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
Department of Energy Overview
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
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
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
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
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
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?

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