### Index to Charts: Guidance to DOE Funding

Information garnered from DOE Budget Submission Presentations & Detailed Justifications and webpages

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The DC Office of Research Advancement has created the Federal Mission Agency Program Summaries (MAPS) website to:

1. Connect PIs with appropriate funding agency programs/program officers
2. Assist in development of white papers/charts/elevator pitches

The website can be accessed using one’s USC NetID and Password.

It has the following resources:

1. **Search Tab** for a searchable database of programs/program officers
   At that website one can do keyword searches to locate the associated mission agency (DHS, DOD, DOE, DOT, ED, EPA, INTEL, NASA, NIST, NOAA and USDA) programs and program officers.

2. **Mission Agency Tab** (DHS, DHHS, DOD, DOJ, DOE, DOT, ED, EPA, INTEL, NASA, NIST, NOAA, USDA)
   Guide to Agency Funding for FYXX
   Agency Research Program Charts
   Agency Planning Documents
   Chart numbers in the text above reference the Agency Research Program Chart files.

3. **Presentation Tab** for charts from recent USC Center of Excellence in Research workshops

4. **Proposal Tab** for report / guides on writing proposals

5. **Email Alerts Tab** for URLs at which one can arrange for automatic solicitation updates

6. **Grantee Tab** for URLs at which one can find previous agency awardees

7. **Visiting DC Tab** for information about DC Office services
Billions of constant FY 2015 Dollars

Source: 1976-1994 figures are from the NSF federal funds survey; remainder is from AAAS R&D reports. FY 2015 are estimates, FY 2016 is the President’s request. © 2015 AAAS
Continuum of Research, Development, and Deployment

- **Discovery Research**
  - Goal: new knowledge / understanding
  - Focus: phenomena
  - Metric: knowledge generation
  - Basic research to address fundamental limitations of current theories and descriptions of matter in the energy range important to everyday life – typically energies up to those required to break chemical bonds.

- **Use-Inspired Basic Research**
  - Basic research for fundamental new understanding on materials or systems that may revolutionize or transform today’s energy technologies.

- **Applied Research**
  - Basic research for fundamental new understanding, usually with the goal of addressing scientific showstoppers on real-world applications in the energy technologies.
  - Proof of new, higher-risk concepts
  - Prototyping of new technology concepts
  - Explore feasibility of scale-up of demonstrated technology concepts in a "quick-hit" fashion.

- **Technology Maturation & Deployment**
  - Research with the goal of meeting technical milestones, with emphasis on the development, performance, cost reduction, and durability of materials and components or on efficient processes.
  - Scale-up research
  - Small-scale and at-scale demonstration
  - Cost reduction
  - Manufacturing R&D
  - Deployment support, leading to market adoption
  - High cost-sharing with industry partners

*ARPA-E: targets technology gaps, high-risk concepts, aggressive delivery times*
Priority: Science and Discovery: Invest in science to achieve transformational discoveries
  – Organize and focus on breakthrough science
  – Develop and nurture science and engineering talent
  – Coordinate DOE work across the department, across the government, and globally

Priority: Change the landscape of energy demand and supply
  – Drive energy efficiency to decrease energy use in homes, industry and transportation
  – Develop and deploy clean, safe, low carbon energy supplies
  – Enhance DOE’s application areas through collaboration with its strengths in Science

Priority: Economic Prosperity: Create millions of green jobs and increase competitiveness
  – Reduce energy demand
  – Deploy cost-effective low-carbon clean energy technologies at scale
  – Promote the development of an efficient, “smart” electricity transmission and distribution network
  – Enable responsible domestic production of oil and natural gas
  – Create a green workforce

Priority: National Security and Legacy: Maintain nuclear deterrent and prevent proliferation
  – Strengthen non-proliferation and arms control activities
  – Ensure that the U.S. weapons stockpile remains safe, secure, and reliable without nuclear testing
  – Complete legacy environmental clean-up

Priority: Climate Change: Position U.S. to lead on climate change policy, technology, and science
  – Provide science and technology inputs needed for global climate negotiations
  – Develop and deploy technology solutions domestically and globally
  – Advance climate science to better understand the human impact on the global environment
## Special Program Features
### (Dr. Dehmer’s Interpretation)

from Dr. Patricia Dehmer’s presentation to Energy Sciences Coalition, 19 May 2009

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<th>Investigator’s and their institutions</th>
<th>Central location for investigators?</th>
<th>Diversity of Disciplines</th>
<th>Period of Award and Management</th>
<th>Award Amount</th>
<th>Core Motivation</th>
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<td><strong>Energy Innovation Hubs</strong></td>
<td>Large set of investigators spanning multiple science and engineering disciplines and possibly including other non-science areas such as energy policy, economics, and market analysis. May be led by Labs or universities. The model is the three existing SC Bioenergy Research Centers.</td>
<td>Yes, there is a central location (building) housing many/most of the investigators. A significant aspect of the Hubs is the collocation of researchers. Collaborators at other institutions may partner with the Hub leader. Industries may also be associated with Hubs.</td>
<td>5 years with one 5-year renewal possible. “The bar is significantly higher” for further renewals. Managed by Offices across DOE. A Board of Advisors consisting of senior leadership will coordinate across DOE.</td>
<td>$25M/year with $10M additional in the 1st year for CE or building mods.</td>
<td>Purpose-driven research, spanning fundamental, transformational science to commercialization. The breadth and emphasis of activities will be influenced greatly by the nature of the Hub. For example, the topics of some Hubs are ready for commercialization or improved manufacturing methods (solar photovoltaics). Other Hubs address topics that may require greater emphasis on fundamental research. In general, DOE determines the topical areas of the Hubs, and FOAs are specific.</td>
</tr>
<tr>
<td><strong>Energy Frontier Research Centers</strong></td>
<td>Self-assembled group of ~6-12 investigators. May be led by Labs or universities. About 2/3 of EFRCs are led by universities.</td>
<td>Ideally, each EFRC will have a lead institution, home to many/most of the investigators, but there is flexibility.</td>
<td>5 years with 5-year renewals possible. Managed by SC/BES</td>
<td>$2-5M/year</td>
<td>Fundamental, transformational research with a clear link to new energy energy technologies or technology roadblocks. In general, the investigators propose the subject matter from among a large set of general energy-relevant topics, and FOAs are broad.</td>
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<tr>
<td><strong>ARPA-E</strong></td>
<td>Single investigator, small group, or small teams.</td>
<td>No</td>
<td>1-3 years Managed by ARPA-E, which reports to the Secretary of Energy</td>
<td>$0.5 -10M/year</td>
<td>High risk research driven by the potential for significant commercial impact. In general, DOE determines the area of interest.</td>
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Major multidisciplinary, multi-investigator, multi-institutional integrated research centers, the Hubs are modeled after the forceful centralized scientific management characteristics of the Manhattan Project.

There are four funded Hubs (~$15-25M/yr):
- Fuels from Sunlight Hub (funded by Basic Energy Sciences, CalTech lead, Joint Center for Artificial Photosynthesis)
- Modeling and Simulation for Nuclear Reactions Hub (funded by Nuclear Energy Office, ORNL lead, Consortium for Advanced Simulation of LWRs,)
- Batteries and Energy Storage Hub (funded by Basic Energy Sciences, ANL lead, Joint Center for Energy Storage Research)
- Critical Materials Hub (funded by EERE Advanced Manufacturing, DOE Ames Laboratory lead, Critical Materials Institute,)

A fifth Hub on Energy Water Desalination is proposed for FY2017

A prior Hub has been scaled down:
Energy Efficient Building Systems Hub (funded by EERE, Penn State Univ lead Building Technologies/Systems Integration at Greater Philadelphia Innovation Cluster,)
Basic Research
Office of Science
Adv Scientific Computing Research Program (ASCR)  
(http://science.energy.gov/ascr/)
To discover, develop, and deploy computational and networking capabilities to analyze, model, simulate, and predict complex phenomena.

Basic Energy Sciences Program (BES)  
(http://science.energy.gov/bes/)
To understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels thereby providing the foundations for new energy technologies. Two divisions manage the University research portfolio: Materials Sciences and Engineering; and Chemical Sciences, Geosciences, and Biosciences.

Biological and Environmental Research Program (BER)  
(http://science.energy.gov/ber/)
To understand biological, climate, and environmental systems by: exploring the frontiers of genome-enabled biology; discovering the phys, chem, and bio drivers of climate change; and seeking the bio, geochem and hydrological molecular determinants of environmental sustainability and stewardship.

Fusion Energy Science Program (FES)  
(http://science.energy.gov/hep/)
To advance the fundamental understanding of matter at very high temperatures and densities, and to develop the scientific foundations needed for a fusion energy source.

High Energy Physics Program (HEP)  
(http://science.energy.gov/hep/)
To understand how our universe works at its most fundamental level by discovering the elementary constituents of matter and energy; probing the interactions between them; and exploring the basic nature of space and time.

Nuclear Physics Program (NP)  
(http://science.energy.gov/np/)
To discover, explore and understand all forms of nuclear matter and to understand how the fundamental particles—quarks and gluons—fit together and interact to create different types of matter in the universe.

Workforce Development for Teachers and Scientists  
(http://science.energy.gov/wdts/)
To help DOE and the Nation have a sustained pipeline of highly trained science, technology, engineering, and mathematics (STEM) individuals for the U.S. workforce.
All Office of Science Core Programs  
ASCR / BER / BES / FES / HEP / NP / WDTS

What:
- Prior to submission of an application for a research grant, the PI is encouraged to contact the program manager whose areas of expertise and responsibilities most closely match the topic of the proposed research activities to learn about current funding opportunities and the nature of the work.
- Based on the interaction with a program manager, the PI may be encouraged to submit a pre-application.
- Based on a review of the proposed research, the principal investigator will be either encouraged or discouraged to submit a full application.
- All grants that are funded undergo external peer review.
- The usual term for a new award is three or four years, divided into one-year budget periods.

When:
Applications may be submitted at any time. However, it is recommended that a full application be sent between June 1st and November 30th in order that a funding decision can be made by June of the following year, which is necessary to obtain funding under that particular fiscal year.

How much: Varies with the program

Where: BAA DE-FOA-0001204 for FY2015
http://science.doe.gov/grants/
Applications must be submitted through Grants.gov to be considered for award.

Resource:
DOE Office of Science Award Search Website http://science.energy.gov/funding-opportunities/award-search/
The award search returns lists of
1. grants,
2. cooperative agreements, and
3. interagency awards currently funded by the DOE Office of Science.
Office of Science Early Career Research Program

What: To support individual research programs of outstanding scientists early in their careers and to stimulate research careers in the disciplines supported by the Office of Science

Who: Within 10 years of receiving a Ph.D., either untenured academic assistant professors on the tenure track or full-time DOE national laboratory employees

How Much:
- Univ. grants $150/yr for 5 years to cover summer salary and expenses
- National Lab awards $500K/year for five years to cover full salary and expenses

When: For FY2016 pre application (white paper) 10 Sept 2015


FY 2015 609 full proposals reviewed; 50 awardees (32 Univ)
FY 2014 750 full proposals reviewed; 38 awardees (21 Univ)
FY 2013 770 full proposals reviewed; 65 awardees (44 Univ)
FY 2012 850 full proposals reviewed; 68 awardees (43 Univ)
FY 2011 1150 full proposals reviewed; 69 awardees (44 Univ)
Energy Frontier Research Centers, 2009 - present

FY 2009 46 EFRCs were launched
- $777M for 5 years, $100M/year base + $277M ARRA

FY 2014 Recompetition Results
- $100M/year base
- 32 EFRCs in 32 States + Washington D.C.
  (22 renewals + 10 new)
- Each $2-4M/yr for up to 4 years
- Led by 23 Universities, 8 DOE Labs, and 1 non-profit
- ~525 senior investigators and ~900 students, postdoctoral fellows, and technical staff at ~100 institutions

FY 2015 – FY 2016 Review and Management Plan
- Full mid-term progress review for all centers in FY 2016, with funding for final two years contingent upon review outcome.

FY 2016 Funding and New Solicitation
- Funding for EFRCs increases $10,000K (FY 2015 = $100,000K; FY 2016 = $110,000K).
- Call for new EFRC proposals with topical areas that complement current portfolio and that are informed by new community workshops.
- The EFRC program will transition to a biennial solicitation cycle starting in FY 2016.

From Pat Dehmer's FY2016 budget presentation
# Acquiring Topic/Program Manager Information

## Advanced Scientific Computing Research (ASCR)

Go to [http://science.energy.gov/ascr/](http://science.energy.gov/ascr/)

Click on Research in left hand column

Click on the appropriate topic for a program description

The program manager contact information is at lower right corner

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Acquiring Topic/Program Manager Information
Basic Energy Sciences (BES)

Go to http://science.energy.gov/bes/

Click on the BES Research tab on the left

Click on the appropriate Division tab on the left

Click on the Research Areas tab on the left

Click on the appropriate topic (mid page)
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Energy Frontier Research Centers  
science.energy.gov/bes/efrc/contacts/

**What:** Integrated, multi-investigator Centers that conduct fundamental research focusing on one or more of several “grand challenges” and use-inspired “basic research needs” recently identified in major strategic planning efforts by the scientific community. The Centers integrate the talents and expertise of leading scientists in a setting designed to accelerate research toward meeting our critical energy challenges.

**How Much:** Funded at ~$3M/yr for five years, with an additional 5 year extension possible.

**When:** Every two years starting in FY2016

**Where:** www.er.doe.gov/bes/EFRC/index.html
BES Scientific User Facilities

- Lawrence Berkeley National Laboratory
  - Advanced Light Source
  - Molecular Foundry
  - National Center for Electron Microscopy

- Argonne National Laboratory
  - Advanced Photon Source
  - Center for Nanoscale Materials
  - Electron Microscopy Center

- Brookhaven National Laboratory
  - Center for Functional Nanomaterials
  - National Synchrotron Light Source
  - National Synchrotron Light Source II

- SLAC National Accelerator Laboratory
  - Linac Coherent Light Source
  - Stanford Synchrotron Radiation Lightsource

- Oak Ridge National Laboratory
  - Center for Nanophase Materials Sciences
  - High Flux Isotope Reactor
  - Shared Research Equipment Facility
  - Spallation Neutron Source

- Sandia National Laboratories
  - Core Facility for Center for Integrated Nanotechnologies

- Los Alamos National Laboratory
  - Gateway Facility for Center for Integrated Nanotechnologies
  - Manuel Lujan Jr. Neutron Scattering Center

http://science.energy.gov/bes/suf/user-facilities/
Acquiring Topic/Program Manager Information
Biological and Environmental Research (BER)

Go to http://science.energy.gov/ber/

Click on the BER Research tab on the left side

Click on the appropriate Division on the left side

Click on the appropriate topic (mid page)

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<td>Dr. Kent Peters</td>
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<td>Dr. Dorothy Koch</td>
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<td>28</td>
<td>Dr. Robert Vallario</td>
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</tbody>
</table>
The DOE Bioenergy Research Centers
Fundamental science underpinning new biofuel technologies

Multidisciplinary fundamental science guided by milestones & deliverables, targeted to key areas needed to improve production of biofuels from renewable biomass.

- BioEnergy Science Center (Oak Ridge National Lab)
- Joint BioEnergy Institute (Lawrence Berkeley National Lab)

In 5 years of operations:
- 1,110 peer-reviewed publications
- Over 400 invention disclosures and/or patent applications

In FY 2014, the BRCs will target:
- Detailed characterization of selected candidate biofuel crops (switchgrass and poplar lines) with reduced recalcitrance properties.
- Improved lignin removal techniques producing a new product stream from pretreated biomass during biofuel production.
- Increased tolerance of biofuel-producing microorganisms to pretreatment processes.
- Optimized biosynthetic pathways in microbial hosts for conversion of cellulosic sugars to a variety of drop-in hydrocarbon fuel components.
- Incorporation of microbe-plant interactions and biogeochemical relationships into analyses of bioenergy crop sustainability on marginal lands.
Office of Fusion Energy Sciences
Edmund Synakowski, Associate Director

Gene Nardella
Chief of Staff

(Vacant)
Administrative Specialist

Pam Miller
Budget & Human Resource Liaison

Research Division
James W. Van Dam, Director

Yvette Walker
Administrative Specialist

Marty Carlin
Procurements

Sam Barish
Long Pulse: Stellarator

Curt Bolton
General Plasma Science

Daniel Clark
Materials & Fusion Nuclear Science

Sean Finnegan
Plasma Science Frontiers

Josh King
Spherical Tokamak

John Mandrekas
Theory & Simulation

Al Opdenaker
Small-scale Experimental Research

Nirmol Podder
General Plasma Science, Exploratory Magnetized Plasma

Francis Thio
Measurement Innovation, Exploratory Magnetized Plasma

(Vacant)
Long Pulse: Tokamak
John Mandrekas, Acting

(Vacant)
High Energy Density Plasmas, General Plasma Science
Sean Finnegan, Acting

Facilities, Operations, and Projects Division
Joseph J. May, Director

Sandy Newton
Program Support Specialist

Mark Foster
Advanced Tokamak

Edward Stevens *
Fusion Nuclear Science, ITER

(Vacant)
U.S. ITER Program Manager
John Mandrekas, Acting

Barry Sullivan
Enabling R&D, Fusion Nuclear Science, ITER

Tom Vanek
ITER, International Agreements Program

Shahida Afzal
International Agreements

* On detail to BES

FESAC
Sam Barish
Sandy Newton

Outreach
Sean Finnegan

Environmental Safety & Health
Barry Sullivan

SBIR/STTR
Barry Sullivan

Office of Fusion Energy Sciences
Edmund Synakowski, Associate Director

Gene Nardella
Chief of Staff

(Vacant)
Administrative Specialist

Pam Miller
Budget & Human Resource Liaison

Research Division
James W. Van Dam, Director

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Procurements

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General Plasma Science, Exploratory Magnetized Plasma

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Measurement Innovation, Exploratory Magnetized Plasma

(Vacant)
Long Pulse: Tokamak
John Mandrekas, Acting

(Vacant)
High Energy Density Plasmas, General Plasma Science
Sean Finnegan, Acting

Facilities, Operations, and Projects Division
Joseph J. May, Director

Sandy Newton
Program Support Specialist

Mark Foster
Advanced Tokamak

Edward Stevens *
Fusion Nuclear Science, ITER

(Vacant)
U.S. ITER Program Manager
John Mandrekas, Acting

Barry Sullivan
Enabling R&D, Fusion Nuclear Science, ITER

Tom Vanek
ITER, International Agreements Program

Shahida Afzal
International Agreements

* On detail to BES
Acquiring Topic/Program Manager Information
Fusion Energy Sciences

Go to  [http://science.energy.gov/fes/](http://science.energy.gov/fes/)

Click on the FES Research tab on the left side

<table>
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<tr>
<th>Program</th>
<th>FY15 Actual ($M)</th>
<th>FY16 Enacted ($M)</th>
<th>FY17 PBR ($M)</th>
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<tr>
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<td>Burning Plasma Science: Foundations - Theory and Simulation</td>
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<td>Burning Plasma Science: Long Pulse - Materials and Fusion Nuclear Science</td>
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<td>Dr. Peter Pappano</td>
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<td>Dr. Nirmal Podder</td>
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<td>Dr. Francis Thio</td>
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Acquiring Topic/Program Manager Information
High Energy Physics Program

Go to  [http://science.energy.gov/hep/](http://science.energy.gov/hep/)
Click on HEP Research tab on left
Click on the appropriate topic

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<th>Program</th>
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<td>Dr. Simona Rolli</td>
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<td>Dr. Lek Len</td>
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Acquiring topic/PO information
Nuclear Physics Program

Go to  http://science.energy.gov/np/

Click on the NP Research tab on the left

Select the appropriate program (mid page)

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<td>Dr. Cyrus Baktash</td>
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<td>Isotope Devel/Prod Research</td>
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<td>Dr. Dennis Phillips</td>
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Workforce Development for Teachers and Scientists

Patricia Dehmer, Associate Director
Mary Jo Martin, Executive Assistant

Internships and Visiting Faculty Program at the DOE Laboratories
  Jim Glownia Team Lead
  Sheila Johnson Program Analyst

Fellowships
  Julie Carruthers Team Lead
  Cindy White Team Lead
  Sheila Johnson Program Analyst

National Science Bowl
  Julie Carruthers Team Lead
  Sheila Johnson Program Analyst

Evaluation Methodology
  Julie Carruthers Team Lead
  Sheila Johnson Program Analyst

Business Systems Development and Maintenance
  Jim Glownia
  Joey Groves Team Co-Leads

Office Management, Procurement, and LEDP
  Vera O'Connor
  Deborah Nance
  Administrative Specialists

Science Undergraduate Laboratory Internship
  Cindy White

SC Graduate Fellowship
  Ping Ge

Regional & Final Event Competitions
  Jan Tyler, JLAB
  Sharon Webb

SULI, CCI, SCGF, VFP
  Julie Carruthers
  Yolanda White Vacancy

WDTS Web Design and Maintenance
  Yolanda White

Laboratory Equipment Donation Program
  Vera O'Connor

Procurement
  Sheila Johnson

Community College Internship
  Cindy White

Albert Einstein Dist. Educator Fellowship
  Brian O'Donnell

Final Event Logistics
  Jim Glownia
  Joey Groves

DOE Lab Education Program Statistics
  Samuel Wheeler

Software Development and Maintenance for SULI, CCI, etc.
  Yolanda White

Visiting Faculty Program
  Brian O'Donnell

Graduate Awards for Lindau Meeting with Nobel Laureates
  Ping Ge

Evaluation Methodology
  Julie Carruthers Team Lead
  Sheila Johnson Program Analyst

Legend:
- Detailee (from DOE laboratories)
- Detailee, approx. ½ time, not at HQ
- Albert Einstein Distinguished Educator Fellow
- SC-27 staff member
- SC-27 staff member

14 January 2013
Acquiring Topic/Program Manager Information
Workforce Development For Teachers and Scientists

Go to  http://science.energy.gov/wdts/

Select program of interest

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<td>Dr. Patricia Dehmer</td>
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Program Manager: Dr. James Glownia
Applied Research Programs

Electricity Delivery and Energy Reliability (OE or EDER)
http://www.oe.energy.gov/
The mission is to lead national effort to modernize the electric grid, enhance security and reliability of the energy infrastructure, and facilitate recovery from disruptions to the energy supply. In addition to develop new technologies for the storage of energy and the transmission of energy.

Energy Efficiency and Renewable Energy (EERE)
http://www.eere.energy.gov/
EERE works to strengthen the United States' energy security, environmental quality, and economic vitality in public-private partnerships. Programs include biomass, buildings, geothermal, hydrogen and fuel cells, solar, vehicles, wind & hydropower and industry.

Fossil Energy (FE)
http://fossil.energy.gov/index.html
Ensuring that we can continue to rely on clean, affordable energy from our traditional fuel resources is the primary mission. Programs include clean coal and natural gas power systems, carbon sequestration, hydrogen and other clean fuels, and oil and natural gas supply and delivery.

Nuclear Energy (NE)
http://www.ne.doe.gov/
The primary mission is to advance nuclear power as a resource capable of making major contributions in meeting the nation's energy supply, environmental, and energy security needs by resolving technical, cost, safety, security and regulatory issues through research, development, and demonstration.
Office of Electricity Delivery and Energy Reliability (OE)
Electricity Delivery and Energy Reliability
From JoAnn Milliken presentation to Association of American Universities Jan 11, 2010

Power Systems Engineering Research Center (PSERC)
- 40 researchers in 3 research areas--- 13 Universities and over 30 Industry Members
  • Multidisciplinary, specializing in:
    ➢ power systems, applied mathematics, non-linear systems, power electronics, control theory, computing, operations research
    ➢ economics, industrial organization and public policy.
  • Strong synergy between research and education
    ➢ Some 85 graduate students working on PSERC research projects
    ➢ Research improves quality of education experience
    ➢ Research required of faculty
  • Quality power programs (grad and undergrad)
    ➢ Students receiving quality and diverse education
    ➢ Interaction with industry invaluable
  • Employment search assistance
    ➢ Faculty available for consultation
    ➢ Creation of PES-Careers (www.PES-Careers.org)
    ➢ Job opportunities web site folder
    ➢ Student listserv for contacting students
Clean Energy Transmission and Reliability supports activities in next-generation cables and conductors to increase the delivery capacity of electricity systems, to improve the affordability of electric services, and to enhance efficiency by reducing energy losses.

Transmission Reliability sponsors research into a variety of tools that will improve advanced system monitoring, visualization, control, operations, and market structure will ultimately modernize the electricity transmission infrastructure to ease congestion, allow for increases in demand, and provide greater security.

Advance Modeling Grid Research Program leverages scientific research in mathematics for application to power system models and software tools. In achieving this goal, the Program also fosters strategic, university-based power systems research capabilities.

Smart Grid Research and Development advance smart grid functionality by developing innovative, next-generation technologies/tools for transmission, distribution, energy storage, power electronics, cybersecurity and the advancement of precise time-synchronized measures of certain parameters of the electric grid.

Cybersecurity for Energy Delivery Systems Through partnerships with academia, CEDS is supporting the development of frontier research, providing a platform to bring power systems engineering and computer science together, to meet the current and future needs of providing cybersecurity for energy delivery systems.

Energy Storage Program performs research and development on a wide variety of storage technologies. The program includes batteries (both conventional and advanced), flywheels, electrochemical capacitors, superconducting magnetic energy storage (SMES), power electronics, and control systems.

Transformer Resilience and Advanced Components (new in 2016)

Power Electronics based on wide bandgap (WBG) semiconductor materials, such as silicon carbide (SiC), gallium nitride (GaN), and diamond. A number of barriers and challenges exist in utilizing WBG semiconductor based PE, including designing new types of devices and creating cost-effective high-vol manuf processes.
EERE R&D Programs

EERE programs support research and development of energy efficiency or renewable energy technologies in the areas:

Office of Energy Efficiency
- Buildings
  http://energy.gov/eere/buildings/building-technologies-office
- Federal Energy Management
  http://energy.gov/eere/femp/federal-energy-management-program
- Advanced Manufacturing
  http://energy.gov/eere/amo/advanced-manufacturing-office
- Sustainability Performance
  http://energy.gov/eere/spo/sustainability-performance-office
- Weatherization and Intergovernmental
  http://energy.gov/eere/wipo/weatherization-and-intergovernmental-programs-office

Office of Renewable Power
- Geothermal
  http://energy.gov/eere/geothermal/geothermal-technologies-office
- Solar
  http://energy.gov/eere/solarpoweringamerica/solar-powering-america-home
- Wind
  http://energy.gov/eere/wind/wind-program
- Water Power
  http://energy.gov/eere/water/water-power-program

Office of Transportation
- Bioenergy
  http://www.energy.gov/eere/bioenergy/bioenergy-technologies-office
- Hydrogen and Fuel Cells
  http://energy.gov/eere/fuelcells/fuel-cell-technologies-office
- Vehicles
  http://energy.gov/eere/vehicles/vehicle-technologies-office

EERE Funding Opportunity Exchange: https://eere-exchange.energy.gov/
Mission

- Develop and demonstrate new, energy-efficient processing and materials technologies at a scale adequate to prove their value to manufacturers and spur investment.
  - Develop *broadly applicable* manufacturing processes that reduce energy intensity and improve production.
  - Develop and demonstrate *pervasive* materials technologies, enabling improved products that use less energy throughout their lifecycles.
- Conduct technical assistance activities that promote use of advanced technologies and better energy management to capture U.S. competitive advantage.

**AMO: Bridging the Innovation Gap**

AMO Investments leverage strong Federal support of basic research by partnering with the private sector to accelerate commercialization.
DOE EERE

AMO Research and Development Projects
http://energy.gov/eere/amo/research-development-projects

Innovative Process and Materials Technologies
http://energy.gov/eere/amo/innovative-process-and-materials-technologies-0
These cost-shared projects are selected through a competitive process from exceptional research teams working on foundational process and materials technologies.

Next Generation Manufacturing Processes
http://energy.gov/eere/amo/next-generation-manufacturing-processes
New manufacturing processes, simulation tools, and technologies are pursued in four key areas - reactions and separation, high temperature processing, waste heat minimization and recovery, sustainable manufacturing - to lower the energy intensity of manufacturing.

Next Generation Materials
http://energy.gov/eere/amo/next-generation-materials
Innovative materials can open new design spaces for high-performance and renewable energy technology manufacturing. Projects focus on three areas with clean energy, carbon, and economic benefits. Current projects are in thermal and degradation resistant materials, highly functional, high-performance materials, and lower-cost materials for energy systems.

Combined Heat & Power (CHP)
http://energy.gov/eere/amo/combined-heat-and-power
Develop, test, and validate advanced CHP and distributed energy systems to pave the way for accelerated deployment in manufacturing and other applications. Current projects are in advanced reciprocating engine systems, packaged CHP systems, high-value applications, fuel-flexible CHP, and demonstrations.
EERE Funding at Universities

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<td>Vehicle Technologies</td>
<td>~ 5%</td>
</tr>
<tr>
<td>Hydrogen/Fuel Cell Program</td>
<td>~10%</td>
</tr>
<tr>
<td>Solar</td>
<td>~ 5%</td>
</tr>
<tr>
<td>Wind &amp; Hydropower</td>
<td>~10%</td>
</tr>
<tr>
<td>Geothermal</td>
<td>~25%</td>
</tr>
</tbody>
</table>
The Advanced Manufacturing Program

Industrial Technologies Program
Industrial Assessment Centers

- DOE's university-based Industrial Assessment Centers (IACs) train engineering students for careers in industrial energy efficiency.
- IACs serve 300+ plants per year (under 1 TBtu/yr) and typically identify savings of 8%-10% or $115,000/plant.
- Database of 13,500 assessment results: http://iac.rutgers.edu/database

http://www.energy.gov/eere/amo/industrial-assessment-centers-iacsl
Energy and Science $9.8B Request
Increases 5% from FY 2014

FE request supports sustainable fossil fuel usage

Carbon Capture, Utilization, and Storage
  Post- and pre-combustion capture systems
  Storage infrastructure and technology

Natural Gas
  Scientific testing of gas hydrates
  Interagency R&D collaboration on shale gas development
  Demonstration of natural gas CCS technology
Fossil Energy

DOE’s CCS University Research Programs

- University Coal Research Program
  - DOE’s longest-running student-teacher research grant initiative, focused on advancing new ideas in coal and CCS research through annual awards.
  - $2.5 million will be available for award in 2010 through competitive solicitation. Funding opportunities are typically announced in October.

- Historically Black Colleges & Universities and Other Minority Institutions Education and Training
  - Emphasizes advancing coal/CCS research and supporting the education of scientists and engineers from diverse backgrounds through annual awards.
  - $800K will be awarded in 2010 through competitive solicitation. Funding opportunities are typically announced in October.

- University Turbine Systems Research (UTSR)
  - Supports university research on a cost-share basis to accelerate basic turbine technology development for hydrogen-fueled turbines.
  - Approximately $2.5 million in federal cost-share is anticipated in 2010 through competitive solicitation of new UTSR research.

- Geologic Sequestration Training and Research
  - Training opportunities for graduate and undergraduate students to provide the human capital and skills required for implementing carbon capture and storage technologies.
  - 43 projects selected in 2009, totaling $12.7 million in federal funding.

more info at [http://www.fe.doe.gov/recovery/projects/geologic_sequestration_training.html](http://www.fe.doe.gov/recovery/projects/geologic_sequestration_training.html)
The Office of Fossil Energy seeks to advance technologies related to the reliable, efficient, affordable and environmentally sound use of fossil fuels as well as manage the Strategic Petroleum Reserve and Northeast Home Heating Oil Reserve to provide strategic and economic security against disruptions in U.S. oil supplies.

Research and Development Areas:
Clean Coal Technologies  http://energy.gov/fe/science-innovation/clean-coal-research
Carbon Capture and Storage  http://energy.gov/fe/science-innovation/carbon-capture-and-storage-research
Oil and Gas  http://energy.gov/fe/science-innovation/oil-gas-research

Research and Development Opportunities
Most R&D procurements for the Office of Fossil Energy are coordinated by the National Energy Technology Laboratory (NETL). Most of the links below are to NETL's business-related web pages.

Financial Assistance for R&D
Financial assistance vehicles support or stimulate R&D for a public purpose. Grants are used when there is no need for substantial involvement between the recipient and agency during performance of the grant. Cooperative agreements are used when substantial involvement is needed between the recipient and agency during performance.

- View a listing of competitive solicitations currently posted by NETL.  http://www.netl.doe.gov/business/solicitations
- DOE encourages organizations and individuals to submit self-generated, unsolicited proposals that are relevant to its research and development mission.  http://www.netl.doe.gov/business/unsolicited-proposals
DOE Office of Nuclear Energy
R&D Programs

Nuclear Reactor Technologies
http://energy.gov/ne/nuclear-reactor-technologies
Supports crosscutting research and development for innovative technologies that offer the promise of dramatically improved performance for advanced reactors and fuel cycle concepts.

Advanced Modeling and Simulation
http://energy.gov/ne/nuclear-reactor-technologies/advanced-modeling-simulation
Using supercomputers to advance nuclear energy technologies.

Fuel Cycle Technologies
http://energy.gov/ne/fuel-cycle-technologies
Working to solve nuclear waste and proliferation issues.

Nuclear Energy University Program
http://energy.gov/ne/nuclear-reactor-technologies/nuclear-energy-university-program
https://neup.inl.gov/SitePages/Home.aspx
NEUP engages U.S. colleges and universities to conduct research and development (R&D), enhance infrastructure and support student education thereby helping to sustain a world class nuclear energy and workforce capability.

Nuclear Energy Enabling Technologies
Develop crosscutting technologies that directly support and complement the Office of Nuclear Energy’s (NE) development of new and advanced reactor concepts and fuel cycle technologies.
Nuclear Energy University Programs

- NE University Programs support comprises two components:
  - University Research and Education
    - Research and development
    - Infrastructure improvements
    - Human capital development through research participation
  - Integrated University Program
    - Basic nuclear science and engineering scholarships and fellowships

- University Research and Education ($55.2M) (Encourages minority-serving institution participation)
  - NE mission-specific and mission-relevant nuclear science and engineering R&D projects (70%)
    - 3-4 yr. projects
    - Mission-specific R&D up to $900K (34 total)
    - Mission-relevant R&D up to $600K (9 total)
  - Infrastructure grants (30%)
    - 1-yr. awards
    - Equipment upgrades up to $300K (26 total)
    - Curriculum development up to $120K (26 total)
    - Reactor upgrade award up to $1.5M (2 total)
    - Reactor Infrastructure up to $200K (7 total)

- Integrated University Program ($5M)
  - Scholarship and fellowships grants
    - 1-yr. $5K scholarships (85 total)
    - 1-yr. $25K scholarships for outstanding students (3 total)
    - 3-yr. $150K fellowships (30 total)
Nuclear Energy University Programs
FY 2010 Timeline

• Research and Development
  – Oct. 9, 2009 – Publish Request for Pre-applications
  – Nov. 10, 2009 – Pre-applications due
  – Dec. 2009 – Publish Request for Full Proposals
  – Jan. 2010 – Full proposals due
  – Apr. 2010 – R&D selections announced
  – Jul./Aug. 2010 - NEUP Workshop

• Scholarships and Fellowships
  – Dec. 2009 – Publish Request for Applications (for students to apply for a scholarship or fellowship)
  – Jan. 2010 – Publish Funding Opportunity Announcement (FOA) (for universities and colleges to administer NEUP scholarships and fellowships)
  – Feb. 2010 – Student applications due
  – Apr. 2010 – Scholarship and fellowship selections announced

• Infrastructure
  – Jan. 2010 – Publish FOA for Infrastructure
  – Mar. 2010 – Infrastructure applications due
  – Apr. 2010 – Complete review process
  – May 2010 – Infrastructure selections announced

From JoAnn Milliken presentation to Association of American Universities Jan 11, 2010
Fulfilling ARPA-E’s Mission

- Find and fund high-risk, high-impact projects
- Identify and promote revolutionary advances in fundamental sciences
- Accelerate transformational technologies or create new technologies where none currently exist
- Translate scientific discoveries and cutting-edge inventions into technological innovations
- Bridge gaps in the energy innovation pipeline

To enhance the economic and energy security of the U.S.

To ensure U.S. technological lead in developing and deploying advanced energy technologies

- Reduce Energy-Related Emissions
- Improve Energy Efficiency
- Reduce Energy Imports
ARPA-E Vision of its Program

ARPA-E Competition Among Portfolio of Approaches to Create New Learning Curves

Cost ($) / Performance

Technology Innovation

NOW

Scale OR Technology Readiness Level

Deployment

Current Learning Curve

ARPA-E Innovation
ARPA-E WAS CREATED WITH A VISION TO BRIDGE GAPS IN THE ENERGY INNOVATION PIPELINE

what ARPA-E will do
- Seek high impact science and engineering projects
- Invest in the best ideas and teams
- Will tolerate and manage high technical risk
- Accelerate translation from science to markets
- Proof of concept and prototyping

what ARPA-E NOT will do
- Incremental improvements
- Basic research
- Long term projects or block grants
- Large-scale demonstration projects
Figure: ARPA-E's Program Development Process

Timeline: 6-8 Months from Program Conception to Execution
### ARPA-E Program Managers

<table>
<thead>
<tr>
<th>Program Manager</th>
<th>Email / Tel</th>
<th>Interests</th>
</tr>
</thead>
<tbody>
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DOE ARPA-E
Funding Announcements

What: ARPA-E issues periodic Funding Opportunity Announcements (FOAs), which are focused on overcoming specific technical barriers around a specific energy area. ARPA-E also issues periodic OPEN FOAs to identify high-potential projects that address the full range of energy-related technologies, as well as funding solicitations aimed at supporting America’s small business innovators.

All ARPA-E applicants are required to first submit a Notice of Intent and Concept Paper. ARPA-E will review the concept paper and provide early feedback on whether the idea is likely to form the basis of a successful full application. Only after ARPA-E has provided a notification on the concept paper will the applicant be permitted to submit a full application.

When: Periodic with specified deadlines

Where: For information on ARPA-E’s current FOAs and detailed information on the ARPA-E funding application process:

http://arpa-e.energy.gov/?q=programs/apply-for-funding

https://arpa-e-foa.energy.gov/
DOE ARPA-E
Idea Development

What
This Funding Opportunity Announcement (FOA) is intended to provide rapid support to revolutionary applied energy research (Studies) that may lead to new ARPA-E programs to develop transformational and disruptive energy technologies.

Applicants will submit brief Concept Papers (4 page maximum) as described below, and selected Concept Paper Applicants will then be invited to submit Full Applications. This FOA addresses only the Concept Paper process. Applicants must propose energy research that *is not* (1) covered by current ARPA-E projects, programs, FOAs, and RFIs (Requests for Information) and (2) an incremental improvement to existing technology. Applicants are encouraged to review current ARPA-E projects, programs, FOAs, and RFIs prior to application.

**How Much** less than $500K for less than 12 months

**When** - not solicited every year. For the past solicitation Concept Paper Submission Deadline: 27 Feb 2015

**Where** DE-FOA-0001261 - Open Innovative Development in Energy-Related Applied Science (Open Ideas)
What:
The SSAA Program was developed to support state-of-the-art research at U.S. academic institutions in areas of fundamental physical science and technology of relevance to the Stockpile Stewardship Program mission. The Office of Research, Development, Test and Evaluation annually invests in the Stewardship Science Academic Programs (SSAP).

Consideration will be given to proposals that emphasize experimental efforts, although proposals to advance theory that have a strong, demonstrable connection to experimental efforts will be considered.

- Topic 1  Properties of Materials under Extreme Conditions and/or Hydrodynamics
- Topic 2  Low Energy Nuclear Science
- Topic 3  Radiochemistry

Restricted to a citizen of the United States or an alien lawfully admitted for permanent residence.

How Much: A research grant is awarded for up to three years at a funding level appropriate for the proposed scope, typically $50K to $300K per year. Total funding up to $9M annually is anticipated.

When: proposals due 27 Oct 2014 for the 2014 FOA

Where: DE-FOA-0001067
What: The centers are either Multidisciplinary Simulation Centers (MSC) or Single-Discipline Centers (SDC) solving a problem that advances basic science/engineering; verification and validation/uncertainty quantification; and contributing towards achieving effective exascale computing, to demonstrate predictive science in a HPC environment.

The NNSA Office of Advanced Simulation and Computing (ASC), in collaboration with LLNL, LANL and SNL, funded the Predictive Science Academic Alliance Program II (PSAAP II) focused on three major integrated areas:

- Discipline-focused research needed to further predictive science and enabled by effective extreme scale computing.
- Developing and demonstrating technologies and methodologies to support effective extreme computing in the context of science/engineering applications.
- Predictive science based on verification and validation and uncertainty quantification for large-scale simulations.

How Much: An estimated total of $20M per year, over a five year period. Up to $4M annually for each MSC and $2M annually for each SDC for five years.

When: June 2012 (present PSAAP cadre 2014-2019)

Where: DE-FOA-0000728

The National Nuclear Security Administration has awarded a $25 million grant to a consortium of universities and national laboratories, including Los Alamos National Laboratory, for research and development of nuclear science and security, the U.S. Department of Energy announced Thursday. JAN 28