role of the DOE Office of Science:

Sponsor Vital Research: Office of Science is the largest government sponsor for basic research in the physical sciences. It is the primary funder for several subdisciplines – including high energy physics, heavy-element chemistry, plasma physics and catalysis – as well as a leading sponsor in the biological sciences, advanced materials, geosciences, computing and engineering. The ESC recommends that the Office of Science continue to make strategic investments in innovative high-risk, high-reward research areas. Discoveries in targeted areas such as quantum science and technology, genomics, microelectronics, machine learning and matter at extreme conditions, have potential far-reaching impacts that could lead to paradigm-shifting innovations that spawn the creation of new industries. In addition to its targeted initiatives, the ESC recommends that the Office of Science continue to grow its core research programs and cross-agency data sharing capabilities to fully utilize its updated world-class facilities and cutting-edge instrumentation.

Prepare the Next Generation of American Scientific and Engineering Talent: Office of Science supports a diverse portfolio of research at colleges and universities nationwide. Through competitively awarded grants, Office of Science supports approximately 22,000 Ph.D. scientists, engineers, graduate students, undergraduates and technical personnel at more than 300 institutions across all 50 states and the District of Columbia. 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. ESC urges the Office of Science to expand successful education programs, such as the Office of Science Graduate Fellowship Program, to support the best and brightest students from multidisciplinary areas of research, such as quantum information science, in pursuing their advanced degrees. ESC also urges the creation of new workforce development programs to increase diversity, equity, and inclusion of STEM professionals working in DOE mission-relevant disciplines, and significantly broaden recruitment pools to leverage existing domestic talent.

Steward World-Class Scientific Facilities: Office of Science supports the operation of the largest collection of major scientific user facilities in the world. Located at national laboratories and universities across the country, these 27 facilities include particle accelerators, experimental reactors, X-ray synchrotron and free-electron laser light sources, leadership-class supercomputers and other high-precision instruments. Annually, more than 36,000 researchers from academia, industry and federal agencies use these facilities to support their pursuits in science and engineering. Nearly half of the DOE facility users are university and federal researchers working to answer fundamental questions in science. Additionally, more than 50 Fortune 500 companies and many small businesses use these facilities to conduct the underlying research required to develop new technologies and products that drive the economy. Robust funding for Office of Science would ensure that construction of and upgrades to major facilities are completed on time and on budget. These projects are necessary to maintain U.S. leadership and help attract and retain the best scientific talent.

Support U.S. Economic Growth: During the last decade, Office of Science has made key investments to advance U.S. leadership in energy technologies. Examples of basic research investments that led to new energy technologies include lithium ion batteries used by car companies for electric vehicles; the design of new, more energy-efficient diesel engines; and organic films for windows and structural surfaces that generate solar energy to power tablets, digital signage, wearable devices and even buildings. These are all examples of high-risk, early-stage research that is beyond the scope of what industry can or will support. ESC supports Office of Science's renewed efforts to help advance and commercialize innovative research and expand public-private partnerships to grow awareness of DOE investments.

Ensure National Security: Office of Science facilities offer researchers from the National Nuclear Security Administration (NNSA), Department of Defense, Department of Homeland Security, and intelligence agencies unique resources necessary to advance a broad range of national security applications. NNSA scientists, for example, rely on Office of Science facilities to understand the material properties of an aging nuclear weapons stockpile and how to defend electronic components against radiation. Additionally, Office of Science-supported research has helped develop stronger, lighter armor for our soldiers, fortify the electric grid against cyber attacks, and improve our ability to detect nuclear and radiological smuggling at our borders.

APPENDIX II. ESC MEMBERSHIP

American Association for the Advancement of Science
American Association of Physicists in Medicine
American Association of Physics Teachers
American Astronomical Society
American Chemical Society
American Crystallographic Association
American Geophysical Union
American Geosciences Institute
American Institute of Physics
American Mathematical Society
American Nuclear Society
American Physical Society
American Society for Engineering Education
American Society of Agronomy
Acoustical Society of America (ASA)
American Society of Mechanical Engineers
American Society for Microbiology
American Society of Plant Biologists
American Vacuum Society
Arizona State University
Association of American Universities
Association of Public and Land-grant Universities
AVS – The Society for Science and Technology of Materials, Interfaces, and Processing
Battelle
Binghamton University
Biophysical Society
Boston University
Case Western Reserve University
City College of CUNY
Clemson University
Coalition for Academic Scientific Computation (CASC)
Consortium for Ocean Leadership
Columbia University
Computing Research Association
Council of Scientific Society Presidents
Cornell University
Cray Inc.
Crop Science Society of America
Duke University
The Ecological Society of America
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
Health Physics Society
IBM
IEEE-USA
Iowa State University
Jefferson Science Associates, LLC
Krell Institute
Lehigh University
Long Island University
Massachusetts Institute of Technology
Materials Research Society
Michigan State University
Michigan Technological University
New York University
Northeastern University
Northern Illinois University
Northwestern University
Oak Ridge Associated Universities (ORAU)
OSA—The Optical Society
Pace University
Penn 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
SPIE
Stanford University
Stony Brook University
Tech-X Corporation
The Ohio State University
University of California System
University of Chicago
University of Colorado Boulder
University of Delaware
University of Illinois System
University of Iowa
University of Maryland, College Park
University of Michigan
University of Missouri System
University of Nebraska
University of North Texas
University of Oklahoma
University of Pennsylvania
University of Rochester
University of Southern California
University of Tennessee
University of Texas at Austin
University of Virginia
University of Wisconsin-Madison
Vanderbilt University
Washington State University
West Virginia University
Yale University