U.S. Department of Energy's Office of Science

Partnerships with other Offices

Dave Goodwin
Dave.Goodwin@Science.doe.gov
301-903-6474

Partnership Overview

- **Facilities:** Allocations, interagency peer review, and acquisition coordination.
- **Research:** SciDAC science applications and Global Nuclear Energy Partnership

NERSC Allocations (CPU hours)

- 28 million (28%) Basic Energy Sciences.
- 25 million(25%) Fusion.
- 16 million (16%) Biological and Environmental Research.
- 16 million (16%) Nuclear Physics.
- 11 million (11%) High Energy Physics.
- 4 million (4%) ASCR.
- 100 million total.

Interagency Review of NERSC

- **To determine "how well is NERSC Performing its mission"**
- **Reviewed planning, acquisition, budget/staffing (including skills mix), allocating, and DOE management**
- **May 17th, 18th, and 19th, 2005**
- **Favorable findings**

Acquisition Coordination

- **DoD and NSF to use some of the NERSC-5 benchmarks for their procurements**

- **DoD sent 1 observer to the NERSC-5 proposal evaluations and NSF sent 3 observers (from U of Illinois, Louisiana State, and U of Pittsburgh)**

SciDAC

- **13 Science applications:** Quantum ChromoDynamics (QCD), High Energy Physics (HEP), Nuclear Physics (NP), Radiation Transport, HEP and NP with Petabytes, Astrophysics, Accelerators, Fusion, Climate, Groundwater Modeling, Turbulence, Materials, and Biology
- **Over 350 Letters of Intent (LOI)**
- **About 270 LOIs encouraged to submit proposals**.
- **230 Proposals received (and counting)**

Science Applications

- **Quantum ChromoDynamics (QCD)**
  - Adapt to additional hardware architectures
  - Manage very large data sets
  - Visualize complex data
  - SC High Energy Physics (HEP) and Nuclear Physics (NP) funding

- **High Energy Physics**
  - Test and refine the Standard Model
  - Test and refine understanding of neutrinos
  - SC HEP funding

Science Applications

- **Nuclear Physics**
  - Stockpile stewardship
  - Relativistic Heavy Ion Collider (RHIC)
  - SC NP and NNSA funding
- **Radiation Transport**
  - Weapons, engines, and reactors
  - 3D models
  - NNSA funding with SC NP review
- **HEP and NP with Petabytes**
  - Petabytes per year after data selection and compression
  - SC HEP and NP funding with the National Science Foundation (NSF) Review

Science Applications

- **Astrophysics**
  - Supernovae (dark energy), gamma bursts (acceleration mechanism), core collapse (nucleosynthesis), dark matter, and Cosmic Microwave Background (gravity waves and inflation)
  - SC HEP and NP funding with NNSA review

- **Accelerators**
  - International Linear Collider, Rare Isotope Accelerator, and Coherent Synchrotron Radiation (for nanotech)
  - SC HEP and NP funding with SC Basic Energy Sciences (BES) review

- **Fusion**
  - Success of International Thermonuclear Test Reactor (ITER) depends on simulations and modeling
  - SC Fusion Funding

Science Applications

- **Climate**
  - El Nino Southern Oscillation (ENSO) and Artic Ocean
  - SC Biological and Environmental Research (BER) and NSF funding
- **Groundwater Modeling**
  - Subsurface reactive transport to simulate mobility
  - SC BER funding
- **Turbulence**
  - Large Eddy Simulations (LES) and viscosity modeling
  - NNSA funding

Science Applications

- **Materials**
  - Complex quantum systems; e.g., nanoscience
  - NNSA funding with SC BES review

- **Biology**
  - Genomes To Life: Keep pace with sequencing; link gene, protein, and function catalogs to regulatory, structure, and metabolic relationships; and data from mass spec and FRET and cryoelectron microscopy
  - SC BER funding

Global Nuclear Energy Partnership (GNEP)

- **Europe, Japan, Russia, and probably India. Was GNEI**
- **President Bush briefed on Jan 26th**
- **$10 billion DOE total over 5 years**
- **$28 billion DOE total over 10 years**
- **≤ 10 gigaflops previously to ≥ 100 TF**
- **Simulations for reprocessing, fuel fab, reactors, and Yucca Mountain**

GNEP Purpose

- Energy security: 103 present U.S. reactors (100 GWe; 20% of capacity) to increase to 1,000 U.S. reactors (> 1 TWe) by 2100 (vs 2000)
- Mitigate climate change (sustainability)
- Enable hydrogen economy: 300 reactors
- Yucca: 10 X increase in present 128 kiloton tech capacity (reduce heat 100X and rad 10X): reduce 200^{0}C at the walls and 96^{0}C between tunnels
- Secretary Bodman: Also for the Global War on Terrorism: to provide energy for Nation building

GNEP Plan

- **Reprocessing for IAEA Fuel Cycle States**
- **Advanced Burner Reactor (ABR): Na cooled, fast neutron, 90 MWe demo on-line 2014 (for 1.2 GWe commercial on-line 2023)**
- **International Reactor Innovative and Secure (IRIS): 0.3 GWe Light Water Reactor for IAEA Reactor States; on-line 2017**

Reprocessing

- **U for re-enrichment/breeder (was $15 per ton, now $40, may go to $60)**
- **Tc to reduce Yucca rad (BES to assist).**
- **Cs/Sr for 300 year decay**
- **TRansUranics (TRU): Transmute/Energy recovery (3 TW-thermal-years X 10): Pu (1 kiloton X 10), Am, Np (rad), Cm**
- **Fission Products (100+ millirem per year for > 1 million years from 1,000 reactors)**

U.S. Utility Companies

- **≥ 17 US reactors at 11 sites by 2015 (> 20 GWe; > $26 billion), 15 passively safe: 100 X safer (1 core damage per 2.5 million reactor years).**
- **$35 per MWHe bus-bar (capital, fuel, operating; v $49 for coal), 93% online (v 70% for coal), 60 year service life (v 40 years for coal).**
- **Japan forge single source for $100 million each reactor vessels: $2 million each to enter 50 month queue.**
- **$70 million each for NRC license.**
- **Up to $3 billion now (not JPN).**