DOE missions

- Sustain basic research, discovery and mission driven
- Catalyze a transformation of the national/global energy system
- Enhance nuclear security
- Contribute to US competitiveness and jobs

DOE Secretary, Dr. Steven Chu
The Office of Science is one of the nation’s largest supporters of peer-reviewed basic research

- We support 27,000 Ph.D.s, graduate students, undergraduates, engineers, and support staff at more than 300 universities and at all 17 DOE laboratories.
- We provide 40% of Federal support in the physical sciences.
- We provide world leading scientific user facilities to over 26,000 users per year.
User Facilities

- Advanced computational resources – terascale to petascale computing and networks for open science
- Four synchrotron light sources, and two next-generation light sources in construction
- Three neutron sources for scattering
- Particle accelerators/colliders/detectors for high energy and nuclear physics
- Fusion/plasma facilities
- Five Nanoscale Science Research Centers – capabilities for fabrication and characterization of materials at the nanoscale
- Joint Genome Institute for rapid whole genome sequencing
- Environmental Molecular Science Laboratory – experimental and computational resources for environmental molecular sciences
- Atmospheric and Environmental Facilities – capabilities for cloud and aerosol measurement and for carbon cycling measurements
Basic Research

- How do we determine US position in various scientific fields?
- How can we balance resources in basic research between fields close to vs distant from applications?
- How do agencies talk to the public, Congress?
- How can we improve climate science?
Multilateral Collaborations: ITER

ITER is a large-scale scientific experiment under construction in Cadarache, France that aims to demonstrate the possibility of commercial production of energy from fusion. Partners include: EU, Russia, China, South Korea, India, Japan, and the US. The US contributes 9% (80% in-kind) and the EU contributes 45%. First plasma is planned for late 2019.

- July 12: EU agreed in principle on EU funding for the project through 2015 (the next EU five-year funding period).
Seven essential steps toward energy goals

- **Transport**
  - Promote vehicle efficiency and conservation
  - Develop alternative vehicle technologies at cost (gradual electrification)
  - Pursue unconventional fuels (e.g. biofuels)

- **Heat and power**
  - Promote conservation and efficiency
    - standards for appliances and buildings
  - Develop/deploy smart grid and storage
    - enable renewables, encourage efficiency, provide system flexibility, reliability, and security
  - Set a price on carbon emissions
    - Natural gas, On-shore wind, Small and medium hydropower, Fission, CCS, Thermal CSP
  - Set low-carbon power portfolio standards
Accelerating Energy Transformation

Energy security:
3.5 M bbl/day reduction in crude use

Greenhouse gas emissions:
17% reduction by 2020, 83% by 2050

- Changing the historically decadal timescale?
- S&T engaging society and industry? The best research structures?
- Coupling basic and applied research?
- Formulating/Communicating sensible policy?

Source: EIA
Energy is a small fraction of government R&D

Note: Defense R&D totalled $80.5 billion in FY2010.
New research structures to catalyze innovation at scale

**Energy Frontier Research Centers**
Small teams of scientists mostly at universities medium term, 5 years

**Energy Innovation Hubs**
Large teams of scientists and engineers ideally under one roof long-term, 5-10 years

**ARPA-E**
short term, 3 year max

Creating a portfolio of competitive and symbiotic technology options through Hubs and ARPA-E

**Scale up of Business-Ready Technologies by Private Industry**
(e.g. Loan Guarantees)

- Basic Science Research
- Feasibility Research
- Technology Development
- Technology Demonstration
- Small Scale Deployment
- Large Scale Deployment

**Technology Readiness Level**
Nuclear Security

- Maintain technical base?
- Keep staff engaged?
- Energy prospects for the National Ignition Facility?
- Exploit simulation capabilities
US Competitiveness

- How do we get to a deep understanding of the issues?
- How do we get public dialog/understanding?
- What is the US strategy?
- How do we execute?
- What role do scientists and S&T play?

"The United States led the world’s economies in the 20th century because we led the world in innovation. Today, the competition is keener; the challenge is tougher; and that is why innovation is more important than ever. It is the key to good, new jobs for the 21st century." -- President Barack Obama, August 5, 2009
Questions/Comments?