# Index to Charts: Guidance to DOE Funding

Revised Feb 26 2010

<table>
<thead>
<tr>
<th>Chart #s</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 5</td>
<td>Overview</td>
</tr>
<tr>
<td>6</td>
<td>ARPA-E</td>
</tr>
<tr>
<td>7</td>
<td>Innovation Hubs</td>
</tr>
<tr>
<td>8 - 43</td>
<td>Office of Science</td>
</tr>
<tr>
<td>9</td>
<td>Early Career</td>
</tr>
<tr>
<td>10 - 15</td>
<td>Advanced Scientific Computing Research (ASCR)</td>
</tr>
<tr>
<td>16 - 27</td>
<td>Basic Energy Sciences (BES)</td>
</tr>
<tr>
<td>28 - 35</td>
<td>Biological and Environmental Research (BER)</td>
</tr>
<tr>
<td>36 - 37</td>
<td>High Energy Physics (HEP)</td>
</tr>
<tr>
<td>38 - 39</td>
<td>Nuclear Physics (NP)</td>
</tr>
<tr>
<td>40 - 41</td>
<td>Fusion Energy Sciences (FES)</td>
</tr>
<tr>
<td>42 - 43</td>
<td>Workforce Development for Teachers and Scientists</td>
</tr>
<tr>
<td>44 - 45</td>
<td>Office of Energy Delivery and Energy Reliability (OE)</td>
</tr>
<tr>
<td>46 - 48</td>
<td>Office of Energy Efficiency and Renewable Energy (EERE)</td>
</tr>
<tr>
<td>49 - 51</td>
<td>Office of Fossil Energy</td>
</tr>
<tr>
<td>52 - 54</td>
<td>Office of Nuclear Energy</td>
</tr>
</tbody>
</table>

To get copies of these charts, pertinent reports and other reference information go to [http://dcresadv.usc.edu/archives/index.html](http://dcresadv.usc.edu/archives/index.html) user name: DCresadv password: Trojan1 look in website Office Library ➔ ftp link ➔ Website Archive Reports ➔ DOE or Energy
Index to Reports/Strategic Plans/....

DC Res Adv Office Developed Charts on getting funds from Federal Agencies
- EPA
- DOD and other Security Agencies
- DOE
- NASA
- NIH
- NSF

Resources / Workshop Reports / Strategic Plans by Federal Agency
- DOD
- DHS
- DOE
- DoEd
- EPA
- NASA
- NIH
- NOAA
- NSF
- NSF CAREER
- USDA

Resources / Workshop Reports / Strategic Plans by topical area
- Nanotechnology
- Energy
- Space-Cosmology

To get copies of these charts, pertinent reports and other reference information go to
http://dcresadv.usc.edu/archives/index.html   user name: DCresadv   password: Trojan1
look in website Office Library ➔ ftp link ➔ Website Archive Reports ➔ DOE or Energy
DC Office for Research Advancement

FY11 Funding Opportunities: DOE

Dr. James S. Murday
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Ex 40 years in DOD S&T with NRL/ONR/OSD

http://dcresadv.usc.edu/archives/
DOE as part of Federal “Basic and Applied Research” Funding

The American Competitiveness Initiative to grow NSF, DOE, NIST

Trends in Research by Agency, FY 1976-2009 *

Source: AAAS analyses of R&D in annual AAAS R&D reports.
* FY 2009 figures are latest AAAS estimates of FY 2009 request. Research includes basic research and applied research. 1976-1994 figures are NSF data on obligations in the Federal Funds survey.
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ARPA - E
http://arpa-e.energy.gov/

ARPA-E Mission
(1) Enhance the economic and energy security of the United States through the development of energy technologies that result in:
   a. reductions of imports of energy from foreign sources;
   b. reductions of energy-related emissions, including greenhouse gases; and
   c. improvement in the energy efficiency of all economic sectors; and
(2) Ensure that the United States maintains a technological lead in developing and deploying advanced energy technologies.

Funding Opportunity Announcements (full proposal due 15 Mar 2010)
   Innovative Materials & Processes for Advanced Carbon Capture Technologies (IMPACCT)
   Batteries for Electrical Energy Storage in Transportation (BEEST)
   Electrofuels

Workshops
Workshop #1: Grid Scale Energy Storage	October 4, 2009 - Seattle, WA
Workshop #2: Direct-Solar Fuel Technologies	October 21, 2009 - Arlington, VA
Workshop #3: Carbon Capture and Conversion	October 29, 2009 - Pittsburgh, PA
Workshop #5: Adv Building Energy Technologies	December 15, 2009 – Arlington, VA
Potential Future Workshops
   Waste Heat Recovery
   Solid State Lighting
Innovation Hubs
http://www.energy.gov/hubs/

The proposed Energy Innovation Hubs will be major multidisciplinary, multi-investigator, multi-institutional integrated research centers. The Hubs are modeled after the forceful centralized scientific management characteristics of the Manhattan Project (e.g., Los Alamos and the Metallurgical Laboratory at the University of Chicago), Lincoln Lab at MIT that developed radar, and AT&T Bell Laboratories that developed the transistor, and on the three $25 million-per-year DOE Bioenergy Research Centers (BRCs) established by the U.S. Department of Energy's Office of Science in 2007.

The Hubs will bring together top researchers from academia, industry and the government laboratories with expertise that spans multiple scientific and engineering disciplines under the leadership of a dynamic scientist-manager. These teams will orchestrate an integrated, multidisciplinary systems approach to overcoming critical technological barriers to transformative advances in energy technology. The Hubs will advance U.S. global leadership in the emerging green economy and are focused in areas that have exceptional potential to reduce our dependence on imported oil and greenhouse gas emissions.

FY2010 Initiation
Fuels from Sunlight (DOE SC Basic Energy Sciences)
Energy Efficient Building (DOE Office of EERE)
Modeling and Simulation for Nuclear Reactors (DOE Office of Nuclear Energy)

Possible Future
Batteries and Energy Storage (projected for FY11 in SC BES)
Electrical Grid Systems
Novel Carbon Capture and Storage
Nuclear Fuel Management
Solar Electricity
DOE Early Career Research Program
http://www.science.doe.gov/SC-2/early_career.htm

Purpose:
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

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

Award Size:
University grants $150,000 per year for 5 years to cover summer salary and expenses
National lab awards $500,000 per year for five years to cover full salary and expenses

FY 2010 Results:
69 awards funded via the American Recovery and Reinvestment Act
1,750 proposals peer reviewed to select the awardees
47 university grants and 22 DOE national laboratory awards
Awardees are from 44 separate institutions in 20 states

FY 2011 Application Process:
Funding Opportunity Announcement issued in Spring 2010
Awards made in the Second Quarter of 2011
The mission of the Advanced Scientific Computing Research (ASCR) program is to discover, develop, and deploy computational and networking capabilities to analyze, model, simulate, and predict complex phenomena important to the Department of Energy. A particular challenge of this program is fulfilling the science potential of emerging multi-core computing systems and other novel “extreme-scale” computing architectures, which will require significant modifications to today’s tools and techniques.

**Deliver Computing for the Frontiers of Science**
- Computer science and software research
- Extending science through computation and collaboration
- Supercomputing technologies for science
- Computational and network infrastructure and tools
SC ASCR
Mathematical, Computational, and Computer Sciences Research

Applied Mathematics
FY11: $45M
http://www.er.doe.gov/ascr/Research/AppliedMath.html

Numerical methods for solving ordinary, partial differential equations; computational meshes for complex geometrical configurations; optimization; multiscale computing; multiphysics computations; math software and libraries

Applied mathematics researchers develop the inner workings of computer simulation – the methods that translate the physical world into language computers understand. They analyze how models behave, optimize algorithms and explore codes to meet new challenges. They make simulations more precise, fast and efficient – in one case, computer scientists and chemists merged components from ASCR-developed software packages to cut simulation runtime nearly in half. ASCR also supports graduate fellowships and other educational programs to ensure a continued supply of experts in the field. These efforts are crucial to provide the computing capability DOE and the Office of Science demand for research to protect our national and economic security.

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Dr. Karen Pao          karen.pao@science.doe.gov Phone: 301 903 5384
Computer Science

http://www.sc.doe.gov/ascr/Research/ComSci.html


ASCR supports the federal government’s largest and most active computer science research effort. DOE researchers, as well as university researchers, suppliers and companies, have used system software and software tools it develops to capitalize on the capabilities of high-performance computers. That allows researchers to simulate and predict complex physical, chemical and biological phenomena important to the Office of Science and DOE.

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SC ASCR
Mathematical, Computational, and Computer Sciences Research

Next Generation Networking for Science
http://www.sc.doe.gov/ascr/Research/NextGen.html

FY11: $14M

The Next Generation Networking for Science activity builds on results from Computer Science and Applied Mathematics to develop integrated software tools and advanced network services to enable large-scale scientific collaboration and to utilize the new capabilities of ESnet to advance DOE missions.

The research falls into two general categories described below.

• Distributed systems software including scalable and secure tools and services to facilitate large-scalenational and international scientific collaboration and high-performance software stacks to enable the discovery, management, and distribution of extremely large data sets generated by simulations or by science experiments such the Large Hadron Collider, the Intergovernmental Panel on Climate Change, and ITER.

• Advanced network technologies including dynamic optical network services, scalable cyber security technologies, and multi-domain, multi-architecture performance protocols to seamlessly interconnect and provide access to distributed computing resources and science facilities.

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Computational Partnerships
http://www.sc.doe.gov/ascr/Research/SciDAC.html

Computational meshes for complex geometrical configurations; numerical methods; optimization; multiscale computing; multiphysics computations; math and software libraries

The Computational Partnership activity supports the Scientific Discovery through Advanced Computing (SciDAC) program to use results from applied mathematics and computer science research on scientific applications sponsored by other Office of Science programs. These partnerships enable improved performance on high-end computing systems for scientists to conduct complex scientific and engineering computations at a level of detail that begin to resemble real-world conditions. A second challenge is driven by the need for capture, storage, transmission, sharing and analysis of large-scale experimental and observational data, as well as data from simulations.

9 multi-institutional Centers for Enabling Technologies (1/2 of SciDAC activity) to focus on key problems in a particular area such as performance, data management, optimization, or visualization

4 multi-institutional SciDAC Institutes with a role in the education and training of the next generation of computational scientists.

35 multi-institutional Science Application Partnerships to dramatically improve the ability of their researchers to effectively utilize petascale computing to advance science.

Dr. Walt Polansky walt.polansky@science.doe.gov Phone: 301 903 5800
Basic Energy Sciences (BES) supports fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels in order to provide the foundations for new energy technologies and to support DOE missions in energy, environment, and national security. The BES program also plans, constructs, and operates major scientific user facilities to serve researchers from universities, national laboratories, and private institutions.

The BES program is one of the Nation's largest sponsors of the natural sciences by funding experiments at more than 160 research institutions through three Divisions. The research portfolio of the Basic Energy Sciences (BES) program consists of the following distinct Core Research Activities (CRAs).

**Materials Sciences and Engineering Division**
- Experimental Condensed Matter Physics
- Mechanical Behavior and Radiation Effects
- Neutron and X-Ray Scattering
- Electron and Scanning Probe Microscopies
- Materials Chemistry

**Theoretical Condensed Matter Physics**
- Physical Behavior of Materials
- Ultrafast Science and Instrumentation
- Synthesis and Processing Science
- Biomolecular Materials

**Scientific User Facilities Division**
- Neutron and X-Ray Scattering Facilities
- Electron-beam Microcharacterization Centers

**Nanoscience Science Research Centers**
- Accelerator and Detector Research

**Chemical Sciences, Geosciences, and Biosciences Division**
- Atomic, Molecular, and Optical Sciences
- Solar Photochemistry
- Catalysis Science
- Heavy Element Chemistry

**Chemical Physics Research (Gas Phase; Condensed Gas and Interface)**
- Energy Biosciences Research (Photosynthetic; Physical Biosciences)
- Separations and Analysis
- Geosciences Research
SC BES
Energy Frontier Research Centers
http://www.er.doe.gov/bes/EFRC/index.html

EFRCs were established to integrate the talents and expertise of leading scientists in a setting designed to accelerate research toward meeting our critical energy challenges. The EFRCs harness the most basic and advanced discovery research in a concerted effort to establish the scientific foundation for a fundamentally new U.S. energy economy. The scientific directions of the EFRCs are overseen by program staff in the Basic Energy Sciences program within the Office of Science to ensure a unified management strategy and structure.

In FY 2011, approximately $40,000,000 will also be available to fund additional EFRCs. New EFRCs will be competitively solicited in two categories: discovery and development of new materials that are critical to both science frontiers and technology innovations, and basic research for energy needs in a limited number of areas that are underrepresented in the original awards.

**Discovery and development of new materials.** Research in this category will focus on new synthesis capabilities, including bio-inspired approaches, to establish a strong foundation for science-driven materials discovery and synthesis in the U.S. This work will focus on materials broadly and will include crystalline materials, which have been highlighted recently as an essential component of the science grand challenges in the 2007 Basic Energy Sciences Advisory Committee report *Directing Matter and Energy: Five Challenges for Science and the Imagination*. As described in the November 2009 National Research Council report *Frontiers in Crystalline Matter: From Discovery to Technology*, the U.S., once the world leader in the discovery and growth of crystalline materials, has fallen behind other nations. Single crystals are vital in understanding the characteristics and properties of new materials, and they also have applications in devices that involve semiconductors, lasers, precision timing devices, solar cells or high temperature operations and provide a natural platform to explore novel states of matter.

**Basic research for energy needs.** Major areas of emphasis will be in fundamental sciences related to carbon capture and advanced nuclear energy systems. For carbon capture, focused areas include the rational design of novel materials and separation processes for post-combustion CO$_2$ capture, as well as catalysis and separation research for novel carbon capture schemes to aid the design of future power plants. For advanced nuclear energy systems, focused areas include radiation resistant materials in fission and fusion applications and separation science and heavy element chemistry for fuel cycles.
Materials Chemistry and Biomolecular Materials

Materials Chemistry
http://www.science.doe.gov/bes/dms/Research_Programs/mc.htm
Basic research on the chemical synthesis of novel materials, and chemical control of their structure and collective properties. Major thrust areas include: Chemical synthesis of nanoscale materials and assembly of nanomaterials into macroscopic structures; Solid state chemistry—Exploratory synthesis and discovery of new classes of magnets, superconductors, thermoelectrics, ferroelectrics, porous materials, and quasicrystals; Surface and interfacial chemistry—Electrochemistry, electrocatalysis, materials aspects of catalysis, molecular level understanding of friction, adhesion and lubrication; Polymers and polymer composites; and Development of science-driven, laboratory-based “Analytical Tools and Techniques”.
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Biomolecular Materials
http://www.science.doe.gov/bes/dms/Research_Programs/bmm.htm
The principal goal of this activity is to explore the use of molecules, methods and concepts of biology to create novel materials and processes with energy significance. Major thrust areas include: Understanding, controlling and building complex structures by “self-assembly”, the approach used by Nature; Biomimetic, bioinspired and biotemplated materials design and synthesis, e.g., synthesis of energy-related materials under mild conditions; Integration of biological systems with non-biological materials – Discovery of new functions and properties; Materials aspects of energy production, conversion and storage based on principles of biology; and Development of science-driven “Tools and Techniques” for biomolecular materials characterization.
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Synthesis and Processing Science
http://www.science.doe.gov/bes/dms/Research_Programs/sps.htm
Basic research in synthesis and processing science to devise innovative preparation routes of new materials with desired structure, properties or behavior; to understand the physical phenomena which underpin the materials synthesis such as diffusion, nucleation and phase transitions; and to develop concomitant in-situ monitoring and diagnostic capabilities. Major thrusts include: Physics of formation and growth of thin-films and nanoscale objects; Phase transitions and transformations in Materials Processing Science; Synthesis and Processing Science for Hydrogen Storage; and Support of Materials Preparation Center (Ames Lab) -- a national resource with unique capabilities in preparation, purification, processing, and fabrication of well characterized materials for research and development.
Dr. Bonnie Gersten  bonnie.gersten@science.doe.gov  Phone: 301 903 0002
Basic research in theory, modeling, and simulations complementing the experimental effort. A current major thrust is in nanoscale science where links between the electronic, optical, mechanical, and magnetic properties of nanostructures and their size, shape, topology, and composition are poorly understood. Other research areas include correlated behavior of two dimensional electron gases, quantum transport, superconductivity, magnetism, and optics. An important facilitating component is the Computational Materials Science Network (CMSN) which enables groups of scientists from Department of Energy (DOE) national laboratories, universities, and (to a lesser extent) industry to address materials problems requiring larger-scale collaboration across disciplinary and organizational boundaries.

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A broad-based experimental program in condensed matter and materials physics research emphasizing electronic structure, surfaces/interfaces, and new materials. It includes the development and exploitation of advanced experimental techniques and methodology. The objective is to provide the understanding of the physical phenomena and processes underlying the properties and behavior of advanced materials. The portfolio includes specific research thrusts in magnetism, semiconductors, superconductivity, materials synthesis and crystal growth, and photoemission spectroscopy.

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Physical Behavior of Materials

Characterize, understand, predict, and control physical behavior of materials by developing the scientific basis underpinning the behavior, and furthermore, establishing rigorous physical models for predicting the response of materials. The forms of stimuli range from temperature, electrical and magnetic fields, chemical and electrochemical environment, and proximity effects of surfaces or interfaces. Basic research topics supported include characterization of physical properties with an emphasis on the development of new experimental tools and instrumentation, and multi-scale modeling of materials behaviors.

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Mechanical Behavior of Materials and Radiation Effects

Understanding the mechanical behavior of materials under static and dynamic stresses and the effects of radiation on materials properties and behavior. The objective is to understand the defect-behavior relationship at an atomic level and to develop predictive models to enable designing materials with desirable properties. In the area of mechanical behavior, the research aims to advance understanding of deformation and fracture, effects of environment and stress, friction and wear, phase transformation, high-temperature intergranular cracking in metallic alloys, and ductile-to-brittle transition without structural change. In the area of radiation effects, the research aims to advance understanding of mechanisms of amorphization (transition from crystalline to a non-crystalline phase), understand mechanisms of radiation damage, predict and learn how to suppress radiation damage, develop radiation-tolerant materials, and modify surfaces by ion implantation.

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SC BES
Materials Science and Engineering Division
Scattering and Instrumentation Sciences

X-ray and Neutron Scattering

**X-ray Scattering**

http://www.science.doe.gov/bes/dms/Research_Programs/xray.htm

Basic research in condensed matter and materials physics using x-ray scattering capabilities primarily at major BES-supported user facilities. Research is aimed at achieving a fundamental understanding of the atomic, electronic, and magnetic properties of materials and their relationship to the physical properties of materials. Both ordered and disordered materials are of interest as are strongly correlated electron systems, surface and interface phenomena, and behavior under environmental variables such as temperature, pressure, and magnetic field. Development of x-ray instrumentation is a major component of the portfolio.

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**Neutron Scattering**

http://www.science.doe.gov/bes/dms/Research_Programs/neutron.htm

Basic research in condensed matter and materials physics using neutron scattering capabilities primarily at major BES-supported user facilities. Research is aimed at achieving a fundamental understanding of the atomic, electronic, and magnetic properties of materials and their relationship to the physical properties of materials. Both ordered and disordered materials are of interest as are strongly correlated electron systems, surface and interface phenomena, and behavior under environmental variables such as temperature, pressure, and magnetic field. Development of neutron instrumentation is a major component of the portfolio.

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Electron and Scanning Probe Microscopies

**Electron and Scanning Probe Microscopies**

http://www.science.doe.gov/bes/dms/Research_Programs/espm.htm

Basic research in condensed matter physics and materials physics using electron diffraction and microscopy and scanning probe techniques. Research includes experiments and theory to understand the atomic, electronic and magnetic structures of materials, structural evolutions, and the relationship of structure to the properties of materials. Increasingly important are the nanoscale structures and the structure and composition of inhomogeneities including defects, interfaces, surfaces, and precipitates. Advancing the state of the art of electron beam and scanning probe techniques and instrumentation for quantitative microscopy and microanalysis is an essential element in this portfolio.

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FY11: $42M
FY11: $27M
Chemical Physics

The Chemical Physics program supports basic research on fundamental molecular processes related to the mission of the Department in such areas as combustion, catalysis, and environmental restoration. Areas of research emphasis include, but are not limited to: gas phase chemical reaction theory, computational chemistry, experimental dynamics and spectroscopy, thermodynamics of reaction intermediates, chemical kinetics and reaction mechanisms at high temperatures in the gas phase and at surfaces, combustion diagnostics, and chemical dynamics and kinetics at surfaces and with metal and semiconductor clusters.

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Chemical Physics (Condensed-Phase and Interfacial Molecular Science)

CPIMS research emphasizes molecular understanding of chemical, physical, and electron driven processes in aqueous media and at interfaces. Studies of reaction dynamics at well-characterized metal and metal-oxide surfaces and clusters lead to the development of theories on the molecular origins of surface-mediated catalysis and heterogeneous chemistry. Studies of model condensed-phase systems target first-principles understandings of molecular reactivity and dynamical processes in solution and at interfaces. The approach confronts the transition from molecular-scale chemistry to collective phenomena in complex systems, such as the effects of solvation on chemical structure and reactivity.

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Computational and Theoretical Chemistry

Proposals should have a sharp focus on tightly coupling research in theory, computation and simulation to fundamental chemistry matters related to the future energy needs of the nation. Research addressing fundamental problems, in the short- or long- term, which will enhance or enable conversion to clean, sustainable, renewable, novel or highly efficient energy use, are of particular interest. Approaches must include application to real molecular-scale systems and should address a current shortcoming in theory, algorithm, computation, or modeling and simulation capabilities.

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Atomic, Molecular, and Optical Sciences

The Atomic, Molecular and Optical Sciences (AMOS) Program supports a balanced portfolio of experiment and theory to study the fundamental properties of atoms, ions and small molecules and the interactions between electrons, photons and ions in collisions with atoms, molecules and surfaces. Research is focused on the most complete quantum mechanical description of these properties and interactions and is intended to provide a basic understanding of physical processes.

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The Solar Photochemistry program supports fundamental molecular-level research on interactions of radiation with matter in the condensed phase. The photochemistry research effort emphasizes fundamental processes aimed at the capture and chemical conversion of solar energy. Biomimetic models (photochemical and photoelectrochemical) seek to mimic the key aspects of photosynthesis – antenna, reaction center, catalytic cycles, and product separation. The research encompasses organic and inorganic photochemistry, photoinduced electron and energy transfer, photoelectrochemistry, biophysical aspects of photosynthesis, and molecular assemblies for artificial photosynthesis. Inorganic and organic photochemical studies provide information on new chromophores, donor-acceptor complexes, and photocatalytic cycles. Photoelectrochemical conversion is explored in fundamental studies of the semiconductor/liquid interface, colloidal semiconductors, and dye-sensitized solar cells. Photochemical reactions are investigated in nanoscale heterogeneous environments, such as zeolites, inorganic multilayer films, dendrimers, silica gel, and liposomes. Biophysical studies on photosynthetic antennas and the reaction center provide molecular design criteria for efficient light collection and charge separation in model systems.

Dr. Mark Spitler  
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The program supports fundamental research on light harvesting, exciton transfer, charge separation, transfer of reductant to carbon dioxide, as well as the biochemistry of carbon fixation and carbon storage. The programmatic goal is uncover underlying structure-function relationships that will guide the development of robust artificial and biohybrid solar energy conversion and fuel production systems, in which the best features from nature are selectively utilized while the shortcomings of biology are bypassed.

Dr. B. Gail McLean  
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Phone: 301 903 7807

This program combines experimental and computational tools from the physical sciences with biochemistry and molecular biology. Research supported includes studies that investigate the mechanisms by which energy transduction systems are assembled and maintained, the processes that regulate energy-relevant chemical reactions within the cell, the underlying biochemical and biophysical principals that determine the architecture of biopolymers and the plant cell wall, and active site protein chemistry that provides a basis for highly selective and efficient bioinspired catalysts. The goal is to provide basic structure-function information necessary to accomplish solid-phase nanoscale synthesis in a targeted manner; i.e., controlling the basic architecture of energy-transduction and storage systems.

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SC BES
Chemical Sciences, Geosciences, and Biosciences Division
Chemical Transformations

**Catalysis Science**
FY11: $49M
http://www.er.doe.gov/bes/chm/Programs/programs.html
This activity supports basic research to understand the chemical aspects of catalysis, both heterogeneous and homogeneous; the chemistry of fossil resources; and the chemistry the molecules used to create advanced materials. This activity is the Nation's major supporter of catalysis research, and it is the only activity that treats catalysis as a discipline integrating all aspects of homogeneous and heterogeneous catalysis research. Results from a fundamental, molecular-level understanding of the syntheses of advanced catalytic materials have the potential of providing new chemicals or materials that can be fabricated with greater energy efficiency or function as energy-saving media themselves.

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**Heavy Element Chemistry**
FY11: $12M
http://www.er.doe.gov/bes/chm/Programs/programs.html
This activity supports research in actinide and fission product chemistry. Areas of interest include aqueous and non-aqueous coordination chemistry; solution and solid-state speciation and reactivity; measurement of chemical and physical properties; synthesis of actinide-containing materials; chemical properties of the heaviest actinide and transactinide elements; theoretical methods for the prediction of heavy element electronic and molecular structure and reactivity; and the relationship between the actinides, lanthanides, and transition metals.

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**Separations and Analysis**
FY11: $17M
http://www.er.doe.gov/bes/chm/Programs/programs.html
This activity supports fundamental research covering a broad spectrum of separation concepts, including membrane processes, extraction under both standard and supercritical conditions, adsorption, chromatography, photo-dissociation, and complexation. Also supported is work to improve the sensitivity, reliability, and productivity of analytical determinations and to develop entirely new approaches to analysis.

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SC BES
Chemical Sciences, Geosciences, and Biosciences Division

Chemical Transformations

Geosciences Research Program  FY11: $51M
http://www.er.doe.gov/bes/geo/geohome.html

Contact the program director before submitting material to the Geosciences Program. Most correspondence is done by email.

- Geochemistry of Mineral-Fluid Interactions
  - Rates and mechanisms of reaction at the atomistic/molecular scale
  - Coupled flow and reactivity in porous and fractured rocks
  - Isotopic tracking of mineral-mineral and mineral-fluid processes

- Geophysical Interrogation of the Earth’s Crust
  - Indirect determination of geologic structure and rock properties
  - Collection and analysis of seismic and electromagnetic data
  - Geophysical signatures of fluids and fluid-bearing reservoirs

- Basic Properties of Rocks, Minerals, and Fluids
  - Analyses of multi-phase, heterogeneous, anisotropic systems
  - Determine physical, chemical, mechanical properties
  - Analysis of rock deformation, flow, fracture, and failure
  - Prediction of fluid transport in large-scale geologic structures

- Analytical Instrumentation and Computational Methods
  - High-resolution geophysical imaging and inversion tools
  - Angstrom-scale resolution in analysis of heterogeneous minerals
  - Advanced computational modeling and algorithm development

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Dr. Patrick F. Dobson          Patrick.Dobson@science.doe.gov       Phone: 301 903 5884
Mission
BER advances world-class biological and environmental research programs and scientific user facilities to support DOE’s energy, environment, and basic research missions. Mission priorities:

- Develop biofuels as a major secure national energy resource
- Understand relationships between climate change and Earth’s ecosystems, and assess options for carbon sequestration
- Predict fate and transport of subsurface contaminants
- Develop new tools to explore the interface of biological and physical sciences

Organizational Structure
- Biological Systems Science Division (BSSD) - supports fundamental research and technology development to achieve a predictive, systems-level understanding of complex biological systems to advance DOE missions in energy, climate, and environment.
- Climate and Environmental Sciences Division (CESD) - supports fundamental research to achieve a predictive, systems-level understanding of climate change, as well as subsurface contaminant fate and transport, to advance DOE missions in energy, climate, and environment.

Research Activities
Since initiating the Human Genome Project in 1986, BER has spearheaded the development of modern genomics-based systems biology and played a major role in seeding and fostering the contemporary biotechnology revolution, while at the same time supporting forefront research on the impacts of energy production and use on climate change. BER’s research program, closely aligned with DOE mission goals, aims at understanding complex biological and environmental systems across many spatial and temporal scales, from the sub-micron to the global, from individual molecules to ecosystems, from nanoseconds to millennia, to develop predictive knowledge relevant to DOE mission challenges. Two areas vital to the Nation’s energy security and environmental future lie at the core of the BER research agenda: developing cost-effective cellulosic biofuels and improving our ability to understand, predict, and mitigate the impacts of energy production and use on climate change.
Foundational Genomics Research

Foundational Genomics Research activity supports fundamental research on microbes and plants, with an emphasis on understanding biological systems across multiple scales of organization, ranging from subcellular protein-protein interactions to complex microbial community structures. At the subcellular level, this research focuses on the characterization and spatial organization of cellular components and the regulatory and metabolic networks of microbes and plants. It investigates how cells are able to balance dynamic needs for synthesis, assembly, and turnover of cellular machinery in response to changing signals from the environment. Foundational genomic research will increasingly focus on understanding how different organisms interact within a biological or environmental system to provide unique functions through mechanisms such as commensal nutrient flow or horizontal gene transfer.

Genomics Analysis and Validation

The Genomics Analysis and Validation activity develops the tools and resources needed to fully exploit the information contained in complete DNA sequences from microbes and plants for bioenergy, carbon sequestration, and bioremediation applications. This activity supports development of new strategies and tools capable of high-throughput, genome-wide experimental and analytic approaches for complex biological systems.

Metabolic Synthesis and Conversion

This activity focuses on understanding biological pathway composition and regulation to effect conversion of carbon from simple precursor forms into advanced biomolecules. Fundamental research focuses on understanding carbon uptake, fixation, and storage in plants and soil microbes, strongly leveraging the increasing availability of information from whole organism genomes and community metagenomes. Research will also focus on understanding the role that microbial communities or plant-microbe associations play in the transfer of carbon between the roots and the soil to identify strategies that would lead to increased carbon storage in the rhizosphere and surrounding soil.

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Dr. John Houghton
john.houghton@science.doe.gov
Phone: 301 903 8288
Computational Biosciences FY11: $13M

Computational models and the necessary algorithmic and computational tools needed to describe the biochemical capabilities of microbial communities or plants are essential to the success of the BER Genomic Sciences activity. The models are needed to integrate diverse data types and data sets—from experiments using genomics, proteomics, and metabolomics—into single models, and they must accurately describe and predict the behavior of metabolic pathways and genetic regulatory networks. A systems biology knowledge base is an integrated experimental framework for accessing, comparing, analyzing, modeling, and testing systems biology data.

Dr. Susan Gregurik susan.gregurick@science.doe.gov Phone: 301 903 7672

Ethical, Legal and Social Issues (ELSI) FY11: $5M

http://www.sc.doe.gov/ober/BSSD/ELSI.html

The explicit intention of ELSI is to interweave, from the outset, thinking about scientific activities with explorations of their potential societal implications. Mission-relevant science of primary importance includes bioenergy, synthetic genomics, and nanoscience. The DOE ELSI Program examines issues associated with DOE science by inviting and supporting peer-reviewed studies of the societal issues and their implications, recognizing that the social context is always evolving and both scientists and society need to adapt along with it in their discussions of societal implications. A principal aim is to break down distinctions among science practitioners and those exploring societal implications, based on the explicit assumption that society, including scientists and the sciences, benefits directly from considering societal implications ahead of time and at each stage of the research.

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Radiochemistry Imaging and Instrumentation  
FY11: $18M  
http://www.sc.doe.gov/ober/BSSD/radiochem.html

The activity supports fundamental research in radiochemistry and radiotracer development activities that include development of new methodologies for real-time, high-resolution imaging of dynamic biological processes in energy- and environment-relevant contexts. Radionuclide imaging continues to stand out as a singular tool for studying living organisms in a manner that is highly quantitative, three dimensional, temporally dynamic, and non-perturbative of the natural biochemical processes under study.

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Radiobiology  
FY11: $24M  
http://www.sc.doe.gov/ober/BSSD/lowdose.html

The Radiobiology activity supports research that will help determine health risks from exposures to low levels of ionizing radiation, information critical to adequately and appropriately protect radiation workers and the general public. Research investigations include a number of critical biological phenomena induced by low dose exposure including adaptive responses, bystander effects, genomic instability, and genetic susceptibility. This activity includes support for understanding the role of epigenetics in integrated gene function and response of biological systems to environmental conditions, including low dose radiation.

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Terrestrial Ecosystem Science  
http://www.sc.doe.gov/ober/CESD/ter.html
The Terrestrial Ecosystem Science activity develops the scientific understanding of the effects of climate change on terrestrial ecosystems and the role of terrestrial ecosystems in global carbon cycling. The research focuses on determining the effects of climate change on the structure and functioning of terrestrial ecosystems, understanding the processes controlling exchange rate of carbon dioxide between atmosphere and terrestrial biosphere, evaluating terrestrial source-sink mechanisms for atmospheric carbon dioxide, and improving reliability of global carbon cycle models for predicting future atmospheric concentrations of carbon dioxide.
Dr. Jeff Amthor  
jeff.amthor@science.doe.gov  
Phone: 301 903 2507

Terrestrial Carbon Sequestration Research  
http://csite.esd.ornl.gov/
Terrestrial Carbon Sequestration research supports efforts to identify, understand, and predict the fundamental physical, chemical, biological, and genetic mechanisms controlling carbon sequestration in terrestrial ecosystems including soils. These challenges are addressed by identifying the physical, biological, and chemical processes controlling soil carbon input, distribution, and longevity; developing models of these systems to predict future scenarios and to inform larger-scale coupled earth systems models; and seeking ways to exploit these processes to enhance carbon sequestration in terrestrial ecosystems.
Dr. Michael Kuperberg  
michael.kuperberg@science.doe.gov  
Phone: 301 903 3511

Subsurface Biogeochemical Research  
http://www.sc.doe.gov/ober/CESD/subbio.html
The Subsurface Biogeochemical Research activity addresses fundamental science questions at the intersection of biology, geochemistry, and physics to describe complex processes in key subsurface environments. The activity builds on BER advances in genome science and promotes crossdisciplinary research to link interdependent relationships between microbial metabolism, geochemical reactions, and physical transport processes with computational modeling to advance a predictive understanding of environmental processes. The current focus of the activity is to predict the impact of biogeochemical processes on the fate and transport of contaminants in the subsurface.
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Phone: 301 903 5549
Dr. David Lesmes  
david.lesmes@science.doe.gov  
Phone: 301 903 2977
Regional and Global Climate Modeling
http://www.sc.doe.gov/ober/CESD/regional.html
Regional and Global Climate Modeling focuses on the research application of regional and global climate models to
develop climate change projections on temporal scales of decades to centuries and spatial scales from regional to global.
Core research areas are climate model diagnosis and intercomparison through the use of appropriate metrics, detection
and attribution of climate change, analysis of multi-model climate change simulations and projections, and understanding
of natural and forced variability of the climate system.
Dr. Renu Joseph  
renu.joseph@science.doe.gov  
Phone: 301 903 9237

Earth System Modeling
http://www.sc.doe.gov/ober/CESD/esm.html
Earth System Modeling develops the components and the mechanisms needed to couple atmosphere-ocean-land-sea ice
models for simulating climate variability and change over decadal to centennial time scales, and thus provides the research
results that underpin the Regional and Global Climate Modeling research activities. Research focuses on the incorporation
of improved physical presentations in the specific modules of the coupled model. The focus is on incorporation and testing
of various schemes for aerosol, convection, ice sheets, and land surface in the coupled models, and evaluation using
innovative metrics that span a variety of climate time scales.
Dr. Anjula Bamzai  
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Integrated Assessment of Global Climate Change
http://www.sc.doe.gov/ober/CESD/ia.html
Integrated Assessment research provides scientific insights into options for mitigation of an adaptation to climate change
through multi-scale models of the entire climate system, including human processes responsible for greenhouse gas
emissions, land use, and combined impacts on and feedbacks from changing human and natural systems, including the
energy system. Importantly, Integrated Assessment research develops advanced quantitative tools for exploring the
implications of science and technology decisions and innovations on our energy, environmental, and economic futures.
Mr. Robert Vallario  
bob.vallario@science.doe.gov  
Phone: 301 903 5758
Atmospheric System Research

The emphasis for Atmospheric System Research is on understanding the radiation balance from the surface of the Earth to the top of the atmosphere and how this balance is affected by clouds, aerosols, and increases in the concentration of greenhouse gases in the atmosphere.

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High Energy Physics explores the most fundamental questions about the nature of the universe. The Office of High Energy Physics supports a program focused on three frontiers of scientific discovery. At the energy frontier, powerful accelerators investigate the constituents and architecture of the universe. At the intensity frontier, astronomically large amounts of particles and highly sensitive detectors offer a second, unique pathway to investigate rare events in nature. At the cosmic frontier, natural sources of particles from space reveal the nature of the universe. Together these three interrelated discovery frontiers create a complete picture, advancing Department of Energy missions through the development of key cutting-edge technologies and the training of future generations of scientists.

The Office of High Energy Physics promotes a broad, long term particle physics program at three interrelated frontiers of particle physics. The office supports current operations and experiments and research and development for future facilities and experiments.

- **The Energy Frontier** directly explores the fundamental constituents and architecture of the universe. Here accelerators produce the highest-energy particles ever made by man; collisions of these particle beams produce unusual and new particles. Sophisticated detectors observe the final state particles, providing insight into the fundamental interactions and windows to the conditions of the early universe.

- **The Intensity Frontier**, accessed with a combination of intense particle beams and highly sensitive detectors, offers a second, unique investigation of fundamental interactions. Neutrinos, though ubiquitous in the universe, are elusive and require populous beams and vast detectors to observe. Measurements of the mass and other properties of neutrinos have profound consequences for understanding the evolution of the universe. Observations of rare processes, that require exquisitely sensitive detectors as well as intense beams, also explore high energies, providing an alternate, powerful window to the nature of fundamental interactions.

- **The Cosmic Frontier** reveals the nature of dark matter and dark energy by using particles from space to explore new phenomena. Cosmic rays in the earth’s atmosphere, neutrinos from the sun, and gamma rays from deep space, are some of the known natural sources. Searches are also underway for alternate explanations of dark matter and energy. Observations of the cosmic frontier reveal a universe far stranger than ever thought possible. The new techniques at the cosmic complement the accelerator-based research of the other frontiers.
Proton Accelerator Physics Grants Program      FY11: $61M
http://www.science.doe.gov/hep/research/proton.shtml
Fully support LHC research activities while maintaining participation in the Tevatron Collider and growing strong neutrino physics programs. Active participation of university physicists is needed to carry out both the collider and neutrino programs at the Tevatron during FY 2011.
Dr. Saul Gonzalez  saul.gonzalez@science.doe.gov  Phone: 301 903 2359

Electron Accelerator Physics Grants Program      FY11: $6M
http://www.science.doe.gov/hep/research/electron.shtml
Funding continues at a reduced level of effort to complete analysis of physics data from BaBar and the CLEO-c experiment at CESR. Smaller efforts devoted to operations of the Belle detector at KEK B, and the Beijing Spectrometer at BEPC and the analysis of data taken there are supported. Also supported is a small research program devoted to physics studies of a much higher performance, higher intensity B-factory.
Dr. John Kogut  john.kogut@science.doe.gov  Phone: 301 903 1298

Non-Accelerator Physics Grants Program       FY11: $23M
http://www.science.doe.gov/hep/research/non_accelerator.shtml
The operating experiments include the Very Energetic Radiation Imaging Telescope Array System, a ground-based gamma ray experiment at the Whipple Observatory in Arizona; the Pierre Auger Observatory in Argentina; and the LAT gamma-ray survey on NASA’s FGST space-based mission. Other active research efforts include searches for dark matter using the upgraded “Super” Cryogenic Dark Matter Search (SuperCDMS) at the Soudan Mine in Minnesota and the Axion Dark Matter eXperiment (ADMX) at LLNL, as well as other dark matter searches using different techniques.
Dr. Kathy Turner  kathy.turner@science.doe.gov  Phone: 301 903 1759

Theoretical Physics Grants Program        FY11: $27M
http://www.science.doe.gov/hep/research/theory.shtml
Enhanced efforts focused on the analysis of current and previous experiments and in the design and optimization of new experiments, so that these experiments can fulfill their maximum potential. It will also support theorists who explore new ideas of physics at all three particle physics frontiers.
Dr. Chung Ngoc Leung  CN.Lueng@science.doe.gov  Phone: 301 903 3715
The mission of the Office of Science Nuclear Physics program is to foster fundamental research in nuclear physics that will provide new insights and advance our knowledge on the nature of matter and energy and develop the scientific knowledge, technologies and trained manpower that are needed to underpin the Department of Energy’s missions for nuclear-related national security, energy, and environmental quality. The program provides world-class, peer-reviewed research results and operates user accelerator facilities in the scientific disciplines encompassed by the Nuclear Physics mission areas under the mandate provided in Public Law 95-91 that established the Department.

Through research, nuclear physicists are leading us on a journey of discovery into the nucleus of the atom - the very heart of matter. The goal is a roadmap of matter that will help unlock the secrets of how the universe is put together.

The Office of Nuclear Physics in the Department of Energy (DOE's) Office of Science supports the experimental and theoretical research needed to create this roadmap. This quest requires a broad approach to different, but related, scientific frontiers: improving our understanding of the building blocks of matter; discovering the origins of nuclei; and identifying the forces that transform matter. Stewardship of the field is shared with the National Science Foundation (NSF's) Nuclear Physics Program. DOE and NSF fund almost all basic research in Nuclear Physics.

Funding for nuclear physics provides leading-edge instrumentation, world-class facilities, and training and support for the people involved in these pursuits. The result is a vast array of information that is helping us understand the universe at ever-deeper levels.

Forefront nuclear physics research provides solid foundations for other fields: the accumulation of new results and the intellectual training of new generations of scientists foster important advances in medicine, chemistry and other sciences.
Medium Energy Nuclear Physics  
FY11: $21M
The Medium Energy subprogram primarily explores the low temperature frontier of QCD to understand how the properties of existing matter arise from the properties of QCD. This research is conducted at two NP National User Facilities (Continuous Electron Beam Accelerator Facility (CEBAF) at the Thomas Jefferson National Accelerator Facility (TJNAF or JLab) and Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL)) and other facilities worldwide.
Dr. Brad Tippens  
brad.tippens@science.doe.gov

Heavy Ion Nuclear Physics  
FY11: $16M
The Heavy Ion subprogram investigates the high temperature frontier of QCD, by trying to recreate and characterize new and predicted forms of matter and other new phenomena that might occur in extremely hot, dense nuclear matter and which have not existed since the Big Bang. Measurements are carried out primarily using relativistic heavy ion collisions at RHIC, the Relativistic Heavy Ion Collider at Brookhaven National Lab.
Dr. Gulshan Rai.  
sulshan.rai@science.doe.gov

Low Energy Nuclear Physics  
FY11: $23M
The Low Energy subprogram studies the frontiers of Nuclear Structure and Astrophysics and Fundamental Symmetry and Neutrinos. Two NP National User Facilities are pivotal in making progress in these frontiers - the Argonne Tandem Linac Accelerator System (ATLAS) at Argonne National Laboratory (ANL) and the Holifield Radioactive Ion Beam Facility (HRIBF) at Oak Ridge National Laboratory (ORNL).
Dr. Cyrus Baktash  
cyrus.baktash@science.doe.gov

Nuclear Theory  
FY11: $16M
The Nuclear Theory subprogram provides the theoretical underpinning needed to support the interpretation of a wide range of data obtained from all the other NP subprograms and to advance new ideas and hypotheses that stimulate experimental investigations. This subprogram supports the Institute for Nuclear Theory (INGT) at the University of Washington. The subprogram also collects, evaluates, and disseminates nuclear physics data for basic nuclear research and for applied nuclear technologies with its support of the National Nuclear Data Center (NNDC).
Dr. George Fai  
george.fai@science.doe.gov
The FES mission is to expand the fundamental understanding of matter at very high temperatures and densities and to develop the scientific foundations needed to develop a fusion energy source. This is accomplished by studying plasmas and their interactions with their surroundings under a wide range of temperature and density, developing advanced diagnostics to make detailed measurements of their properties, and creating theoretical and computational models to resolve the essential physics.

The physics of plasmas is at the heart of understanding how stars shine and evolve over billions of years. Plasmas, essentially hot gases of ions and electrons, are found in environments as familiar as fluorescent lighting and lightning bolts, as unimaginably harsh as the centers of stars, and as exotic as the environments surrounding super massive black holes. The science of plasma physics that describes the plasmas in these environments also describes the auroras that gently illuminate the northern and southern skies and the solar corona, where temperatures are far higher than on the sun’s surface.

The transformation of plasma science from empirical to predictive has come from a sustained investment in flexible experiments that can explore an ever-increasing range of plasma conditions, advanced diagnostics that sample plasma phenomena at temporal and spatial scales covering many orders of magnitude, and simulation capability that also can capture these disparate scales and offers the promise of integrated, validated simulation of burning plasmas in the laboratory and in future energy producing reactors. Importantly, plasma science has also been advanced by vigorous national and international collaboration where fusion’s puzzles and challenges have been addressed in joint experiments promoted by international physics activities.

Today, FES investments are focused on extending this progress into the yet unexplored regime of self sustaining, or burning, fusion reactions. Since the earliest work on fusion energy, most fusion reactor concepts have shared a common approach—the fusion fuel (usually a mixture of the hydrogen isotopes deuterium and tritium) is heated to extremely high temperatures (on the order of 100 million degrees) creating a plasma of ionized deuterium and tritium. Under these conditions, the deuterium and tritium nuclei fuse, releasing substantial amounts of energy.
Tokomak Experimental Research
FY11: $54M
The tokamak magnetic confinement concept has been the most effective approach to date for confining high-temperature plasmas in a laboratory environment. Many of the important issues in fusion science are being studied in tokamaks, including the two major U.S. tokamak facilities: DIII-D and Alcator CMod. In association with the International Tokamak Physics Activity (ITPA), U.S. tokamaks continue to give high priority to joint experiments with tokamak facilities in Europe and Japan.
Dr. Erol Oktay
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Alternative Concept Experimental Research
FY11: $72M
This program element broadens the fusion program by exploring the science of confinement optimization in the extended fusion parameter space, with plasma densities spanning twelve orders of magnitude, by seeking physics pathways to improve confinement, stability, and reactor configurations. Two alternate concepts are being pursued at the larger-scale, proof-of-principle level, a number of concepts at a concept-exploration level, and research in high energy density plasmas.
Dr. Steve Eckstrand
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Phone: 301 903 5546

Theory
FY11: $24M
The Theory program provides the conceptual scientific underpinning of the magnetic fusion energy sciences program by supporting three thrust areas: burning plasmas, fundamental understanding, and configuration improvement. Theory efforts describe the complex multiphysics, multiscale, non-linear plasma systems at the most fundamental level and, in doing so, generate world-class science.
Dr. Curt Bolton
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Phone: 301 903 4914

Advanced Fusion Simulations
FY11: $13M
The FES Advanced Fusion Simulations program includes projects funded under the auspices of the SC Scientific Discovery through Advanced Computing (SciDAC) program as well as a new computational activity focused on integrated modeling, the Fusion Simulation Program (FSP).
Dr. Steve Eckstrand
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Phone: 301 903 5546

General Plasma Science
FY11: $14M
The General Plasma Science program is directed toward basic plasma science and engineering research. This research strengthens the fundamental underpinnings of the discipline of plasma physics that complements burning plasma science and reaches beyond into many basic and applied physics areas.
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Office of Science
Workforce Development for Teachers and Scientists
http://www.scied.science.doe.gov/scied/sci_ed.htm

The mission of the Workforce Development for Teachers and Scientists program is to provide a continuum of opportunities to the Nation's students and teachers of science, technology, engineering and mathematics (STEM).

Programs FY11: $36M

- Undergraduate Internships
  - Science undergraduate Laboratory Internships
  - Community College Institute of Science and Technology
  - Pre-Service Teacher

- Programs for K-12 Students
  - DOE National Science Bowl
  - RealWorld Design

- Programs for Teachers
  - Albert Einstein Distinguished Educator Fellowship Program
  - DOE Academies Creating Teacher Scientists

- Programs for Graduate Students
  - DOE Office of Science Graduate Fellowship Program
  - Graduate Student Awards for the Lindau Meeting of Nobel Laureates

- Other Programs
  - Faculty and Student Teams
  - Science & Energy Research Challenge
  - Energy Research Laboratory Equipment Program

Mr. Bill Valdez bill.valdez@science.doe.edu Phone: 202 586 2218
$10 million will be available in FY 2011 to fund about 170 additional fellowships

Purpose:
To educate and train a skilled scientific and technical workforce in order to stay at the forefront of science and innovation and to meet our energy and environmental challenges

Eligibility:
Candidates must be U.S. citizens and a senior undergraduate or first or second year graduate student
Candidates must be pursuing advanced degrees in areas of physics, chemistry, mathematics, biology, computational sciences, areas of climate and environmental sciences important to the Office of Science and DOE mission

Award Size:
The three-year fellowship award, totaling $50,500 annually, provides support towards tuition, a stipend for living expenses, and support for expenses such as travel to conferences and to DOE user facilities.

FY 2010 Results:
160 awards will be made this Spring with FY 2010 and American Recovery and Reinvestment Act funds

FY 2011 Application Process:
Funding Opportunity Announcement issued in Fall 2010
Awards made in March 2011
The mission of the Office of Electricity Delivery and Energy Reliability is to lead national efforts to modernize the electric grid; enhance security and reliability of the energy infrastructure; and facilitate recovery from disruptions to energy supply.

**Research and Development**

http://www.oe.energy.gov/our_organization/rnd.htm

Electric Power Systems Research and Development accelerates discovery and innovation in electric transmission and distribution technologies and creates "next generation" devices, software, tools, and techniques to help modernize the electric grid. Projects are planned and implemented in concert with partners from other Federal programs; electric utilities; equipment manufacturers; regional, state, and local agencies; national laboratories; and universities. Coordination is critical to focusing Federal efforts and ensuring that projects are properly aligned with public, private, local, and national needs. Priorities include:

- Clean Energy Transmission and Reliability
- Smart Grid
- Energy Storage
- Cyber Security for Energy Delivery Systems

**Partnerships with National Laboratories and Universities**

http://www.oe.energy.gov/our_organization/rnd_partnerships.htm

The Program works with national laboratories (notably, NREL and PNNL) to develop an integrated national laboratory support effort that assembles the capabilities of the various labs and makes them available to manufacturers and end users for testing and evaluation of the performance of various systems integration designs. In addition, through the National Science Foundation, the Program engages universities in collaborative research in design, testing, and analysis of the Microgrid concept.
Office of Electricity Delivery and Energy Reliability (OE)
Research and Development Program
http://www.oe.energy.gov/our_organization/rnd.htm

The EDER Research and Development (R&D) program is to advance technology, in partnership with industry, government, and the public, to meet America’s need for a reliable, efficient, secure and affordable electric power grid.

Clean Energy Transmission and Reliability
http://www.oe.energy.gov/transmission.htm
FY11: $35M

The Transmission Reliability and Renewables Integration activity focuses on equipping system planners and operators with the real-time information they need for achieving the long-term goal of improved electric transmission planning and operations. It is developing advanced technologies and tools to help create a resilient electric transmission system that can better detect disturbances, accommodate a variety of generation sources, and automatically reconfigure to prevent widespread outage and/or rebalance the system.

Smart Grid R&D
http://www.oe.energy.gov/smartgrid.htm
FY11: $39M

A systems approach will be undertaken through all stages, from planning to development and implementation, and will encompass activities such as design and architecture, electric/communications/information technology infrastructure integration, integration of electric/market operations and policies, and advances in smart grid capabilities, functions, and services to evolve the electric grid into a 21st century smart grid.

Energy Storage
http://www.oe.energy.gov/storage.htm
FY11: $39M

Reducing the cost and size of energy storage systems is the key to more widespread use. Effort is needed to assess opportunities for new devices and new manufacturing processes to reduce the cost of existing battery storage devices. For all types of systems, effort is needed to explore the possibilities of substituting lower cost materials without sacrificing technical performance. The program will initiate new efforts in developing high temperature power electronic devices for energy storage devices.

Cyber Security for Energy Delivery Systems
http://www.oe.energy.gov/controlsecurity.htm
FY11: $30M

Test Bed Assessments for Next-Generation Control Systems – Researchers conduct cyber security assessments of SCADA and other control systems utilized in the energy sector, identify vulnerabilities, and provide mitigation recommendations for vendors to develop next-generation, secure control systems. Through the Trustworthy Cyber Infrastructure for the Power Grid (TCIPG) program – a university-industry collaboration led by the University of Illinois in Champaign-Urbana, conduct R&D to develop a resilient cyber infrastructure for a Smart Grid topology using an application-driven, risk-based approach to protect, detect, and respond to cyber attacks without loss of critical functionality. Continue development of a virtual control system capability to rapidly evaluate the risk (impact) of newly discovered vulnerabilities and cyber attack techniques.
Mission: The mission of EERE is to undertake Research, Development, Demonstration & Deployment (RDD&D) activities that advance technologies and related practices to help meet the growing global demand for clean, reliable, sustainable, and affordable energy services, and to reduce energy consumption. EERE achieves this mission by developing cost competitive clean energy technologies and practices, and facilitating commercialization and deployment in the marketplace to strengthen U.S. energy security, environmental quality, and economic vitality.

EERE Technology Development programs work to advance and invest in scientific research through targeted, RD&D programs at National Laboratories, university campuses, and private facilities spanning the country.
## Energy Efficiency and Renewable Energy (EERE) Programs with Some University Funding Components

<table>
<thead>
<tr>
<th>Program</th>
<th>FY11 Funding</th>
<th>Website</th>
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<tbody>
<tr>
<td>The mission of the Hydrogen and Fuel Cell Technologies (HFCT) Program is to reduce petroleum use, greenhouse gas (GHG) emissions and criteria air pollutants, as well as to contribute to a more diverse energy supply and more efficient domestic energy use by enabling the widespread commercialization and application of hydrogen and fuel cell technologies.</td>
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<td>The mission of the Biomass Program is to facilitate the development and transformation of domestic, renewable, and abundant biomass resources into cost-competitive, high performance biofuels, bioproducts, and biopower through targeted research, development and deployment (RD&amp;D) leveraged by public and private partnerships.</td>
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<td>The mission of the Solar Energy Program (Solar Program) is to conduct research, development, demonstration and deployment (RDD&amp;D) activities to accelerate widespread commercialization of clean solar energy technologies which will lower greenhouse gas (GHG) emissions, provide a clean and secure domestic source of energy, and create high-paying green jobs.</td>
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<td>The mission of the Wind Energy Program is to increase the development and deployment of reliable, affordable, and environmentally sustainable wind power, and realize the benefits of domestic renewable energy production.</td>
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<td>The mission of the Geothermal Technology Program (GTP) is to conduct research, development, and demonstration to establish Enhanced Geothermal Systems as a major contributor for baseload electricity generation. Field demonstrations with the private sector and academic institutions via competitive solicitations will validate the commercialization potential of EGS.</td>
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Energy Efficiency and Renewable Energy (EERE)
Programs with Some University Funding Components

Water Power
http://www1.eere.energy.gov/windandhydro/
The mission of the Water Power Program is to research, test, and develop innovative technologies capable of generating renewable, environmentally responsible, and cost-effective electricity from water.

Vehicles
http://www1.eere.energy.gov/vehiclesandfuels/
  Adv Combustion Engine R&D
  Energy Storage R&D
  Adv Power Electronics and Electric Motors
The mission of the Vehicle Technologies program (VTP) is to develop more energy-efficient and environmentally friendly highway transportation technologies (for both cars and trucks) that will enable America to use significantly less petroleum and reduce greenhouse gas (GHG) emissions while meeting or exceeding drivers' performance expectations and environmental requirements.

Building Technologies - Emerging Technologies
http://www1.eere.energy.gov/buildings/
The long-term goal of the Emerging Technologies subprogram is to develop cost effective advanced technologies (e.g., lighting, windows, and space heating and cooling) for residential and commercial buildings. R&D efforts include lighting, space conditioning and refrigeration, building envelope, simulation/modeling, solar heating/cooling, and an Innovation Hub.

RE-ENERGYSE
The mission of RE-ENERGYSE (Regaining our Energy Science and Engineering Edge) is to provide the education and training necessary to build a highly skilled U.S. clean energy workforce dedicated to solving the world’s greatest energy challenges. The Higher Education subprogram will support fellowships, internships, post-doctoral opportunities, and the development of interdisciplinary masters programs in the area of clean energy.

FY11: $39M
FY11: $58M
FY11: $94M
FY11: $23M
FY11: $93M
FY11: $35M
Ensuring that we can continue to rely on clean, affordable energy from our traditional fuel resources is the primary mission of DOE's Office of Fossil Energy. Fossil fuels supply 85% of the nation's energy, and we are working on such priority projects as pollution-free coal plants, more productive oil and gas fields, and the continuing readiness of federal emergency oil stockpiles.

Coal Technology - Fuels and Power Systems
   Innovations for Existing Plants
   Advanced Integrated Gasification Combined Cycle
   Advanced Turbines
   Carbon Sequestration
   Fuels
   Fuel Cells
   Advanced Research
Unconventional Fossil Energy Technologies
Office of Fossil Energy
http://fossil.energy.gov/

Fuels
Developing technologies that will facilitate the production of ultra high-purity hydrogen derived from coal for stationary applications. Research will target reducing costs specific to production of hydrogen from coal (versus other hydrogen sources), delivering high purity hydrogen to electric power generation turbines, and increasing efficiency of the coal-based hydrogen systems.

Fuel Cells
http://fossil.energy.gov/programs/powersystems/fuelcells/index.html
Fuel Cells activity will continue to increase reliability of the Solid State Energy Conversion Alliance (SECA) fuel cell technology to commercially acceptable levels and initiate design and development of 250 kW to 1 MW pilot scale, atmospheric, combined fuel and air single module units capable of 50 % HHV efficiency. Continue to develop the technology base to permit low, ultra-clean, 55-60 % electrical efficiency coal-fueled and distributed generation capable systems. This development will focus on atmospheric, separate fuel and air stream fuel cells capable of post fuel cell oxy-combustion to enable 99% carbon capture. Work will be initiated on higher-risk pressurized fuel cell operation.

Advanced Research
The Advanced Research activity serves as a bridge between basic and applied research by fostering the development and deployment of innovative systems for improving efficiency and environmental performance while reducing costs of Advanced Fuels and Power Systems.
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Innovations for Existing Plants
FY11: $65M
The IEP activity is focused on the development of post-combustion CO\textsubscript{2} capture technology for new and existing plants. Post-combustion CO\textsubscript{2} capture technology is applicable to pulverized coal (PC) coal power plants, which is the current standard industry technology for coal-fueled electricity generation.

Advanced Integrated Gasification Combined Cycle
FY11: $55M
The IGCC activity is developing advanced gasification-based technologies to reduce the cost of near-zero emissions (including CO\textsubscript{2}) coal-based IGCC plants, to improve the thermal efficiency, and to achieve near-zero atmospheric emissions of all pollutants, including CO\textsubscript{2}, SO\textsubscript{2}, NO\textsubscript{x}, and mercury.

Advanced Turbines
FY11: $31M
The Advanced Turbines activity will be implementing projects that will enable efficient, clean and cost effective hydrogen fueled turbines for coal-based integrated gasification combined cycle power systems that capture and store CO\textsubscript{2}.

Carbon Sequestration
FY11: $143M
All of the nine identified projects within the Development Phase of the Regional Carbon Sequestration Partnerships (RCSP) are planned to be injecting CO\textsubscript{2} at the initial sites for large volume geologic storage tests. Most of the large-scale field tests will have completed the first stage of the projects consisting of site selection and characterization, NEPA, pre-injection monitoring, and permitting ($133M). Geological and Environmental Systems research at NETL will continue its applied research in support of Phase III field efforts from the Regional Carbon Sequestration Partnerships (RCSPs). In general, FY 2011 efforts ($10M) will focus on continuation of needs in support of the six areas emphasized in FY 2010 (capacity/injectivity; seal integrity; geochemical processes for monitoring and that could impact groundwater systems; geophysical processes for quantitative monitoring; geospatial data management and assessment; multiscale, multiphase flow in support of risk assessment).
Since its inception, the Nuclear Energy Research Initiative (NERI, http://www.ne.doe.gov/neri/neNERIresearch.html) has been realizing its goal of both developing advanced nuclear energy systems and providing state-of-the-art research concerning nuclear science and technology. In addition, all new NERI projects will be led entirely by participating U.S. universities. The goal of this fresh focus is to concentrate more on highly needed applied engineering research and to better integrate the educational institutions with the research efforts and initiatives of DOE. DOE and the universities will act as partners in the success of the new, more focused program. This new outlook will further NERI's goals and objectives: to assist in addressing technical nuclear energy R&D challenges, to maintain the nation's leading position in nuclear energy research and development, to advance the state of U.S. nuclear technology, and to improve the nation's nuclear science and engineering infrastructure so the industry will be ready for future expansion.

In fiscal year 2009, the Office of Nuclear Energy (NE), consolidated its university support to what is now called the Nuclear Energy University Programs (NEUP, http://www.ne.doe.gov/universityPrograms/neUniversity2a.html). Through a competitive solicitation process, NE has designated 20 percent of funds appropriated to its R&D programs for work to be performed at university and research institutions. These funds support investigator-initiated basic research and mission-specific applied R&D activities; human capital development activities such as fellowships and scholarships; and infrastructure and equipment upgrades for university-based research reactors and laboratories.

RE ENERGYSE

The mission of RE-ENERGYSE (Regaining our Energy Science and Engineering Edge) is to provide the education and training necessary to build a highly skilled U.S. clean energy workforce dedicated to solving the world's greatest energy challenges.
Small Modular Reactors
This program element supports laboratory/university and industry cost-shared projects to conduct nuclear technology R&D and to develop advanced computer modeling and simulation tools that demonstrate and validate new design capabilities of innovative SMR designs.

Light Water Reactor Sustainability
The research will focus on aging phenomena and issues that require long-term research that affect the existing fleet of both boiling and pressurized water reactors. Because industry has a significant financial incentive to extend the life of existing plants, the Department will work to ensure that activities are cost-shared to the maximum degree possible.

Advanced Reactor Concepts
This program is an expanded version of the Gen IV R&D program. It will continue the Gen IV R&D work being done today but has been expanded to encompass reactor technologies beyond Generation IV. The program will focus on reactors that could dramatically improve performance in sustainability, safety, economics, security, and proliferation resistance. This work includes scientific research at national laboratories and universities as well as through international collaboration. Competitive cost sharing arrangements will be used where practical to establish beneficial government-industry partnerships.

Transformative Nuclear Concepts R&D
This effort is a key mechanism in NE’s R&D portfolio to further encourage out-of-the-box thinking and promote creative solutions to the universe of nuclear energy challenges and questions. By pursuing novel and transformative concepts across all aspects of nuclear technologies, the projects funded under this activity may ultimately enable NE to make significant leaps forward in advanced nuclear technology development. This program is not focused on bringing nuclear concepts to the prototype stage.
Separations and Waste Forms
FY11: $31M
http://www.ne.doe.gov/fuelcycle/neFuelCycle.html
Challenges in separations and waste forms include: 1) develop separations technologies and systems with reduced proliferation risk, very low process losses, and minimal undesirable waste streams; and 2) develop waste forms with predictable, long-term behavior and enhanced resistance to long-term degradation suitable for a variety of potential storage or geologic repository environments.

Advanced Fuels
FY11: $40M
One challenge in advanced fuels is to develop nuclear fuels and/or targets for thermal and fast reactors with multi-fold increases in performance over previous generation fuels. Fuel research under Fuel Cycle R&D is specifically motivated by fuel cycle challenges.

Modeling and Simulation
FY11: $16M
http://www.ne.doe.gov/AdvModelingSimulation/overview.html
Program activities encompass the micro-behavior level of fuels and materials in Fuel Cycle R&D, to the macro-behavior level of reactor systems (e.g., LWRs and advanced reactors in Reactor Concepts RD&D) and their fuel cycles. The successful application of these advancements will enable the use of computer simulation in a fundamentally new way for design, licensing, and operation of nuclear systems.

Energy Innovation Hub for Modeling and Simulation
FY11: $24M
http://www.ne.doe.gov/AdvModelingSimulation/overview.html
The Hub will integrate and simplify the use of a wide range of technologies needed to use high performance advanced modeling and simulation by employing a cross-disciplinary team of nuclear engineers and scientists, computer scientists, mathematicians, verification and validation specialist and other experts. The result will increase the pace of innovation, lower costs, and reduce uncertainty and risk for the design of reactors.

Systems Analysis and Integration
FY11: $16M
Provides support in the areas of technical integration, project controls, quality assurance, document management, knowledge management, and communications. This function ensures the technical consistency of the program, integrated product development, and planning and monitoring of work activities.

Used Nuclear Fuel Disposition
FY11: $45M
http://www.ne.doe.gov/fuelcycle/neFuelCycle.html
TheUsed Nuclear Fuel Disposition technical area is to identify alternatives and conduct scientific research and technology development to enable storage, transportation, and disposal of used nuclear fuel and all radioactive wastes generated by existing and future nuclear fuel cycles. The challenge for Used Nuclear Fuel Disposition is the development of storage, transportation, and disposal systems resulting in near-zero radionuclide releases.