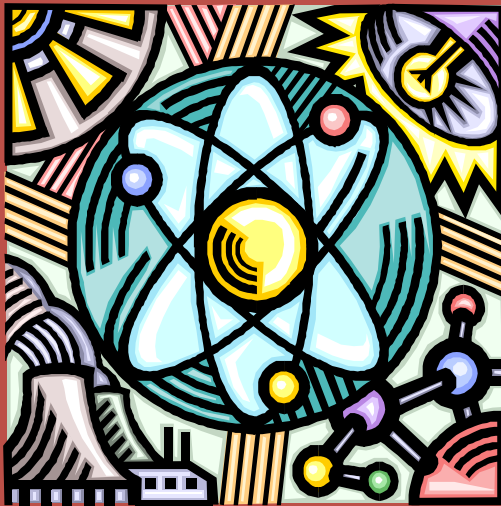




# NSF Support of Energy through CBET



**Dr Judy Raper**  
**Division Director**

**Chemical, Bioengineering, Environmental &  
Transport Systems (CBET)**  
**Engineering Directorate**  
**National Science Foundation**



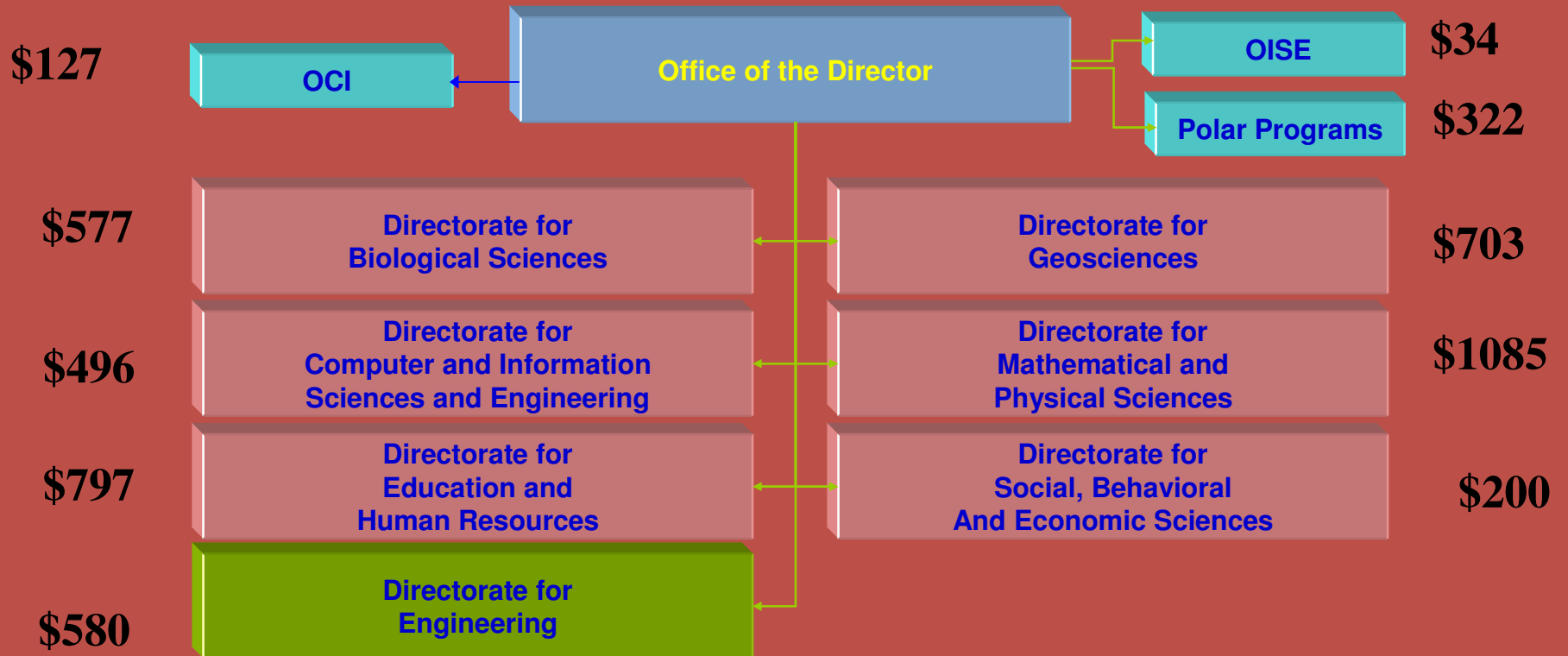
# Overview

- ◆ Introduction
  - ◆ NSF
  - ◆ ENG
  - ◆ CBET
- ◆ Statistics
- ◆ Direction
- ◆ Sample Projects from CBET





# NSF Organizational Structure



(incl. \$100 for SBIR/STTR)

**Dollar figures: total FY 2006 budgets in millions**



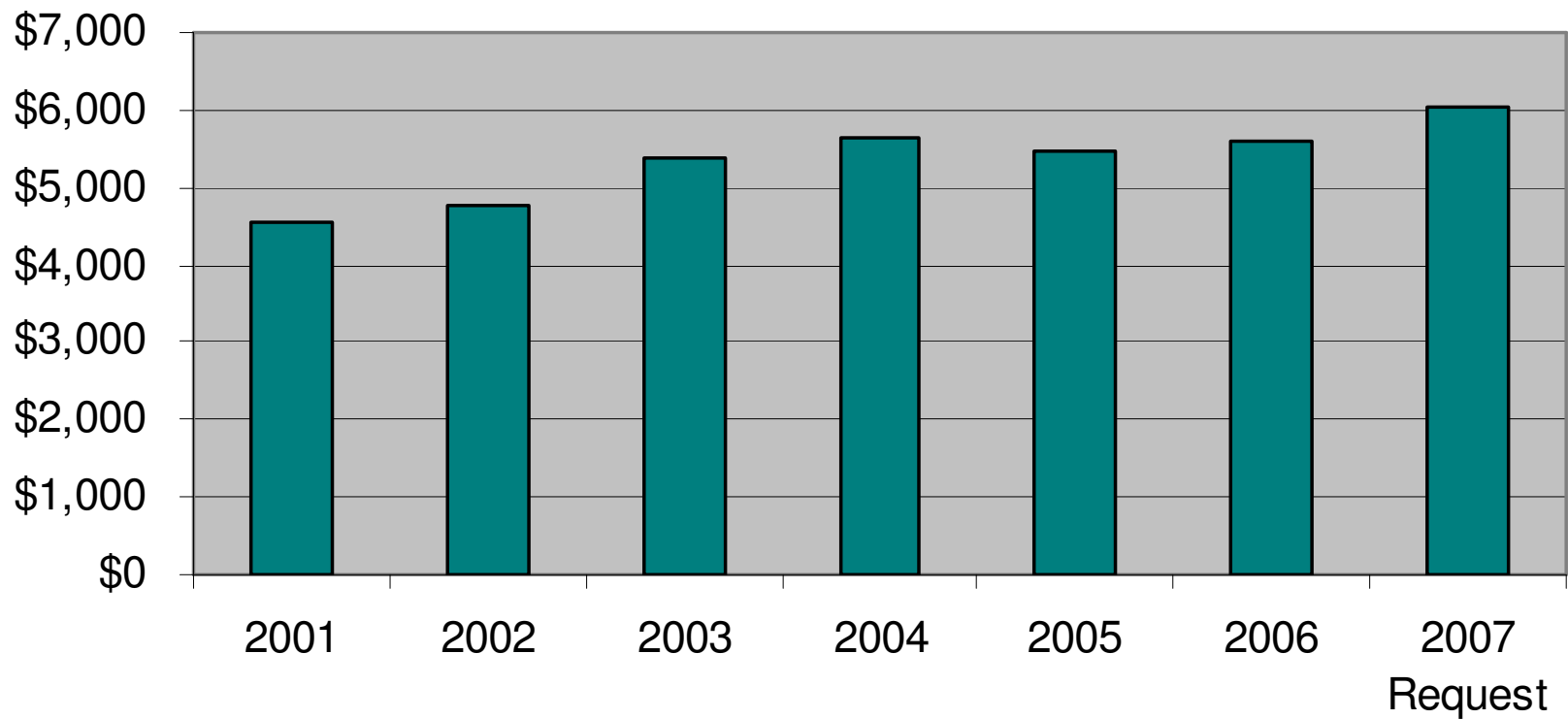
# NSF Focus Areas

- ◆ **PEOPLE**: Activities to Better Attract and Retain Science & Engineering Graduates and to Ensure That They Receive a Quality Education.
- ◆ **IDEAS**: Advancement of Knowledge About Fundamental STEM Research.....
- ◆ **TOOLS**: Enhancement of Infrastructure to Conduct STEM Research.....
- ◆ **ORG.EXCELLENCE**: Admin. Activities to Enable NSF to Achieve its Mission ...



# NSF Budget 2001-2007

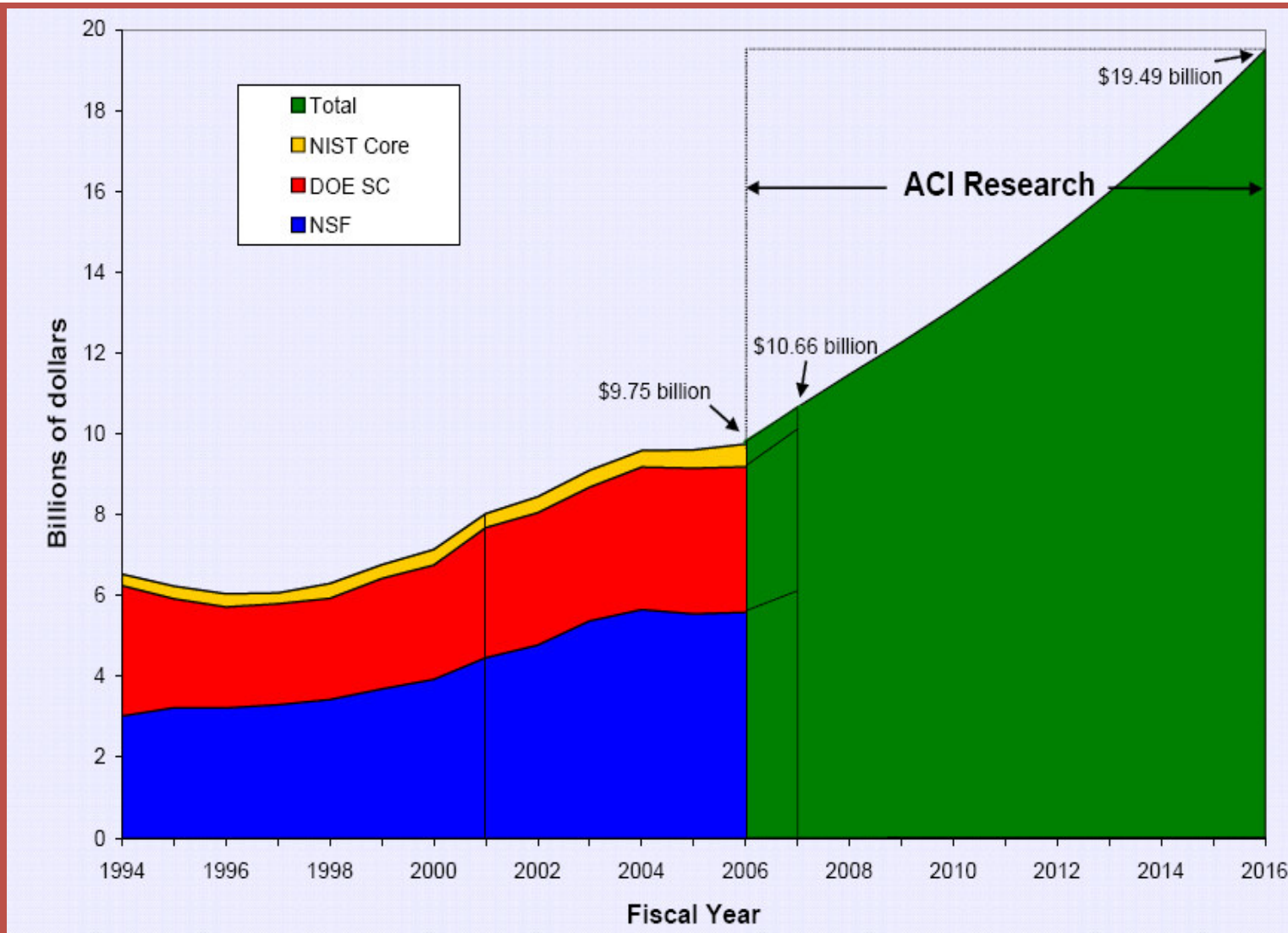
(Dollars in Millions)





# Our Hope for the Future?

## The American Competitive Initiatives





# American Competitiveness Initiative (ACI)

- ◆ **New money**
- ◆ **Administration initiative**
- ◆ **Double the NSF budget over 10 years**
- ◆ **Boost physical sciences**
- ◆ **Math & science education**
- ◆ **Focus on applied energy research**
- ◆ **Makes the Research & Experimentation Federal Tax Credit permanent**



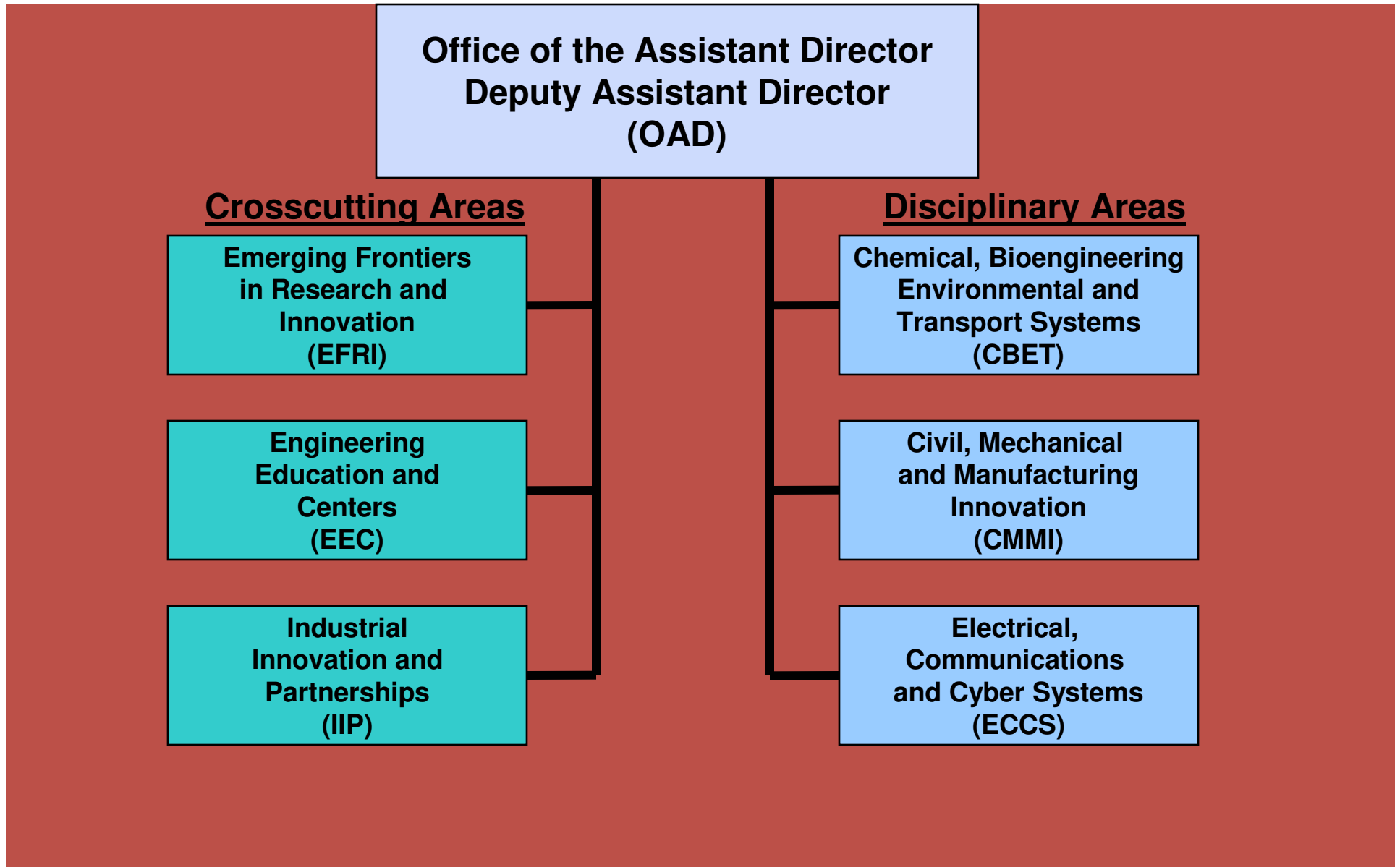
# NSF Priority Areas

- ◆ Homeland Security
- ◆ Nanoscale Science & Engineering
- ◆ Cyberinfrastructure (CI)
- ◆ Energy & Environment
- ◆ Understanding Complex Biological Systems





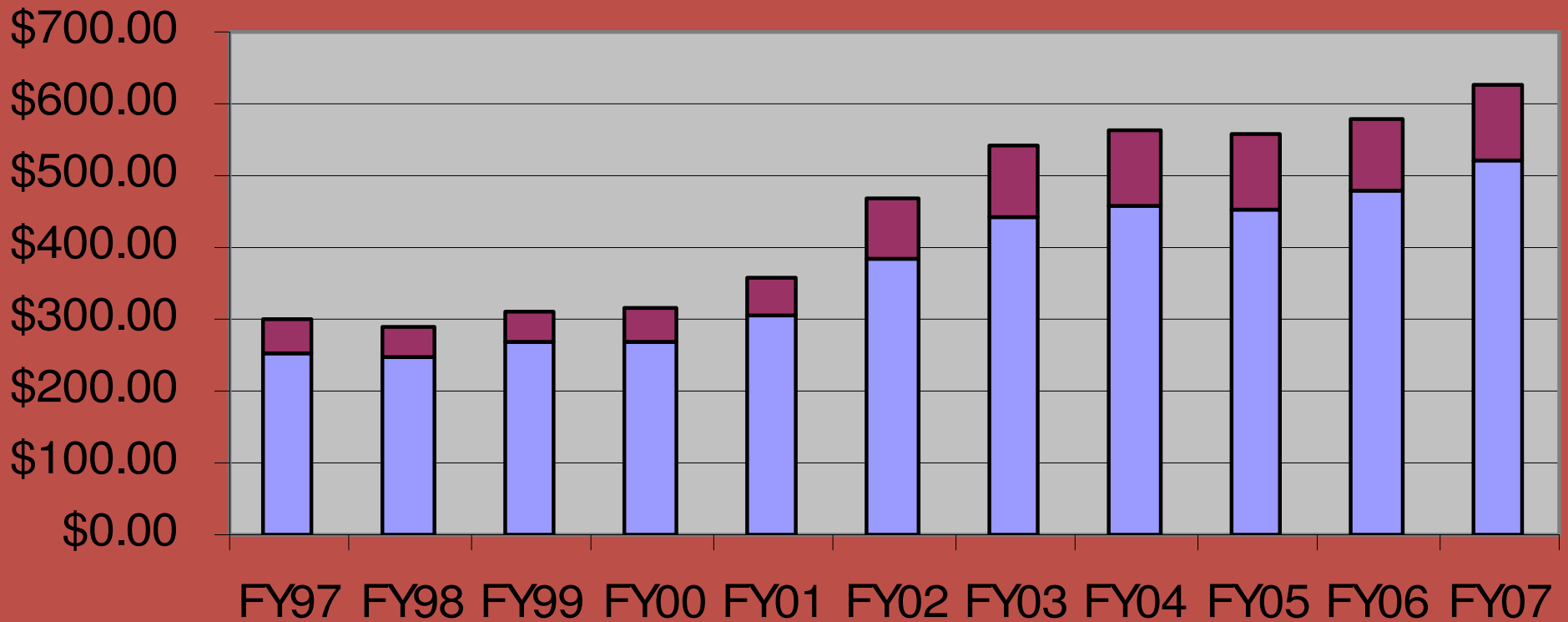
# New ENG Organizational Structure





# ENG and SBIR/STTR Budget History

Dollars in Millions



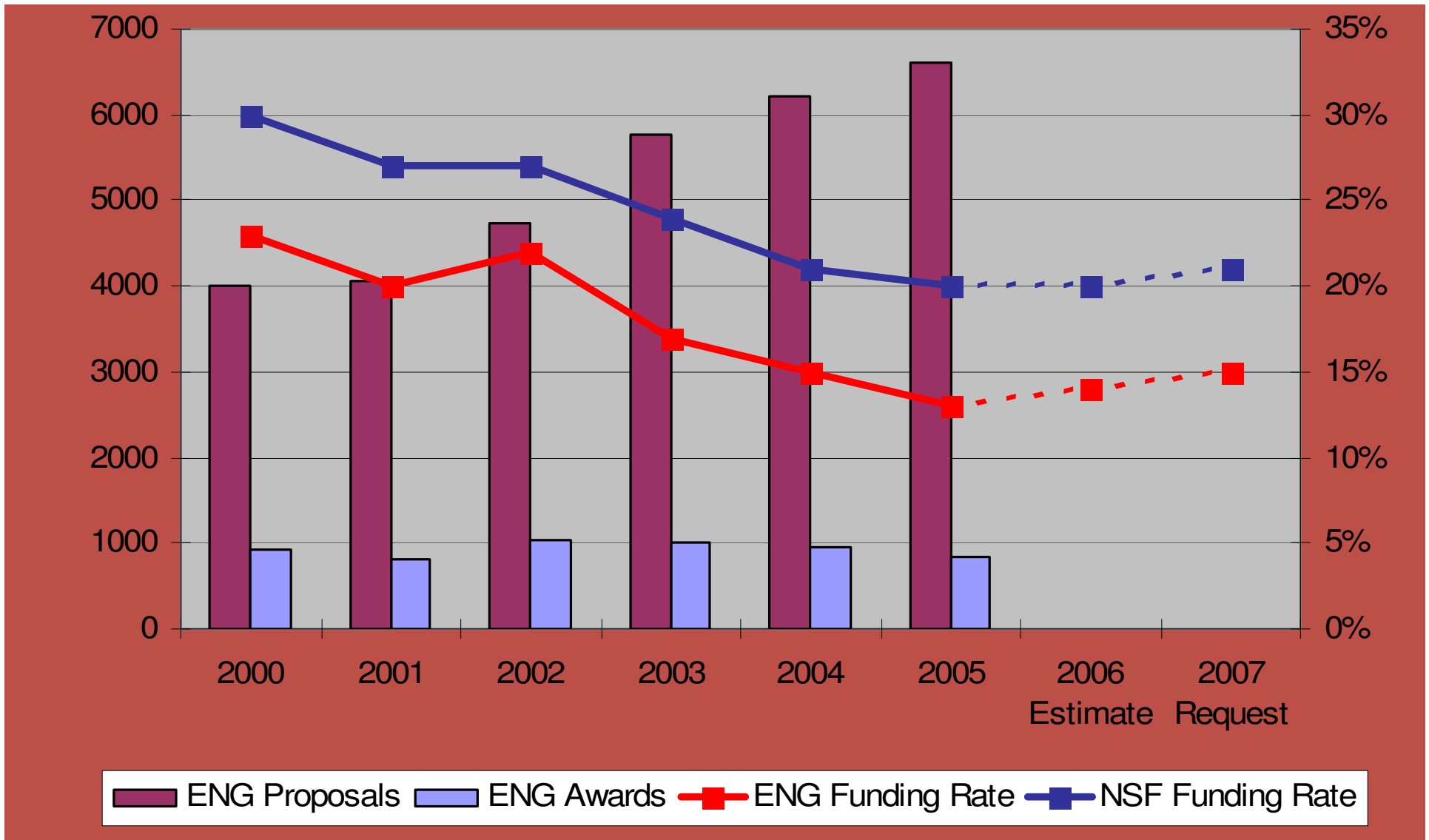
■ ENG ■ SBIR/STTR



# ENG and NSF Funding Rates



## Research Grants





# Emerging Frontiers in Research & Innovation (EFRI)



- ◆ Solicitation NSF06-596
- ◆ Auto-reconfigurable Engineered Systems Enabled by Cyberinfrastructure (ARES-CI)
- ◆ Cellular and Biomolecular Engineering (CBE)
- ◆ Letter of intent (optional) October 16, 2006
- ◆ Pre-proposal November 17, 2006
- ◆ Full proposal April 30, 2006
- ◆ \$25 million FY2007



# CBET's Role

- ◆ **Division of Chemical, Bioengineering, Environmental, & Transport Systems (CBET)**
  - ◆ **Merger of CTS & BES on Oct 1, 2006**
  - ◆ **Support Research in Chemical, Bioengineering, Environmental, & Transport Systems**
  - ◆ **Catalyze the merging of biology, chemistry, physics and socio-economic science in engineering research**
  - ◆ **Support research to enhance and protect US national health, energy, environment, security and wealth**



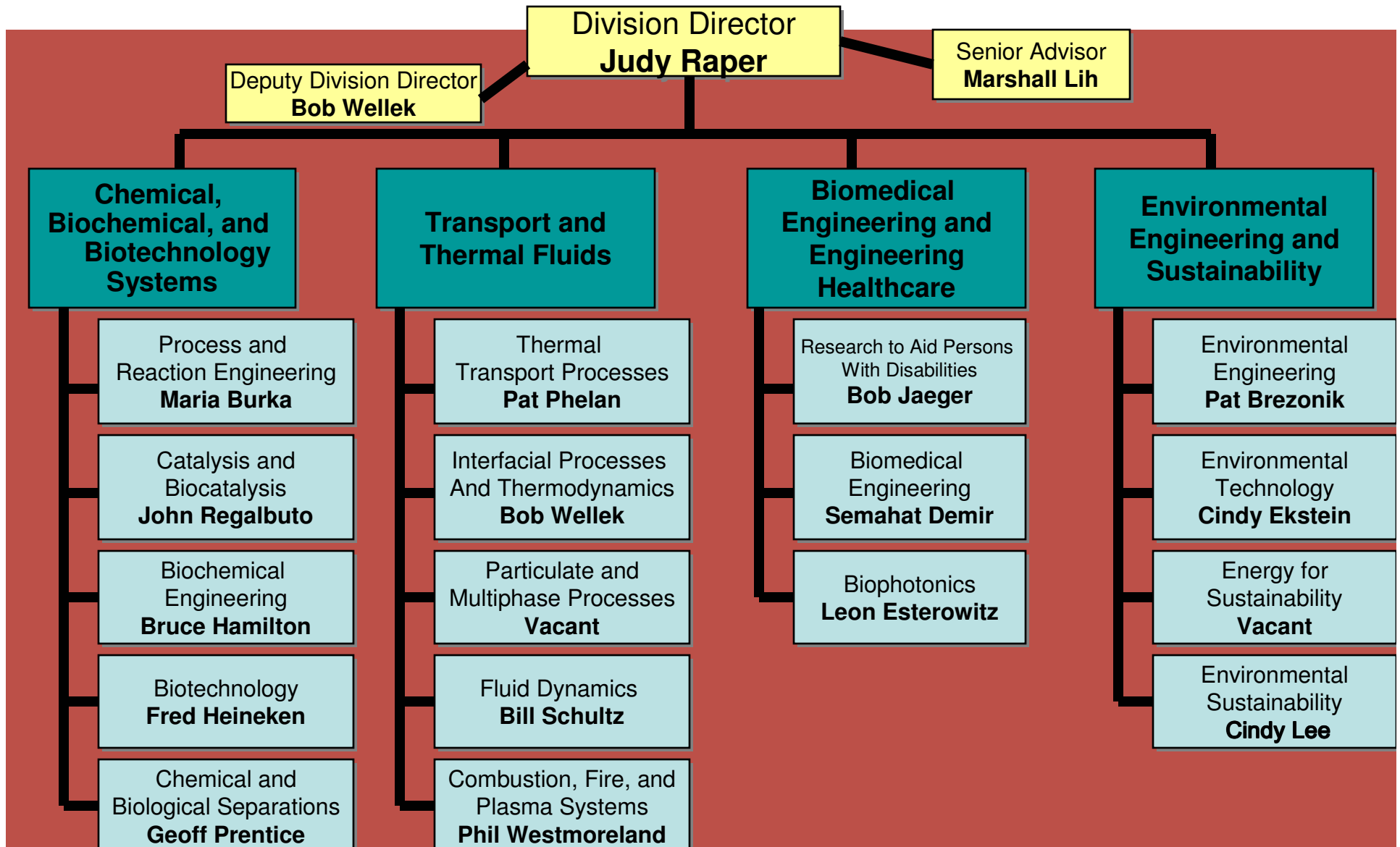
# CBET Priority Areas *FY07*



- ◆ Nanoscale Science & Engineering
- ◆ Cyberinfrastructure (CI)
- ◆ Energy, Environment & Sustainability
- ◆ Biology in Engineering
- ◆ Multi-scale Modelling



# CBET Organizational Chart





# CBET Budget

- ◆ **FY 2006 Plan**
  - ◆ **BES \$52 million**
  - ◆ **CTS \$71 million**
- ◆ **FY 2007 Request**
  - ◆ **CBET \$124 million**





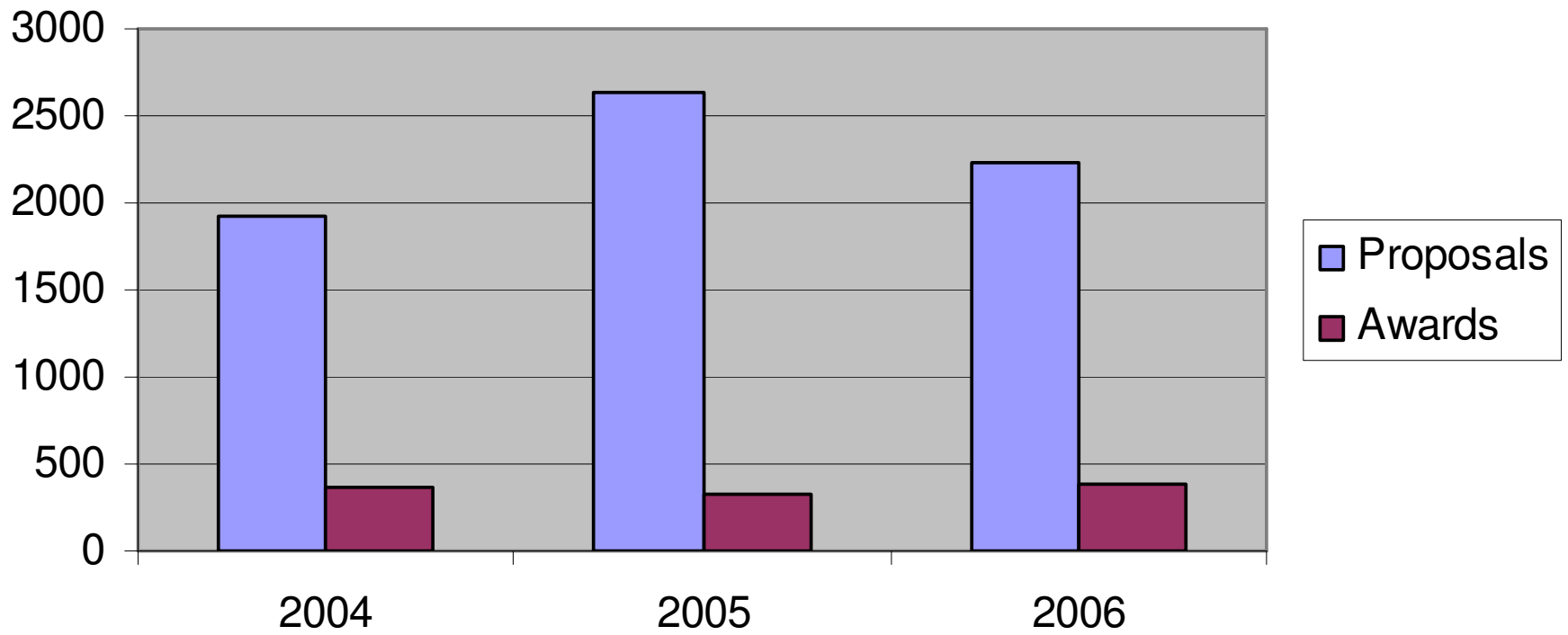


# Major CBET Initiatives for FY 2007



- ◆ **NNI (National Nanotechnology Initiative)**
  - ◆ \$43 Million
- ◆ **Sensors/Explosives**
  - ◆ \$5 Million
- ◆ **EFRI (Emerging Frontiers in Research & Innovation)**
  - ◆ Support for Interdisciplinary Group Projects
  - ◆ \$25 Million Total for ENG
    - ◆ **CYBERINFRASTRUCTURE for RECONFIGURABLE SYSTEMS**
    - ◆ **CELLULAR-MOLECULAR BIOENGINEERING**

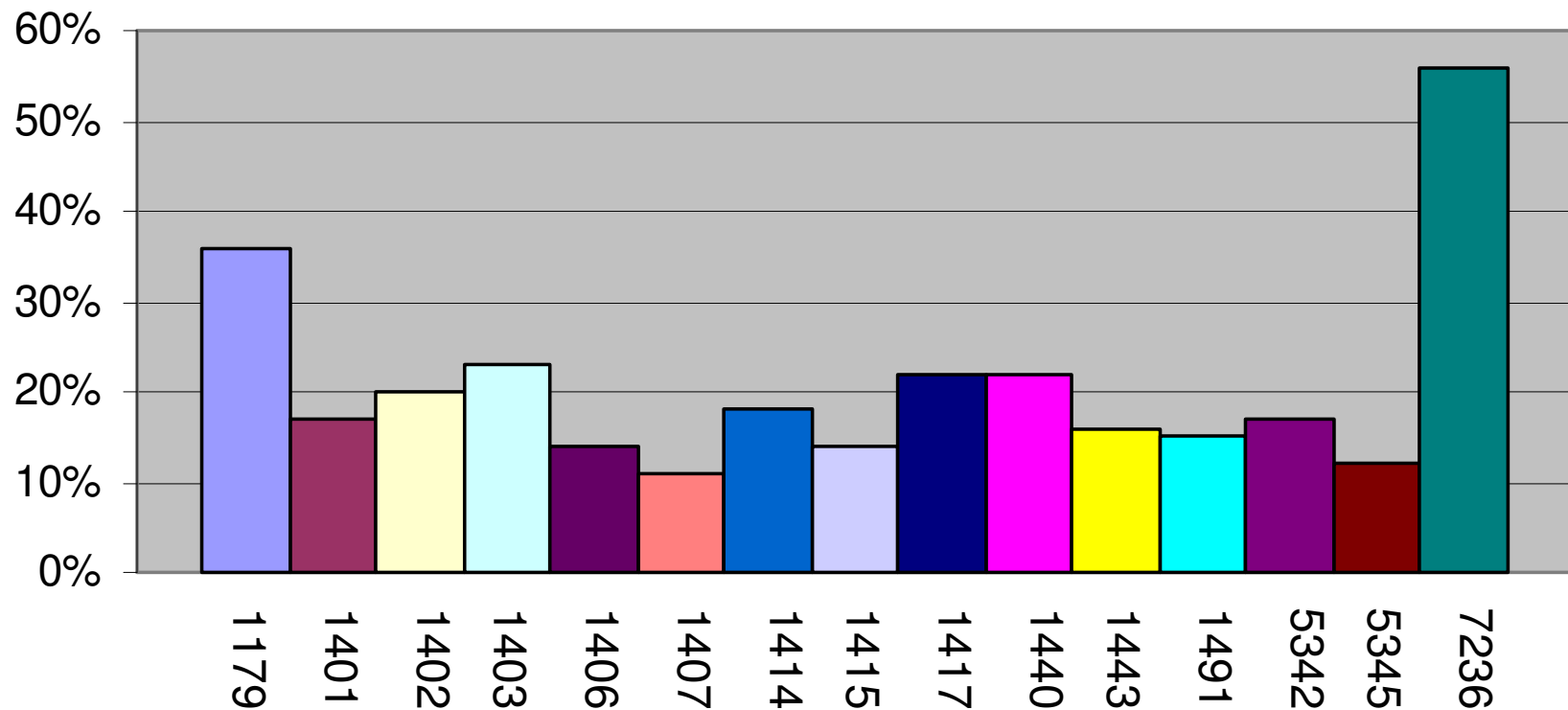
## CBET Proposals & Awards FY 04-06



1179 – Environmental Technology  
 1401 – Catalysts and Biocatalysts  
 1402 – Biochemical Engineering  
 1403 – Process and Reaction Engineering  
 1406 – Thermal Transport Processes  
 1407 – Combustion, Fire, and Plasma Systems  
 1414 – Interfacial Processes and Thermodynamics  
 1415 – Particulate and Multiphase Processes

1417 – Chemical and Biological Separations  
 1440 – Environmental Engineering  
 1443 – Fluid Dynamics  
 1491 -- Biotechnology  
 5342 – Research to Aid Persons with Disabilities  
 5345 – Biomedical Engineering  
 7236 – Biophotonics  
 7643 – Environmental Sustainability  
 7644 – Energy Sustainability

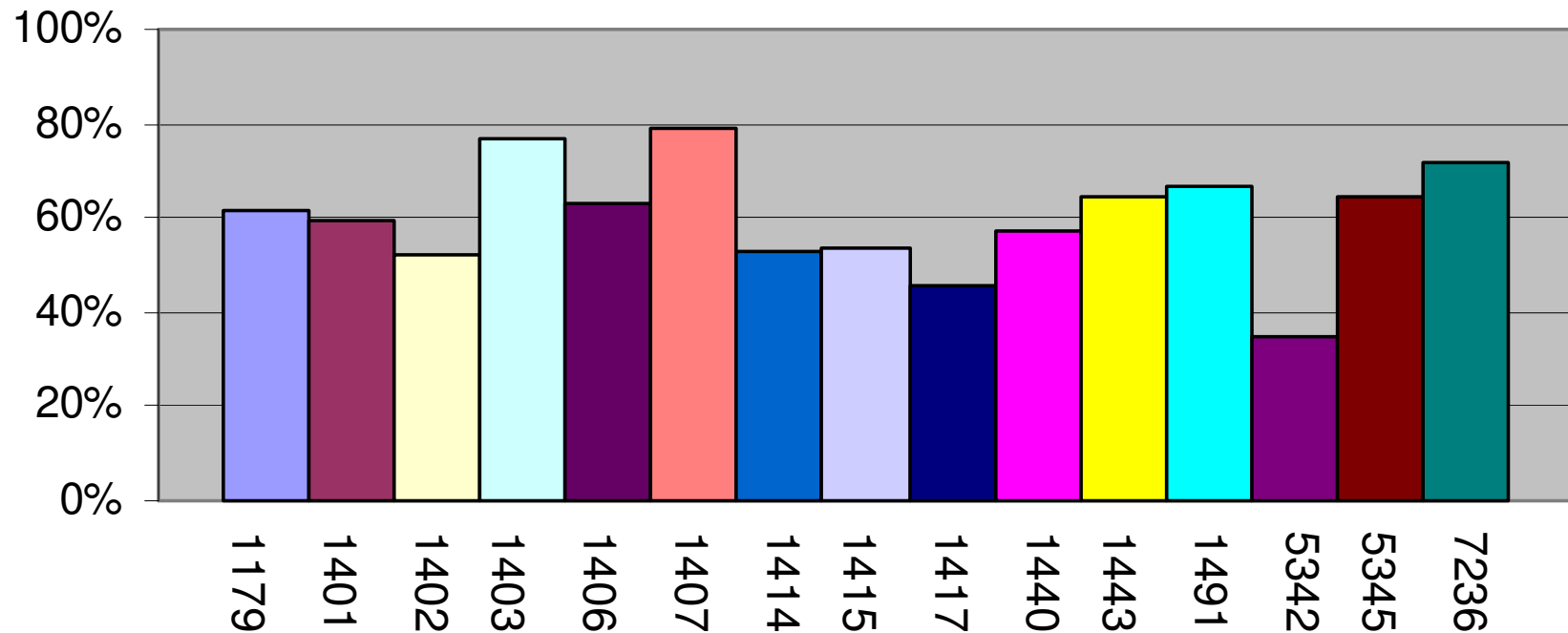
### Success Rates CBET 2006



1179 – Environmental Technology  
 1401 – Catalysts and Biocatalysts  
 1402 – Biochemical Engineering  
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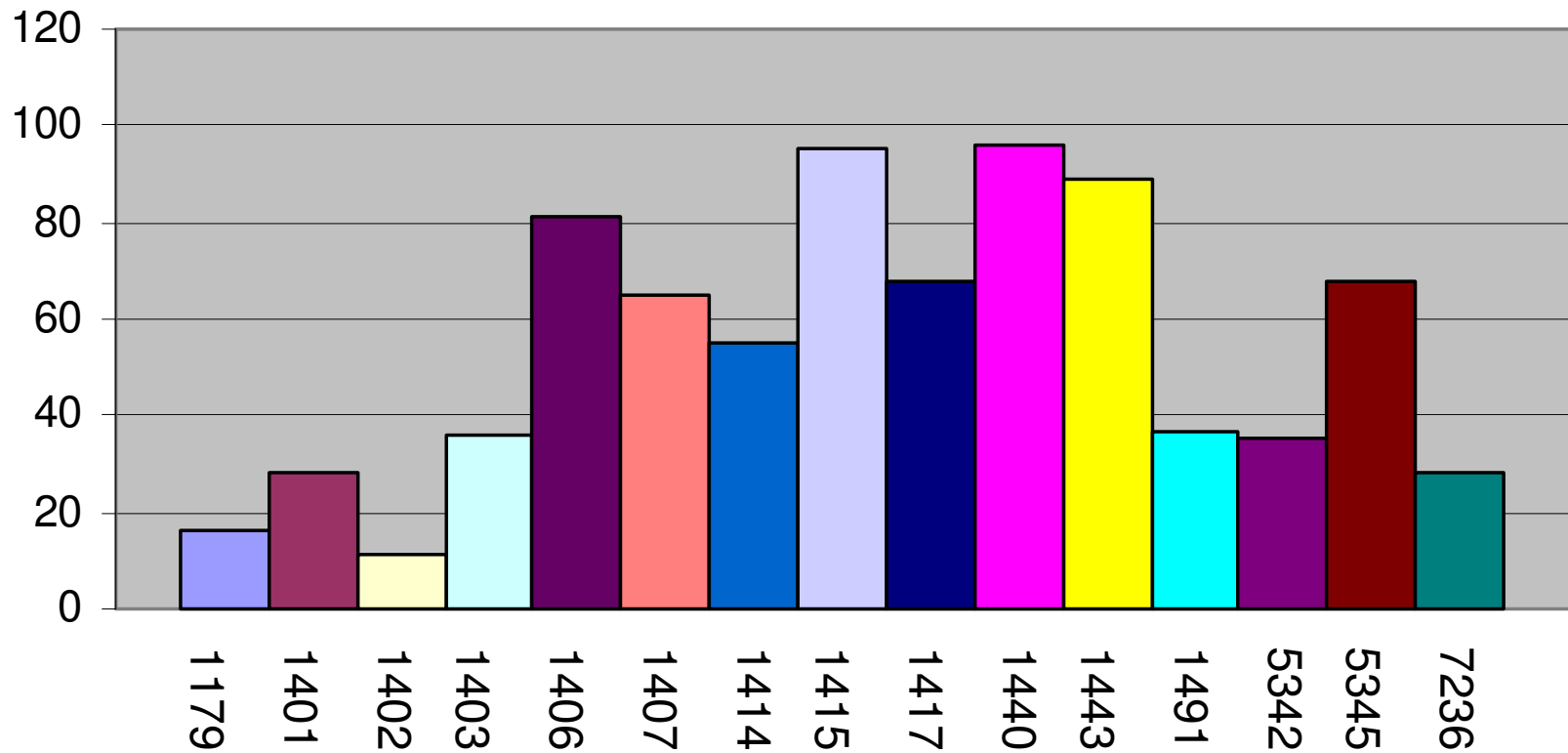
**Percentage of Average Awarded Versus Average Requested FY 06**



1179 – Environmental Technology  
 1401 – Catalysts and Biocatalysts  
 1402 – Biochemical Engineering  
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### CBET Unsolicited Proposals FY 07 as of 10-20-06

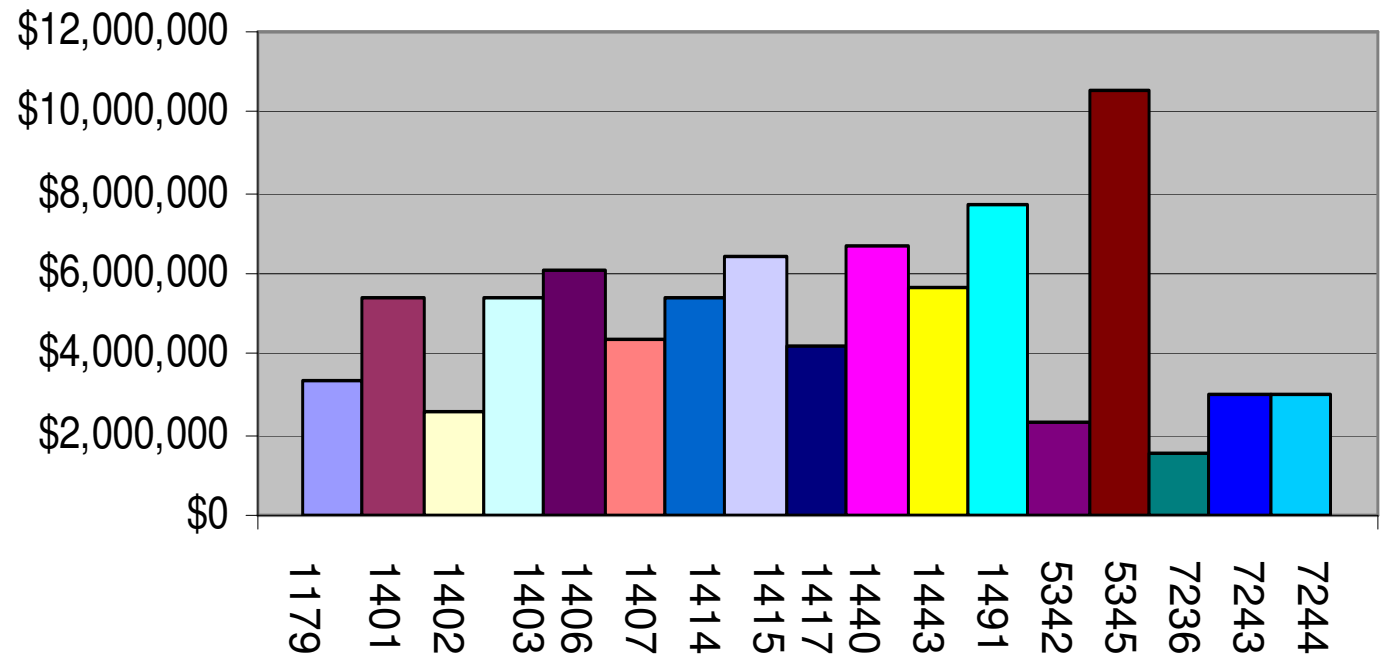




# CBET's 2007 Budget By Program

- 1179 – Environmental Technology
- 1401 – Catalysts and Biocatalysts
- 1402 – Biochemical Engineering
- 1403 – Process and Reaction Engineering
- 1406 – Thermal Transport Processes
- 1407 – Combustion, Fire, and Plasma Systems
- 1414 – Interfacial Processes and Thermodynamics
- 1415 – Particulate and Multiphase Processes
- 1417 – Chemical and Biological Separations
- 1440 – Environmental Engineering
- 1443 – Fluid Dynamics
- 1491 -- Biotechnology
- 5342 – Research to Aid Persons with Disabilities
- 5345 – Biomedical Engineering
- 7236 – Biophotonics
- 7243 – Environmental Sustainability
- 7644 – Energy Sustainability

### CBET Program Budget Projected FY 07





# Direction in Energy

“...NSF has and will continue to catalyze fundamental innovations vital to a new energy future for our nation and the world.”

(Dr. Richard O. Buckius, Assistant Director for Engineering, National Science Foundation, Testimony before the United States Senate Commerce Committee's Subcommittee on Technology, Innovation and Competitiveness Wednesday, June 14, 2006)





# Why?

- ◆ Sustainability of Current Resources
- ◆ Need for Alternatives







# NSF's Role

- ◆ Provide Resource for Research Proposals and Grants to Further Develop Existing Technologies
- ◆ Encourage Pursuit of Science to Include New Alternative Energy Sources





# CBET's Role

◆ Fund Research and Education in Rapidly Evolving Fields to Include Alternative Energy





# Future Impact

- ◆ **Continue to Support Proposals for Alternative Energy**
  - ◆ Environment Friendly
  - ◆ Reduce Air Pollution
  - ◆ Cost Effective
    - ◆ Monetary
    - ◆ Planetary
- ◆ **Paradigm Shift on Energy Use**
  - ◆ Education
  - ◆ Incentives



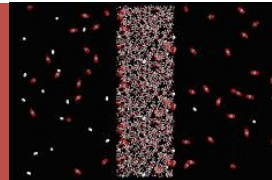
# Typical Projects

Reverse-selective membrane materials for purification of H<sub>2</sub> and other light fuels

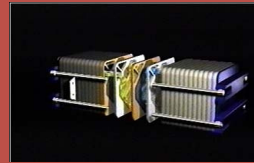
Hydrogen Fuel Cells

Purification of Natural Gas

Design polymer hi-press membrane to separate H<sub>2</sub>



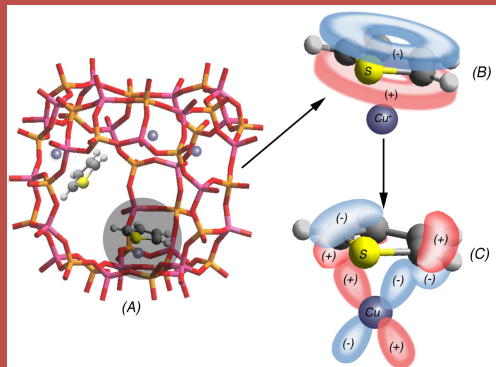
Benny D. Freeman, UT, Austin



Catalytic activity of N<sub>2</sub>-containing functional groups supported on C structures for cathodic reduction reaction in PEM fuel cells

Develop alternatives to Pt O<sub>2</sub> Reduction Reaction (ORR) at Lo-T Commercialization of Lo-T PEM Fuel Cells

Umit S. Ozkan, Ohio State U



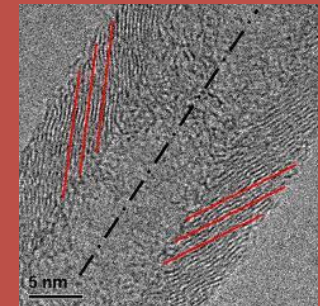
Ralph T. Yang, U Michigan  
Selective adsorption of thiophene by Cu-Y zeolite.

New sorbents for ultrapurification of transportation fuels

Reduce air pollution more effectively by removing fuel contaminants before combustion

Find adsorbents configurations with superior electivities and capacities

Guide adsorbent selection by molecular orbital theory



Nitrogen-doped carbon fiber



# Questions?

