



DOE Webinar

June 7, 2019

Ben Kallen

Lewis-Burke Associates, LLC

LEWIS-BURKE

ASSOCIATES LLC

www.lewis-burke.com

About Lewis-Burke

- Thirty policy experts with range of expertise/backgrounds allow multi-layered issue teams with deep expertise in agencies and scientific/higher education areas
- Support federal relations activities to develop and implement federal strategies to pursue, shape, and create new sources of funding to increase and diversify research portfolio
- Able to engage on multiple levels:
 - Individual faculty (including early career faculty)
 - Teams of faculty
 - Associate Deans for Research
 - Deans and Center Directors
 - University leadership and campus-wide priorities/activities

LEWIS-BURKE

ASSOCIATES LLC

www.lewis-burke.com



Department of Energy Overview

LEWIS-BURKE

ASSOCIATES LLC

www.lewis-burke.com

Agenda

- Overview
- Research Priorities and Opportunities
- Tips for Engagement

Department of Energy (DOE)

- Department of Energy (DOE) has three core missions:
 - Science and Energy (basic and applied research)
 - Nuclear Security (maintaining a credible nuclear deterrent)
 - Environmental Management (cleanup of Cold War legacy sites)
- Since he assumed leadership of DOE, Secretary Perry has been consistent with his 3 major priorities: maintaining the nuclear weapons stockpile, cybersecurity of energy assets, and high performance computing
- Focus of the R&D portfolio is on early stage research and high risk projects where there is no industry investment

DOE National Labs

Department of Energy National Laboratories



- Establishing partnerships with one or more of the 17 DOE national labs is critical
- Labs can provide funding directly to universities through their Annual Operating Plan funds
- They also provide insight into DOE program plans, such as energy materials networks

Current DOE Funding

- DOE saw big funding increase in FY 2018 and a slightly more modest 3.4 percent in FY 2019 - **\$35.7 billion**
- Single largest increases have been for the **Office of Science** (22 percent growth over two fiscal years) because of bipartisan support for basic research in the physical sciences
 - Top priorities: exascale computing, quantum information science, new and upgraded science facilities, AI/machine learning, Energy Frontier Research Centers
- **ARPA-E** is not eliminated; increased by 16% to \$353 million in FY 2018, additional 3.6 percent to \$366 million in FY 2019
 - Future topics are likely to include energy-smart farms, advanced nuclear reactors, performance-based energy resource feedback, optimization and risk management for the grid, and innovative fusion energy pathways
- All **applied energy** programs saw increases in both FY 2018 and FY 2019—Cybersecurity and Water Security top priorities
 - DOE currently competing a fifth Energy Innovation Hub on Energy-Water Desalination and a new Clean Energy Manufacturing Institute on Cybersecurity for Energy Efficient Manufacturing
- **Renewed focus on technology transfer and commercialization:** Innovation Expos on energy storage, grid technologies, and advanced manufacturing. Fall 2019 expo on AI/machine learning at Argonne
- **Upcoming larger-scale funding opportunities:** QIS R&D centers, Energy Frontier Research Centers, Computational Materials Science centers

FY 2020 Outlook

- Trump Administration released its FY 2020 budget proposal in mid-March; energy R&D priorities include:
 - Advanced manufacturing, including smart, digital, and additive manufacturing
 - Leadership in high performance computing, AI, and machine learning
 - Modernization of the nuclear deterrent
 - Microelectronics
 - Quantum information science (QIS)
- Still, budget proposed steep cuts to Office of Science, EERE, Nuclear and Fossil, while ARPA-E would be eliminated entirely
- Congress will likely reject these proposals again
 - House bill would grow Office of Science by 4.3%, major increases to EERE (11.5%) and ARPA-E (16.1%)
 - Senate has not finished drafting their FY 2020 bill yet, but past support has been strong and bipartisan



Office of Science and ARPA-E

LEWIS-BURKE

ASSOCIATES LLC

www.lewis-burke.com

Office of Science Overview

- Office of Science is DOE's basic research arm and is the largest funder of the physical sciences in the U.S.; the office is funded at \$6.59B in FY 2019
- Funding supports 20,000 scientists and 35,000 scientists use user facilities
- 40 percent of the research budget goes to universities
- There are six program offices covering different aspects of the DOE basic research mission space:
 - Advanced Scientific Computing Research (ASCR)
 - Basic Energy Sciences (BES)
 - Biological and Environmental Research (BER)
 - Fusion Energy Sciences (FES)
 - High Energy Physics (HEP)
 - Nuclear Physics (NP)

Office of Science Research Priorities (by Program Office)

ASCR

- Fundamental research toward AI/machine learning
- Quantum computing (algorithms and hardware)
- Application of high performance computing toward other areas of Office of Science and DOE more broadly

BES

- Quantum Materials and Chemistry
- Catalysis Science
- Energy-Water Issues
- Energy Storage
- Crosscutting: Synthesis, Instrumentation

BER

- Biological systems science
- Earth and environmental systems
- Microbial to Earth system pathways
- Energy sustainability
- Data analytics and computing

FES

- Burning plasma science (foundational, long pulse, and high power)
- Discovery plasma science

HEP

- Neutrino science
- Study of fundamental interactions between subatomic particles such as the Higgs Boson
- Dark matter and dark energy, cosmic acceleration, inflation

NP

- Heavy ion physics
- Medium and low energy nuclear physics
- Theoretical nuclear physics
- Accelerator physics
- Isotopes

Sample of Office of Science Opportunities

- **Energy Frontier Research Centers** – \$2-4 million/year for 4 year award terms; multi-disciplinary teams focused on “grand challenge” science and fundamental research described in the Basic Research Needs Workshop reports.
 - Next competition in FY 2020
 - Up to 20 new EFRCs expected
 - \$30M available (\$10M specifically for recompetition of four existing environmental cleanup EFRCs)
- **Core Foundational Research** – All six Office of Science program offices support single investigators (~\$150K/year) and small groups (~\$500K-\$2M/year) engaged in fundamental research; investigators propose topics of their choosing in response to annual FOA.
- **Early Career Research** – The Early Career Research program supports talented university and National Laboratory researchers early in their careers with the goal of nurturing a scientific workforce capable of meeting Office of Science needs; the annual FOA outlines specific topic areas across all six program offices

Quantum Information Science

- In FY 2019, Office of Science is investing \$105 million to support QIS research with goal of advancing quantum materials, computing, sensors, and communications; at least \$168 million in FY 2020
- Individual program offices including ASCR, BES, HEP, NP, and FES have released QIS solicitations for proposals ranging in size from single investigators to larger team-based activities
- Goal is to build out broader QIS research community capable of contributing to large-scale QIS R&D centers DOE plans to implement in FY 2020
 - Those interested should respond to the RFI released in May; topics will include:
 - Quantum communications
 - Quantum materials/chemistry
 - Qubit devices and sensors
 - Quantum computing
 - Quantum foundries
- Part of larger National Quantum Initiative formally established by legislation in Dec. 2018

Artificial Intelligence

- Viewed as a transformative tool for scientific discovery, \$119 million in FY 2020
- Three-pronged approach in Office of Science:
 - Research in applied math/computational science to advance foundational aspects of machine learning, major emphasis on explainability, verification/validation, uncertainty quantification
 - Development of machine learning algorithms with specific scientific applications, will require partnerships with domain-specific disciplines
 - Co-design of hardware and software for AI and machine learning
- Cross-agency efforts aimed at feeding Office of Science-led AI/ML advancements to technology programs
 - Geothermal and Solar Technologies Offices solicitations to improve operations and siting for future deployments
 - ARPA-E solicitation on machine learning-enhanced energy product development
- Strong potential for national initiative akin to the NQI

ARPA-E Overview

Mission: To overcome long-term and high-risk technological barriers in the development of energy technologies

- \$366M in FY 2019
- Modeled after DARPA—small, nimble organization with very low overhead costs
- Program managers rotate through every 3-4 years
- About 40% of ARPA-E funding goes to universities every year; universities are expected to provide a 5% cost share for most proposals
- Programs:
 - Focused Solicitations – Opportunities tied to a targeted program focusing on specific technology (energy storage, grid modernization, biofuels, nuclear reactors, etc.)
 - OPEN Solicitation – Broad categories but far less restrictive than focused awards, once every three years
 - Innovative Development in Energy-Related Applied Science (IDEAS)—opportunity for single-phase grants of up to 12 months, \$500K



Applied Energy Programs

LEWIS-BURKE

ASSOCIATES LLC

www.lewis-burke.com

Applied Energy Overview

DOE supports applied energy R&D across four primary offices:

- Energy Efficiency and Renewable Energy (EERE) - \$2.38B in FY 2019
 - Wind
 - Solar
 - Hydroelectric and wave
 - Geothermal
 - Hydrogen and fuel cells
 - Bioenergy
 - Vehicles
 - Advanced manufacturing
 - Buildings
 - Light bulbs
- Fossil Energy (FE) - \$740M in FY 2019
 - Carbon capture and sequestration
- Nuclear Energy (NE) - \$1.4B in FY 2019
 - Advanced reactor concepts, materials research, sensors and control systems, modeling and simulation, advanced manufacturing
- Electricity Delivery - \$156M in FY 2019
 - Grid modernization and resilience
- Cybersecurity, Energy Security, and Emergency Response (CESER) - \$120M in FY 2019

Sample of Applied Energy Opportunities

- The main mechanisms for university participation in applied energy programs are annual Funding Opportunity Announcements (FOAs):
 - **Buildings Energy Efficiency Frontiers & Innovation Technologies (BENEFIT)** – BENEFIT is an annual, open FOA soliciting proposals for early stage R&D in energy efficient building technologies such as materials, windows, cyber-physical systems, etc.
 - **Advanced Vehicle Technologies Research FOA** – Released on behalf of the DOE Vehicle Technologies Office (VTO), focused on early stage R&D in specific topic areas such as batteries, optimized advanced engines and fuel technologies, efficient systems integration, etc.
 - **Nuclear Energy University Program (NEUP)** – NEUP consolidates all NE funding under one program and supports early stage R&D and technology development at academic institutions
- Individual offices also issue specific funding opportunities tailored to their needs.
 - Ex: The Advanced Manufacturing Office released a solicitation for proposals for its **Energy-Water Desalination Hub**

Water Security Grand Challenge

- The goal is to advance transformational technologies to meet the global need for safe, secure, and affordable water and specifically by 2030:
 - Launch desalination technologies that deliver cost-competitive clean water
 - Transform the energy sector's produced water from a waste to a resource
 - Achieve near-zero water impact for new thermoelectric power plants, and lower freshwater use intensity within the existing fleet,
 - Double resource recovery from municipal wastewater
 - Develop small, modular energy-water systems for urban, rural, tribal, national security, and disaster response settings
- DOE is currently developing targeted programs to shape future funding calls; most funding will come from the applied energy programs Office of Science could play a role (BER interested in integrated water cycle, BES EFRCs, etc.)
- Most recent opportunity under the WSGC was the solicitation for proposals for the Energy-Water Desalination Hub
- Summary of fall 2018 R&D workshop expected soon, will define scope of future opportunities

Other Emerging Priorities

Grid Modernization Initiative

- Agency-wide initiative aimed at strengthening grid resilience, reliability, security (including cyber), affordability, flexibility, and sustainability
- Projects are lab-led, but university participation is integral component
- OE planning to release a \$40 million solicitation shortly

Cybersecurity

- CESER created as a standalone office, demonstrating leadership's interest in elevating cyber as a cross-agency priority
- Research will focus on “self-healing” systems, continuous monitoring systems for spotting anomalies, differentiating b/w cyberattacks and other types of disruptions (natural disasters), integration of cybersecurity systems into the grid and other power systems

Critical Materials

- Research on critical materials has been heavily focused on new sources and substitutes for rare-Earth elements, EERE wants to shift focus to downstream processes like reuse and recycling
- Launch of three-phase, \$5.5M Lithium-Ion Battery Recycling Prize challenge
- Establishment of \$15M Lithium Battery R&D Recycling Center at Argonne National Laboratory



Engagement with DOE

LEWIS-BURKE

ASSOCIATES LLC

www.lewis-burke.com

Serve on Review Panels

- Similar to how interested proposers approach NSF, DOD, and NIH, meetings with DOE program managers can be fruitful
- However, serving on review panels is often an even more advantageous approach to securing research funding from DOE
- DOE uses peer review panels to assess the merit of proposals
- These are conducted through in-person meetings as well as mail-in reviews
- Participation in panels allow researchers to:
 - Demonstrate interest in the research topic and/or program
 - Meet directly with DOE program managers and officials
 - Showcase ability to meet deadlines and honor commitments
 - Gain first-hand intel on what makes for a successful proposal and what does not
- In order to participate:
 - Email the program manager asking if they're looking for volunteers to serve on a panel
 - Include a CV and a description of your research interests; make sure these are aligned with the goals of the program

Review Strategic Plans

- Basic Research Needs Workshop Reports
 - Scientific Machine Learning
 - Quantum Information Science
 - Microelectronics
 - Nuclear Energy
 - Catalysis
- Multi-year Program Plans
 - Advanced Manufacturing
 - Buildings
 - Grid Modernization

Participate in Workshops

- Workshops are used to define future research directions for the Department; reports are often produced as a result
- Often invite-only; LBA can feed names of interested personnel to DOE for consideration
- Good way to:
 - Network with others in your research field
 - Meet DOE officials and demonstrate your interest in their programs
 - Raise your own profile as well as that of UC
 - Influence the trajectory of DOE's R&D enterprise
- Examples include:
 - Basic Research Needs Workshops
 - Water Security R&D workshop

Respond to RFIs

- DOE uses Requests for Information (RFIs) to solicit community feedback on planned funding opportunities
- Respond in order to:
 - Demonstrate interest in the research topic and/or program
 - Get your name out there
 - Influence the ultimate scope and focus of future funding solicitations
- Examples include:
 - ARPA-E releases RFIs frequently as they establish several new programs every year
 - QIS R&D centers RFI from Office of Science

Partnering with National Labs

- While DOE provides about \$3 billion a year in direct support to research universities through grants and cooperative agreements, 90 percent of DOE funding is for the National Labs (research, construction and operation of user facilities, security)
- Still, another \$500 million a year is provided directly by the National Labs to university partners (often PI to PI collaborations or through consortia)
 - Example: the QIS R&D Centers will be lab-led, but university partners will receive funding through those awards

Student Opportunities

- Office of Science Graduate Student Research Fellowship
- NNSA Graduate Fellowship Program
- Computational Sciences Graduate Fellowship (SC and NNSA)
- Science Undergraduate Laboratory Internships
- Mickey Leland Energy Fellowship Program (fossil energy)
- DOE Scholars Program
- Competitions:
 - Collegiate wind competition (undergraduate students)
 - EcoCAR competition
 - Solar Decathlon
 - Cyber Defense competition
 - Cleantech University Prize (Cleantech UP)

Questions?

ben@lewis-burke.com

LEWIS-BURKE
ASSOCIATES LLC

www.lewis-burke.com