

Overview of Chemical, Bioengineering, Environmental, and Transport Systems Division (CBET)

Sohi Rastegar
Engineering Advisory Committee
October 16, 2012



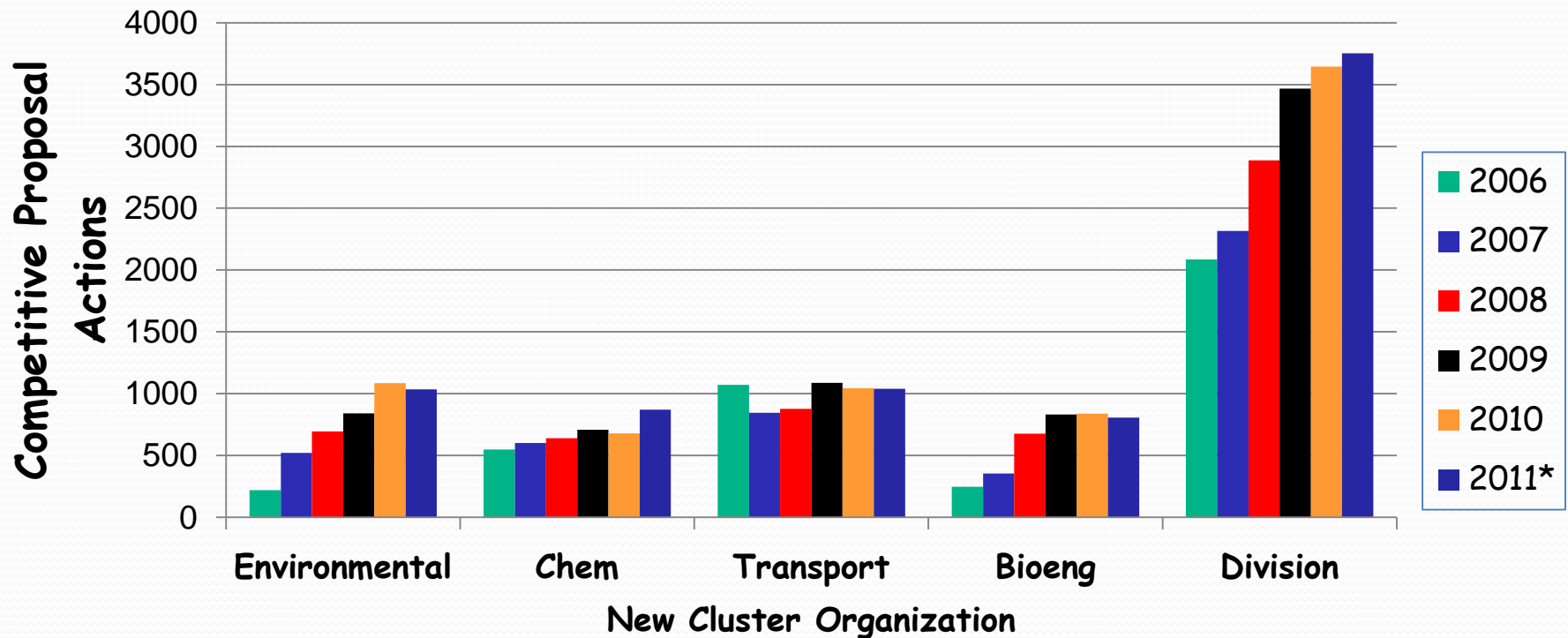
CBET Mission and Purpose

- (CBET) supports research and education in the rapidly evolving fields of bioengineering and environmental engineering and in areas that involve the transformation and/or transport of matter and energy by chemical, thermal, or mechanical means
- These investments contribute to advances that are important for the environment, energy, information technologies, health-related products, and other areas that impact our daily lives.

Current & Future Areas of Focus

- Sustainability
 - Water, Energy, Climate, Environment Nexus
 - Sustainable, Advanced Manufacturing: Chemistry, Engineering and Materials
 - Critical Elements and Materials
 - Advances in engineering to stimulate the bio-economy
 - Environmental Health & Safety of Nanotechnology (nanoEHS)
- Healthcare
 - Neurobiology
 - Synthetic Biology
 - Robotics for Disabled and Aged
 - Bio-Sensing & Bio-photonics for “smart” healthcare diagnostics and treatment strategies
- More partnerships and more use-inspired flavor

CBET Experienced Rapid & Significant Growth in Environmental & Bioengineering

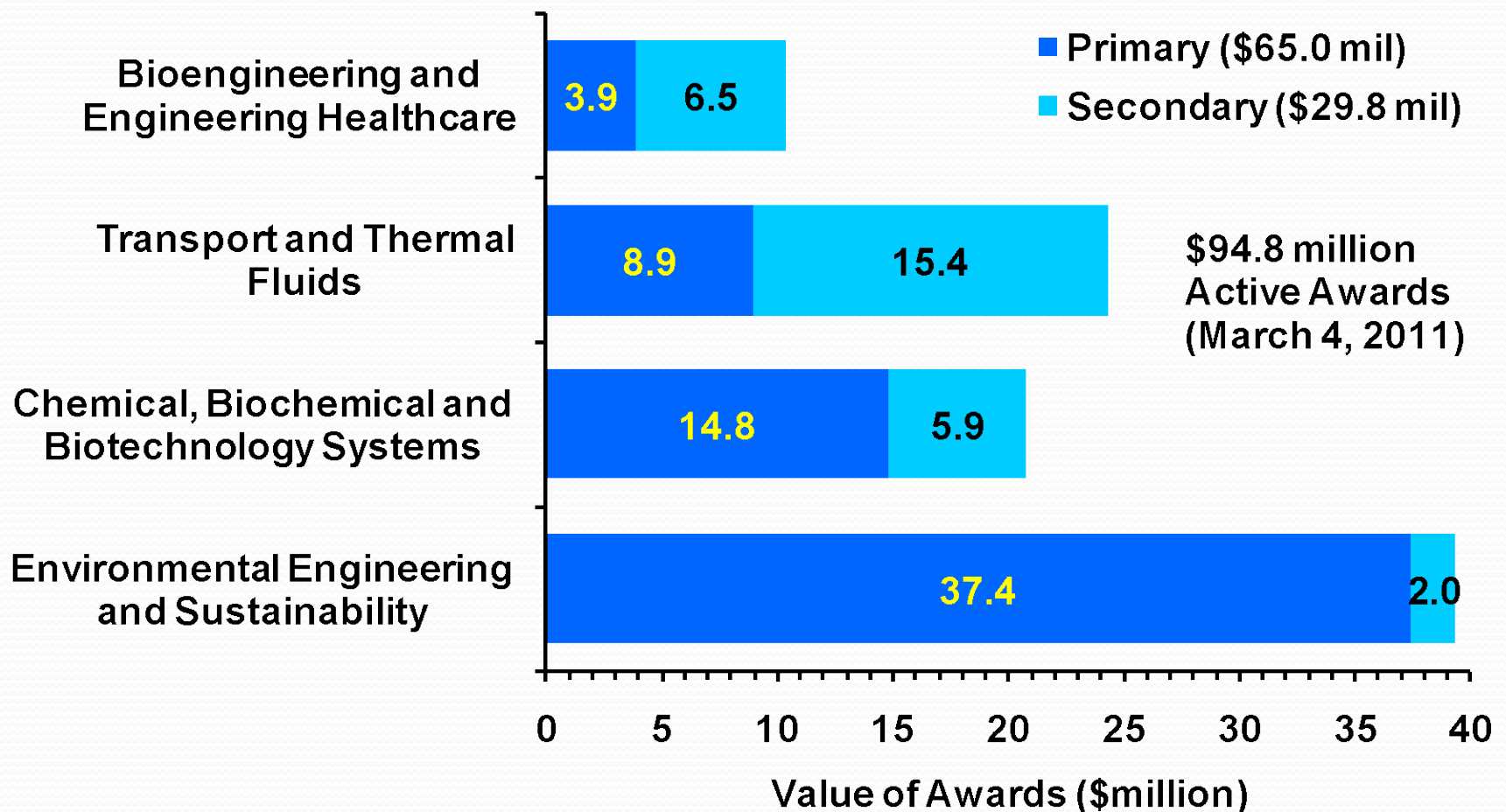


Changes in CBET Proposal Submissions due to “Single Window” Policy

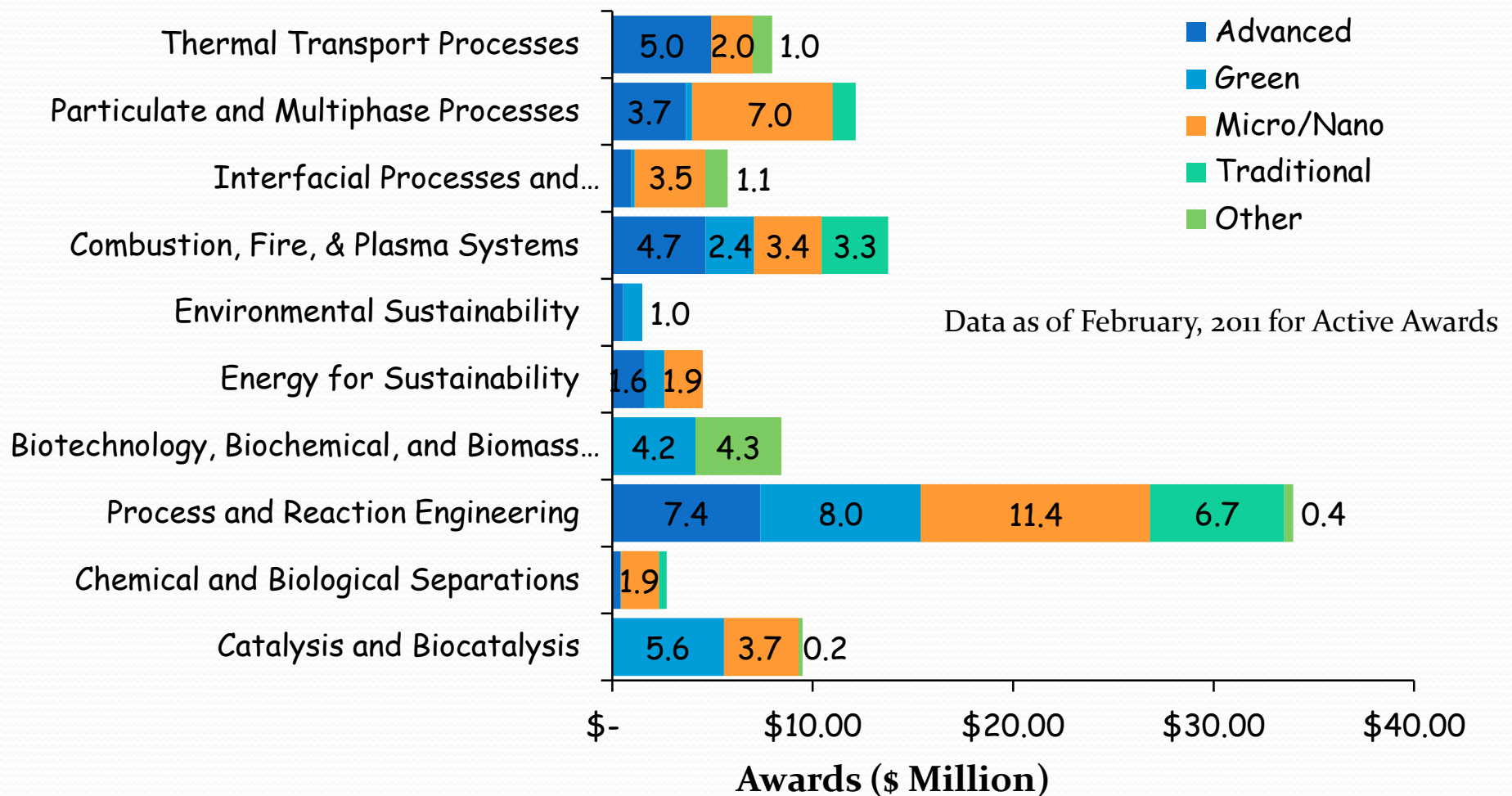
	FY10	FY11	FY12
Total	3645	3752	3164 (about 16% decrease)

	FY11	FY12	FY13
Fall Only		1089	1055 (about 5% decrease)

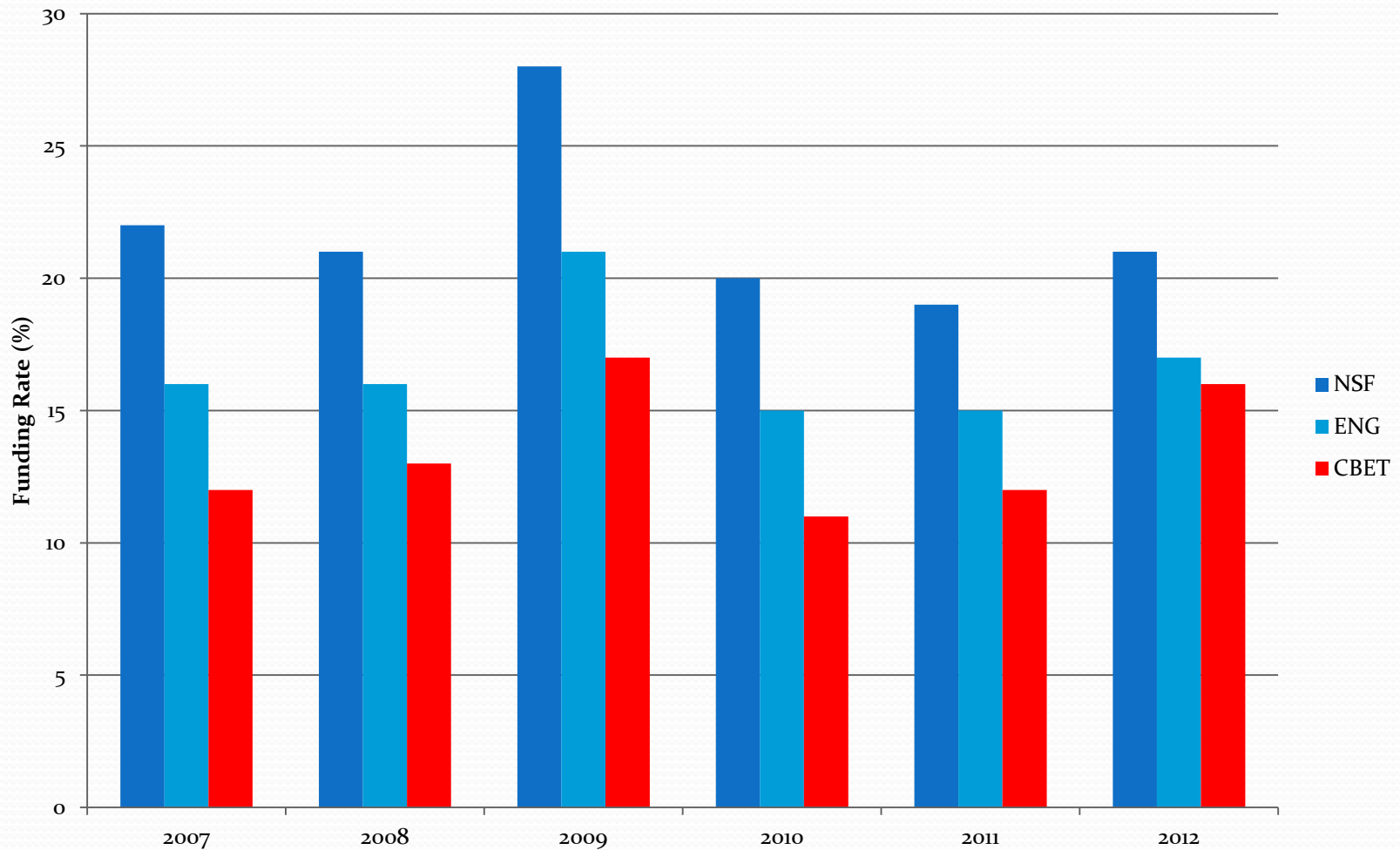
All Four Clusters Can Potentially Affect Strategic Areas in CBET Portfolio (Clean Energy)



All Four Clusters Can Potentially Affect Strategic Areas in CBET Portfolio (Adv. Manufacturing)

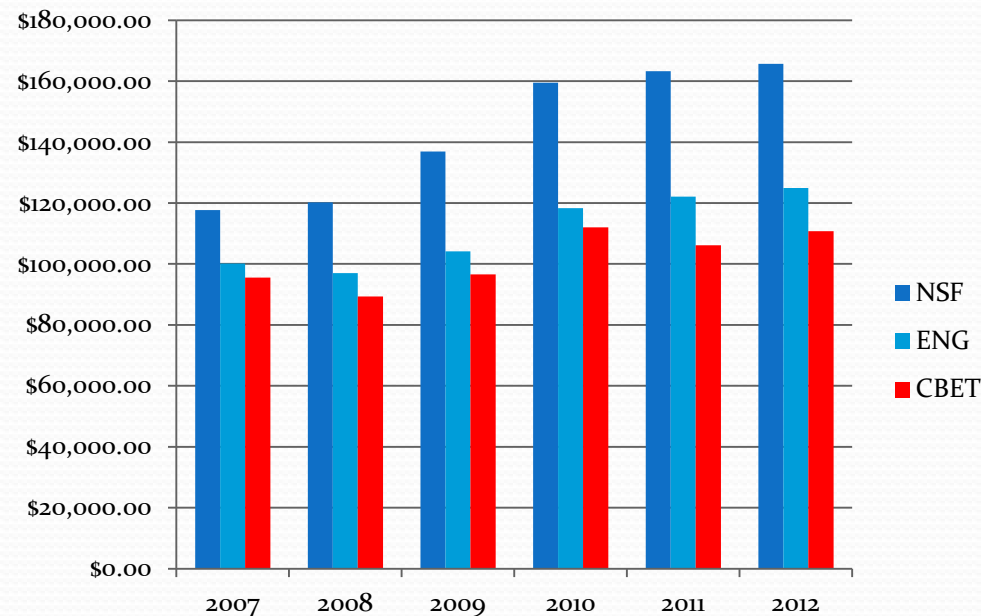


Relative Funding Rates are Consistent between CBET and NSF, ENG Directorate



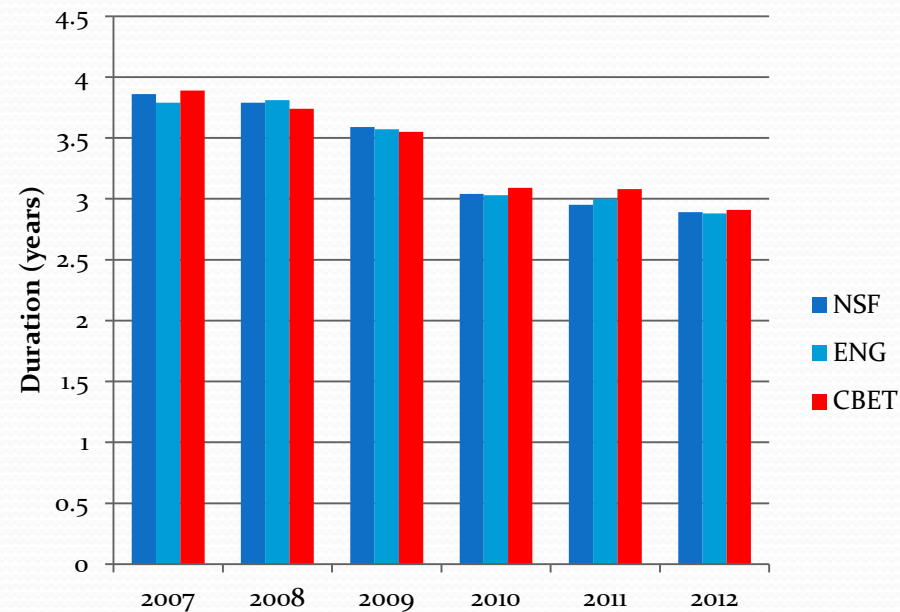
Award Size and Duration Have Remained Stable

Mean Annual Award Size



* Data do not reflect no-cost extensions for more recent years

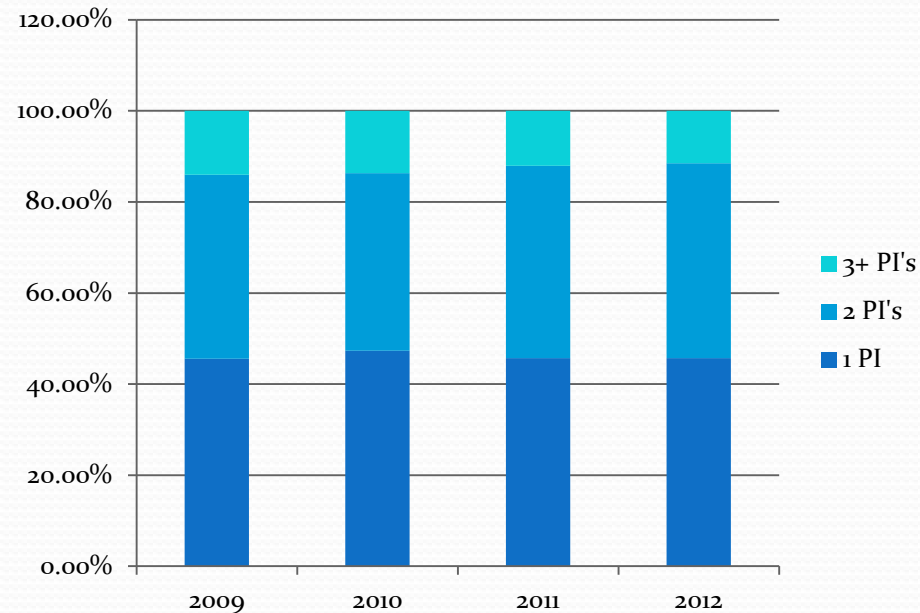
Mean Award Duration



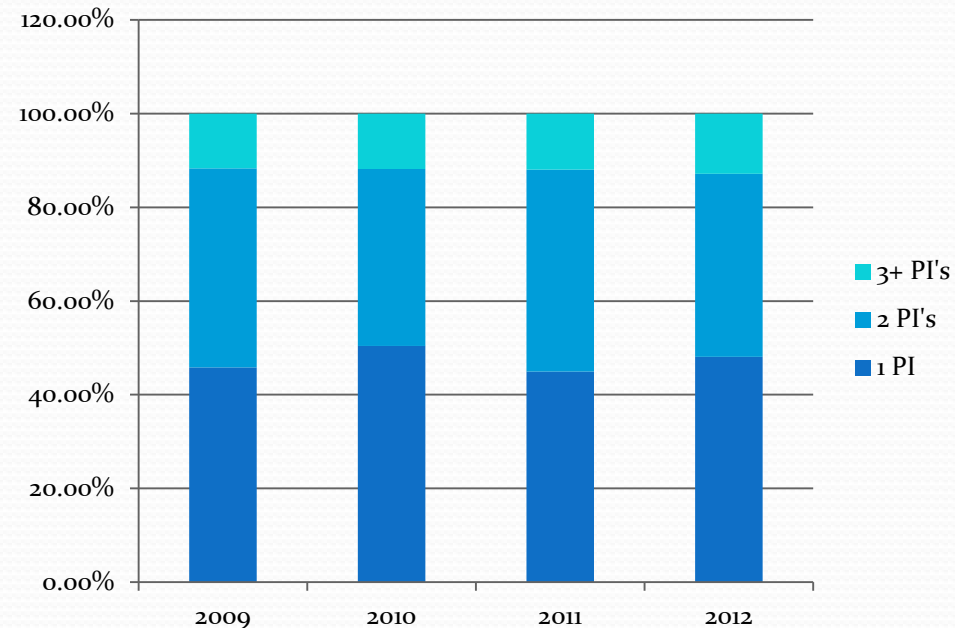
* Data do not reflect no-cost extensions for more recent years

Balance of Single & Multiple PI Awards in CBET

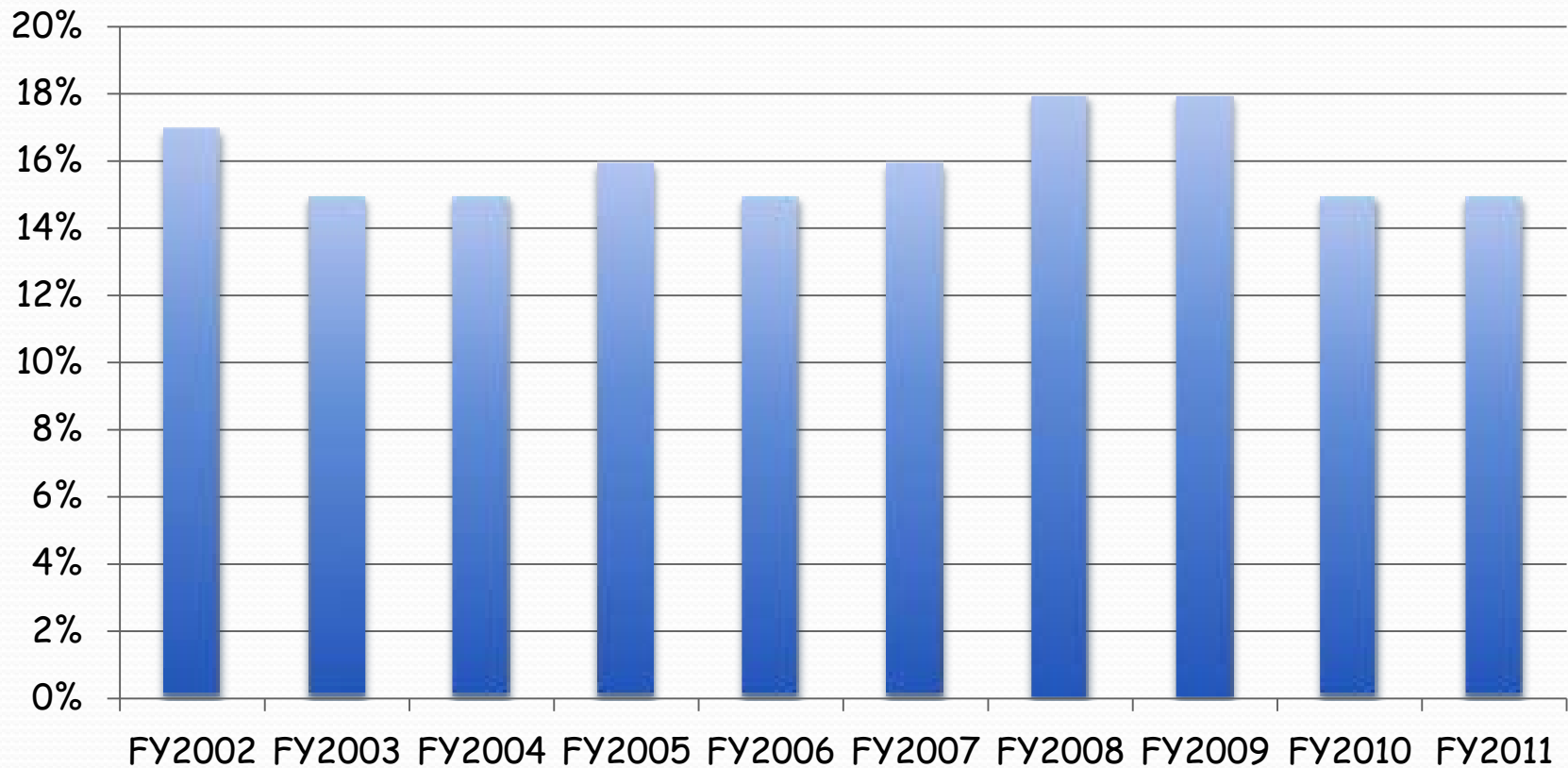
**Distribution of CBET Proposals
by # PIs**



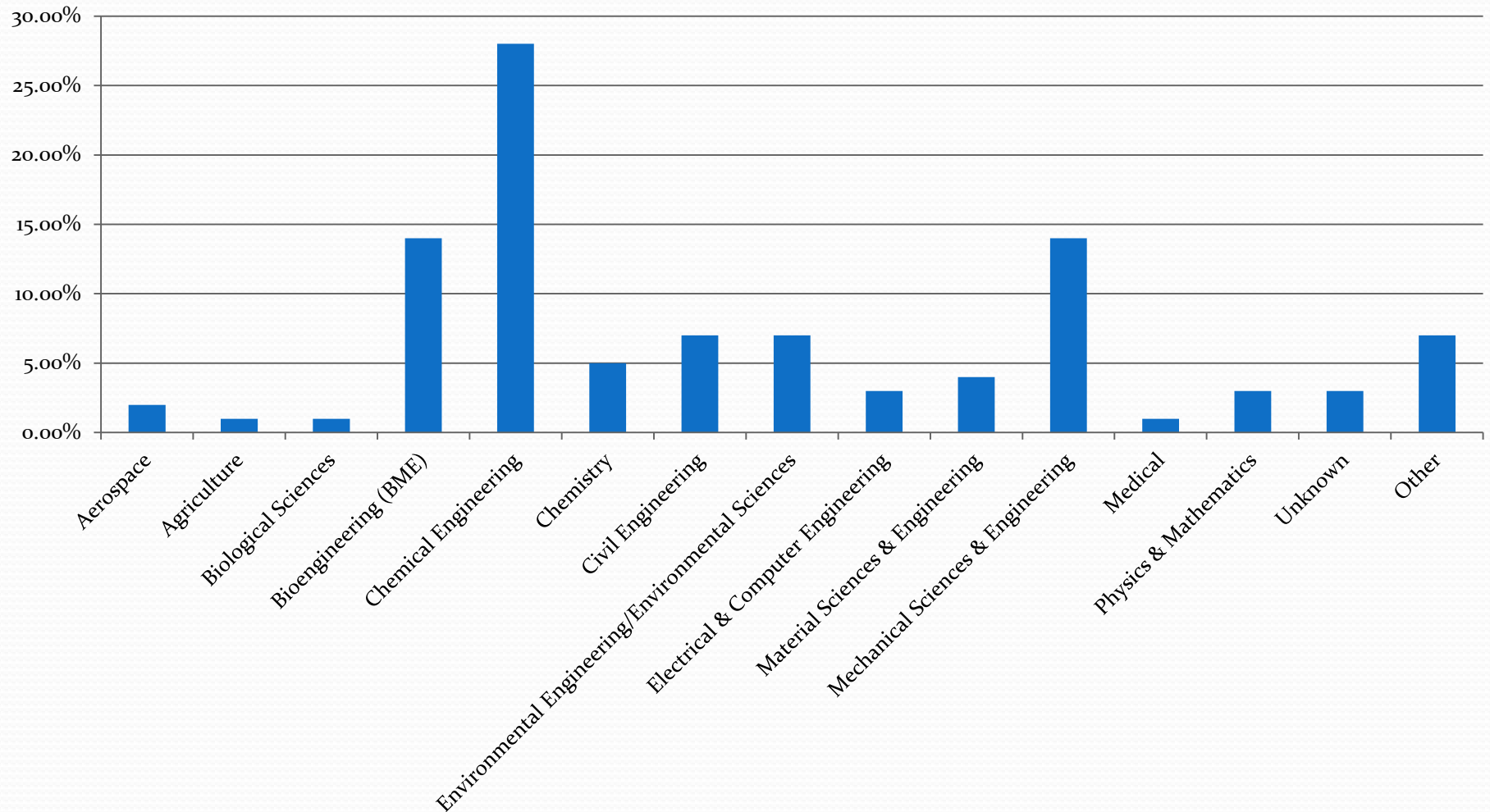
**Distribution of CBET Awards
by # PIs**



CBET Has Stable CAREER Support as Fraction of Budget

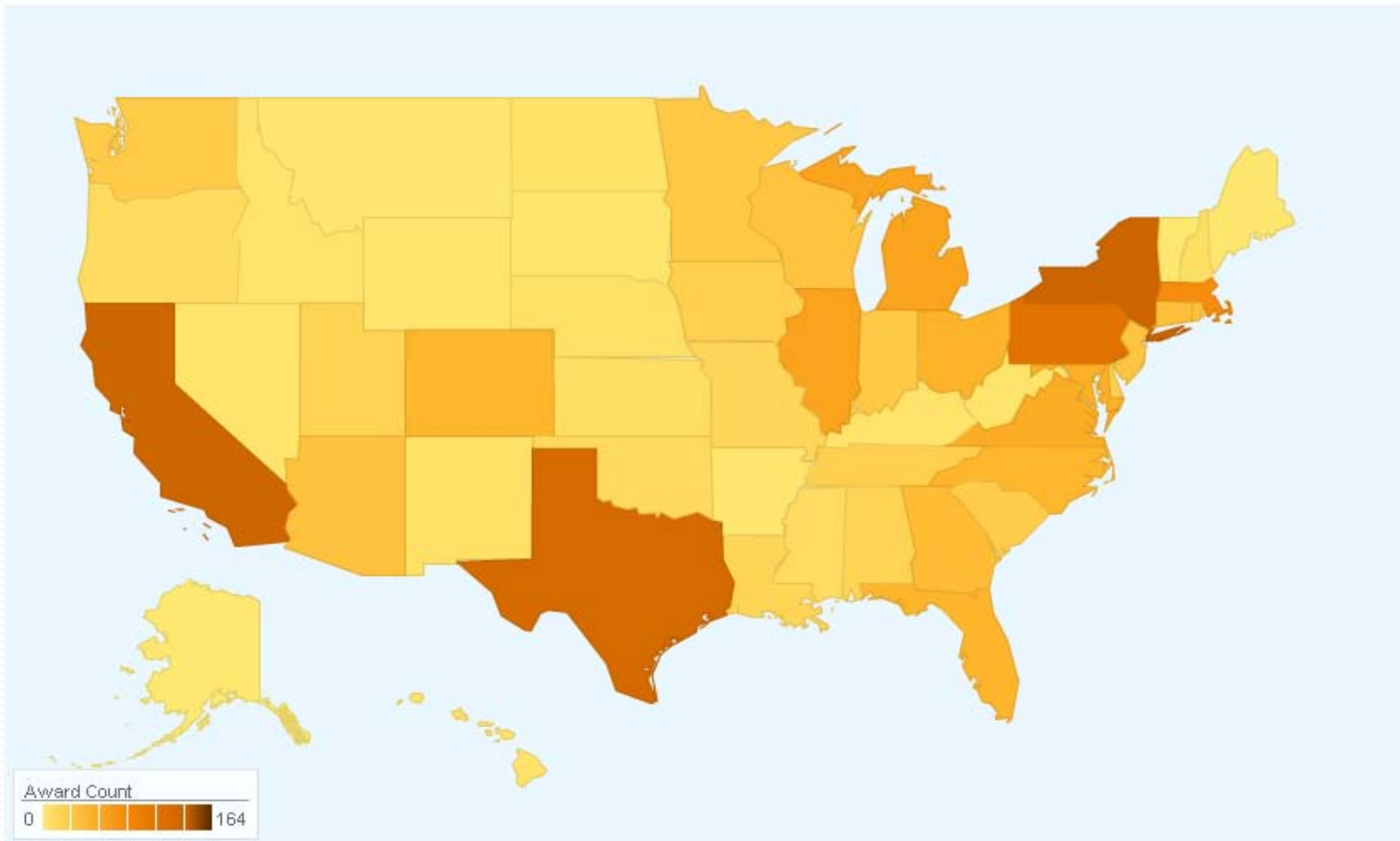


Most CBET Awards to ChEs, MEs & BMEs



All Competitive Proposals Submitted FYs 2009 & 2010

Geographic Distribution of CBET Awards FYs 2009-2011



Current & Future Research Areas in CBET Are Highlighted by Participation in Various Cross-Platform Initiatives

- Internal
 - Broadening Participation Research Initiation Grants in Engineering 2012 (BRIGE)
 - Computation and Data-Enabled Science and Engineering (CDS&E)
 - Supplemental Opportunity for Translational Research in the Academic Community (TRAC)
 - Network for Computational Nanotechnology
 - Scalable Nanomanufacturing (SNM)
 - SusChEM-Targeted Proposals
 - SEES Components: SEES Fellows, SRN, & RCN-SEES Awards
- Inter-Agency
 - NSF-NIST Interaction in Basic and Applied Scientific Research in BIO, ENG & MPS
 - NSF/DOE Partnership in Basic Plasma Science and Engineering
 - NSF/DOE Partnership on Advanced Combustion Engines
 - NSF/FDA Scholar-in-Residence at FDA
 - Physical and Engineering Sciences in Oncology (PESO)
 - NSF/CPSC MOU in Nano EHS

CBET PDs actively lead and support ERCs, STCs, and EFRI

- **ERCs**

- Leads:

- NSF-ERC for Revolutionizing Metallic Biomaterials (RMB)
 - ERC for Re-Inventing America's Urban Water Infrastructure (ReNUWIt)

- Supports:

- ERC for Biomimetic MicroElectronic Systems (BMES)
 - Synthetic Biology Engineering Research Center (SynBERC)
 - ERC for Mid InfraRed Technologies for Health and the Environment (MIRTHE)

- **STC (Leads)**

- Emergent Behaviors of Integrated Cellular Systems

- **EFRI**

- Leads:

- Cellular and Biomolecular Engineering (CBE)
 - Resilient and Sustainable Infrastructure (RESIN)
 - Engineering Technologies for Multicellular and Interkingdom Signaling (MIKS)
 - Hydrocarbon from Biomass (HyBi)
 - Photosynthetic Biorefineries (PSBR)

- Supports:

- Cognitive Optimization (COPN)
 - Flexible Bioelectronic Systems (BioFlex)

CBET Imagines a World Where...

Humans Will Live Sustainably on Earth



Bryce Richter

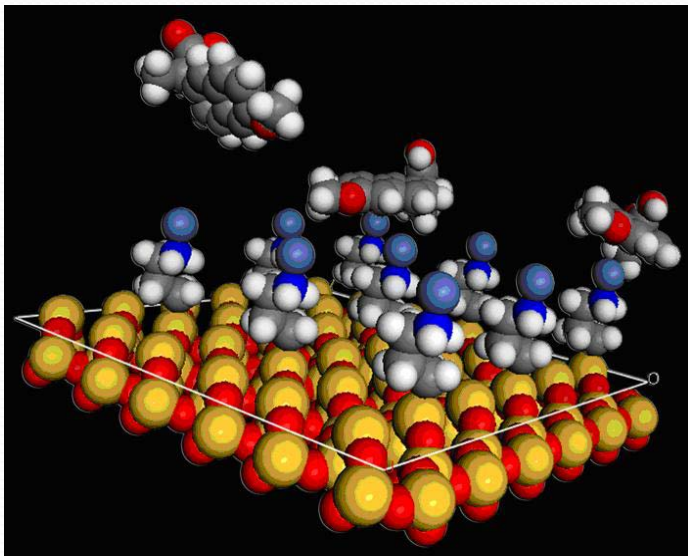
The Quality & Length of Life Will Be Maximized

Tongue Drive System for Individuals with
Quadriplegic Paralysis
Credit: Ghovanloo, Georgia Institute of Technology



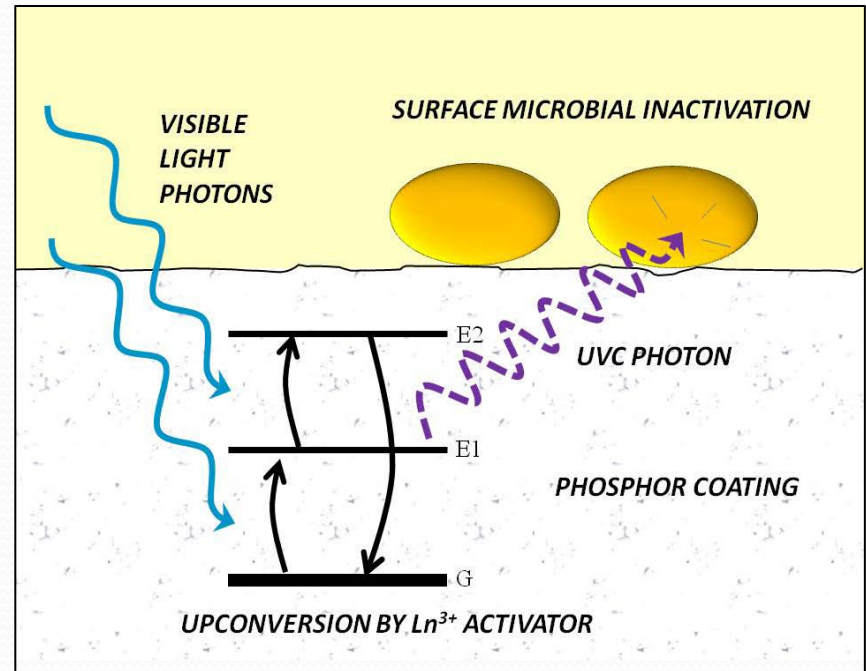
Humans Will Live Sustainably on Earth

- Drinking water will be clean and availability sustainable



Removal of pharma molecules via adsorption with a silica rich surface grafted with nickel-based complexes.

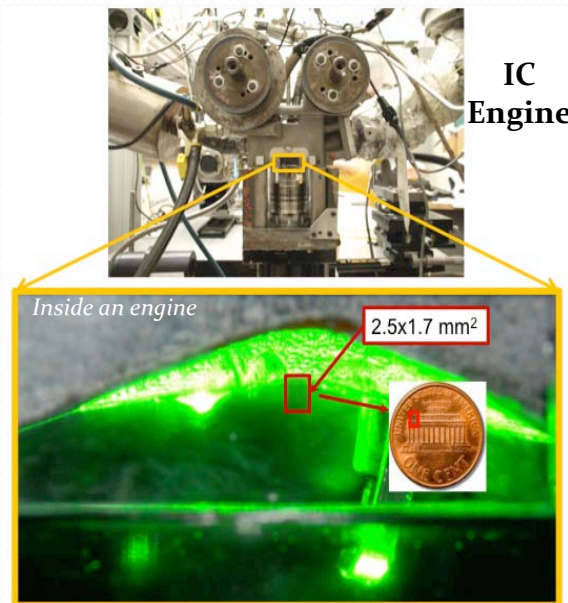
Credit: Hernandez-Maldonado (UPR-Mayaguez)



- New, sustainable approach to environmental technologies such as water disinfection and surface disinfection.
Credit: Kim, Georgia Institute of Technology

Humans Will Live Sustainably on Earth

- Air, ground and sea transportation will be safe and efficient
- Advanced Cooling technology leading to:
 - Desktop Supercomputers
 - Higher Efficiency Engines
 - Higher Efficiency Heat Exchangers for Autos, HVAC & Power Plants



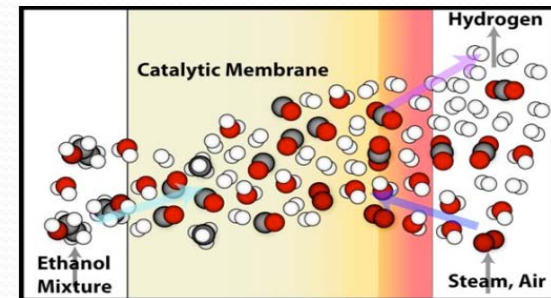
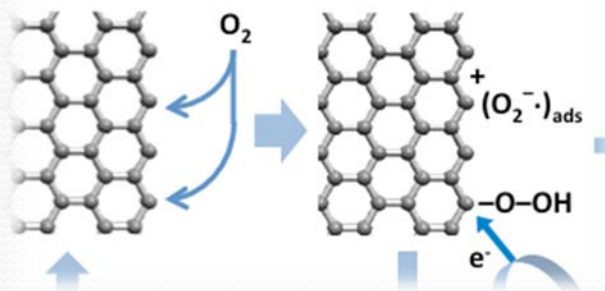
Humans Will Live Sustainably on Earth



- Protect air, water, land and climate
- Control and abate pollutants
- Reduce & reuse greenhouse gas emissions
- Protect humans from nanotechnology before widespread environmental infiltration

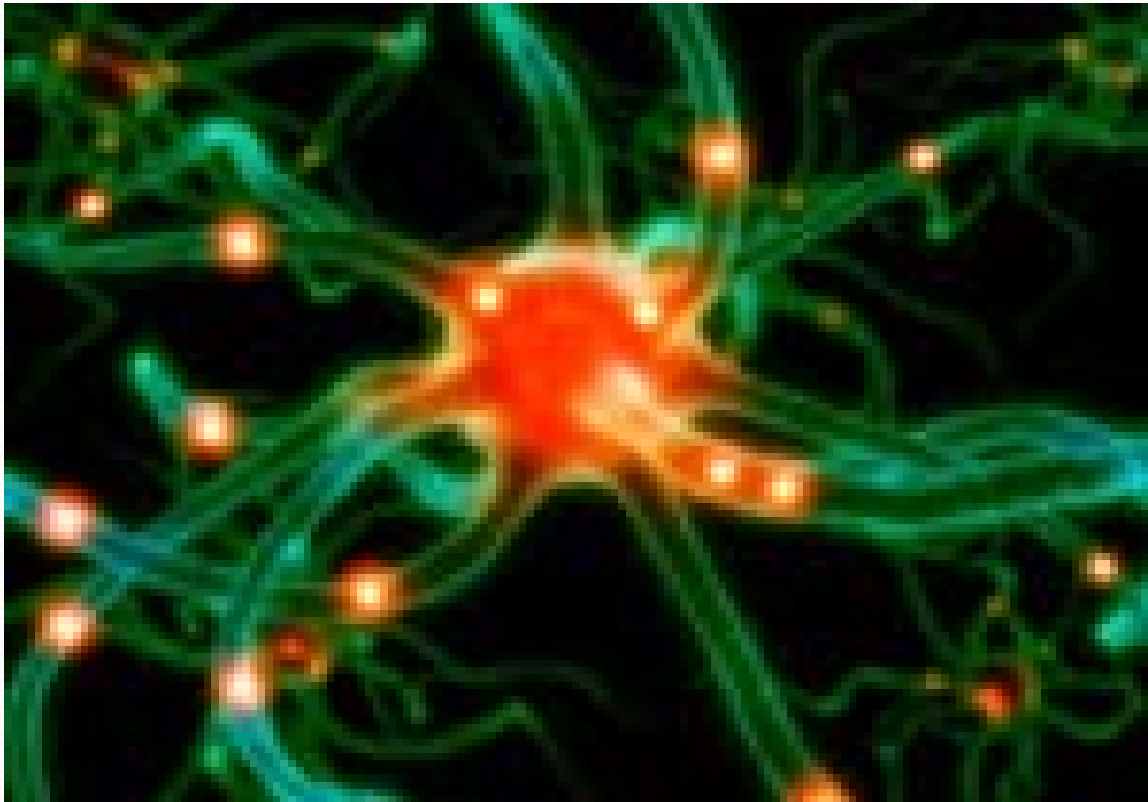


graphene edge or defect sites



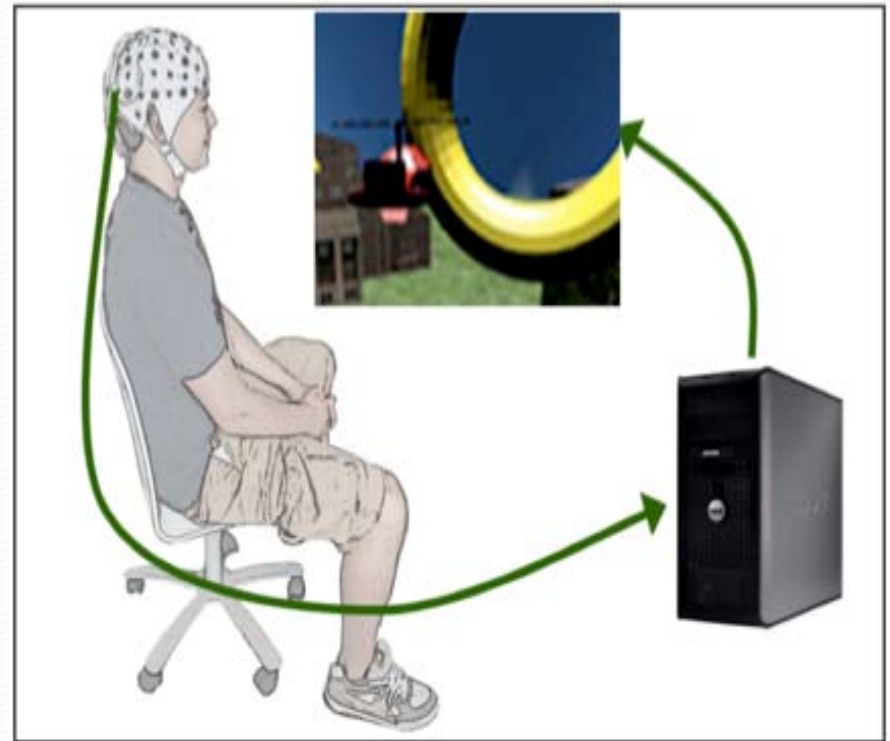
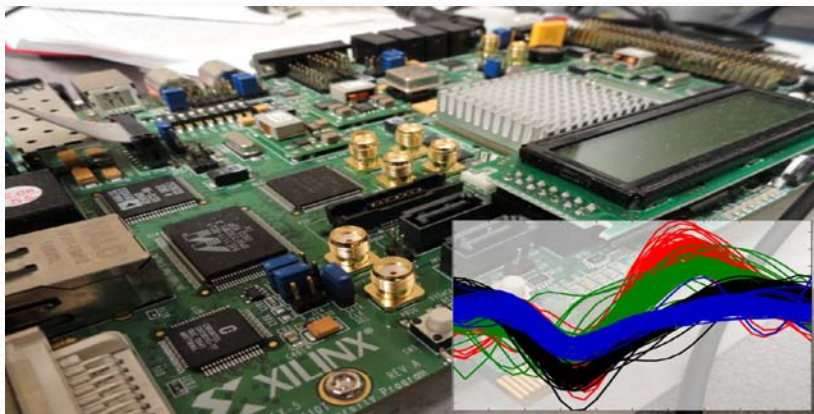
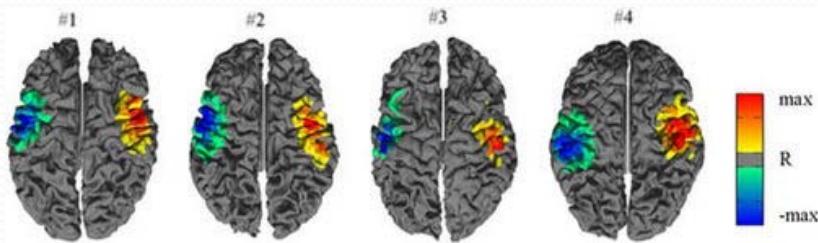
Catalytic Membrane Design: As ethanol diffuses through the membrane, it is catalytically broken down first into methane and carbon monoxide, and subsequently into hydrogen and carbon dioxide. Steam and air ensure complete reaction of carbon monoxide pollutant.
Credit: Benjamin A. Wilhite, Texas A&M University, College Station, TX

The Quality & Length of Life Will Be Maximized



- Optogenetics will make it possible to probe neural circuits in live mammals to understand physiologic and pathologic neuro-psychiatric function

The Quality & Length of Life Will Be Maximized

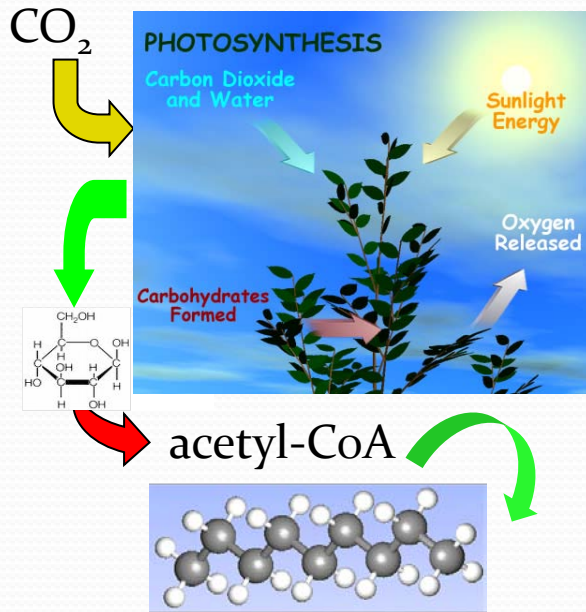


- Neural engineering will make it possible to study the brain and to develop minimally-invasive methods to diagnose and treat neural disorders
- Build brain-like devices

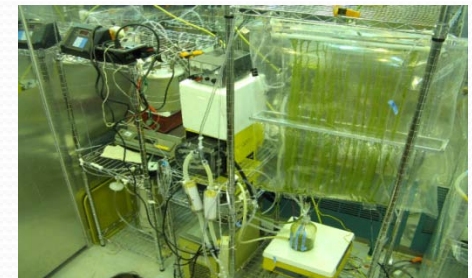
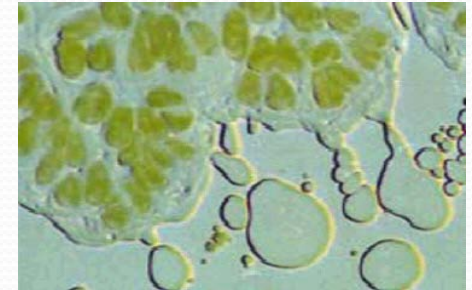
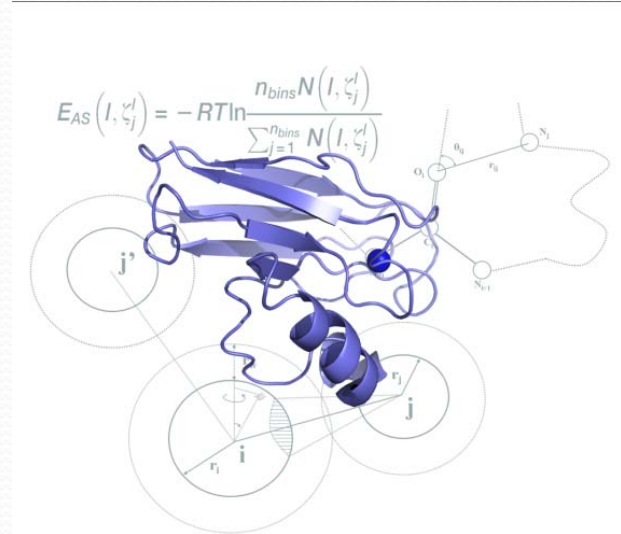


Thank You

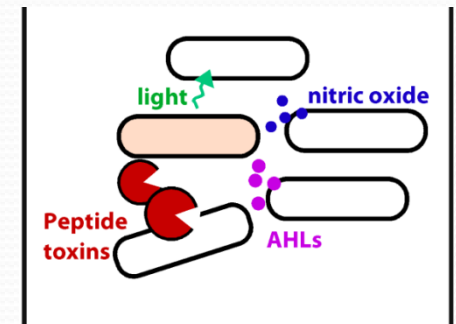
Humans Will Live Sustainably on Earth



"Green hydrocarbon biofuel"

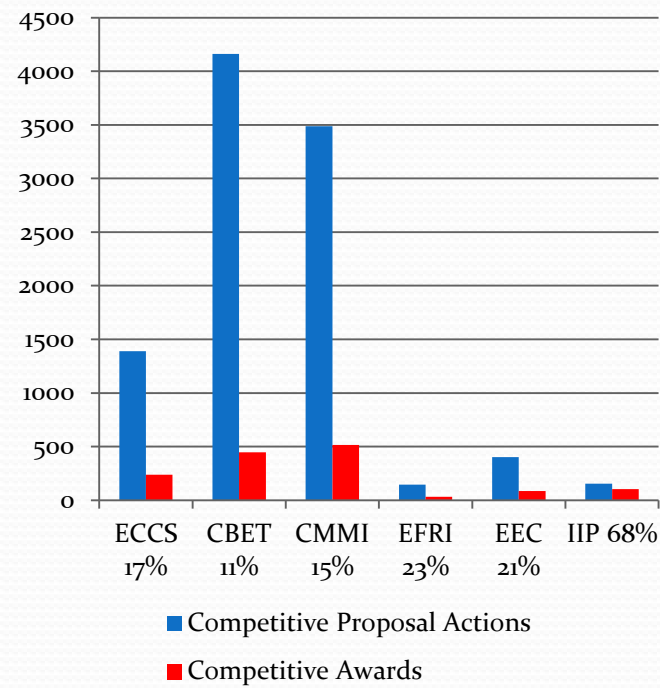


Engineered algae and photo-bioreactor for production of energy dense hydrocarbons. Wayne Curtis, Penn State

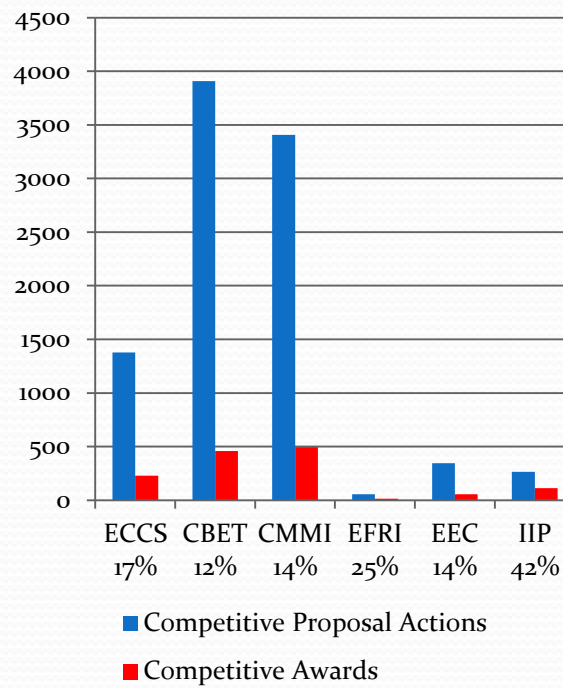


- A thriving bio-economy will use bio-renewable and renewable resources to produce sustainable fuels and chemicals

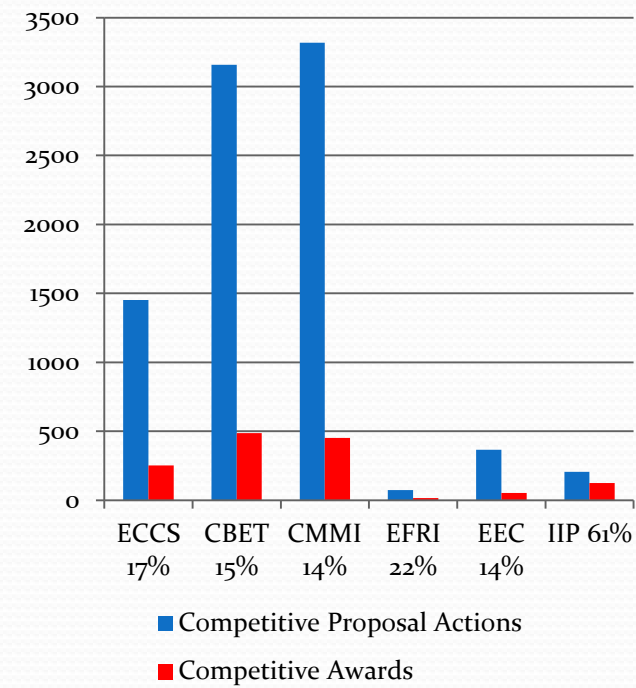
CBET Experiences high Proposal Loads and Low Award Rates



FY10 Research Grants



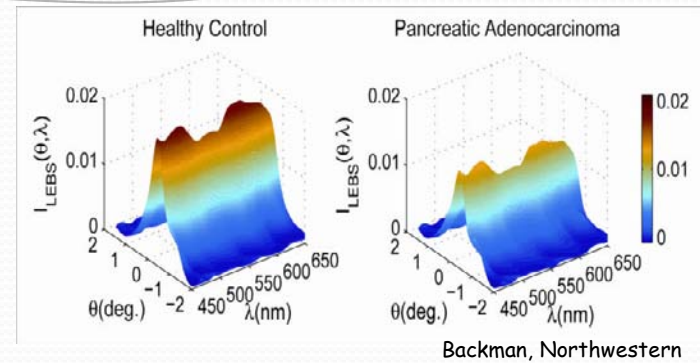
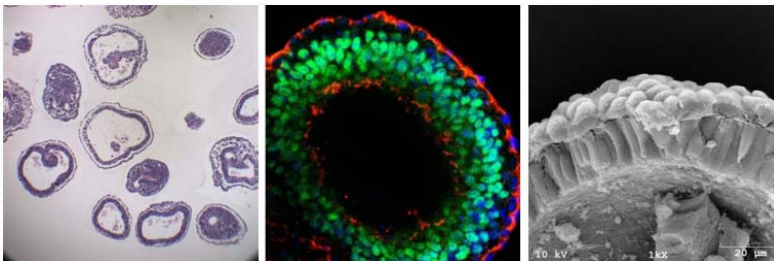
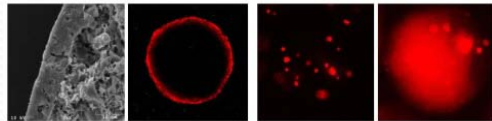
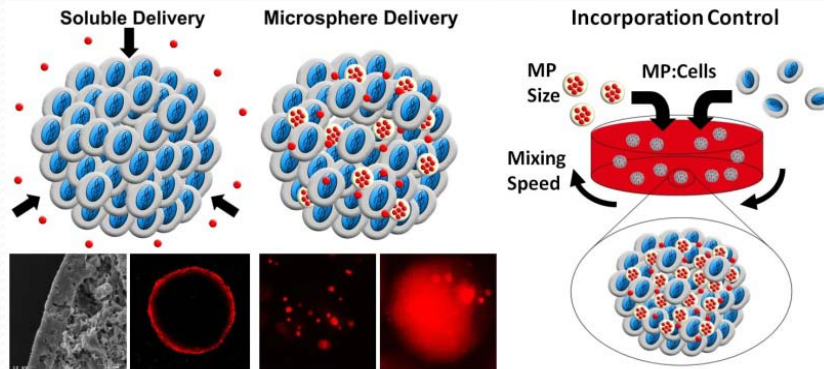
FY11 Research Grants



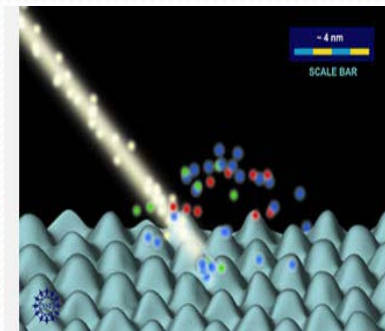
FY12 Research Grants

CBET In 0 Words

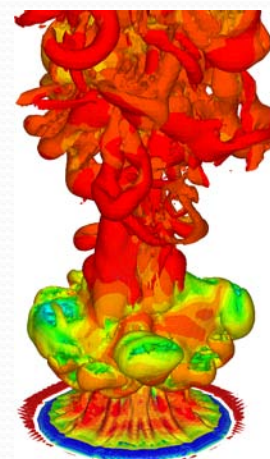
CBBS



BEH

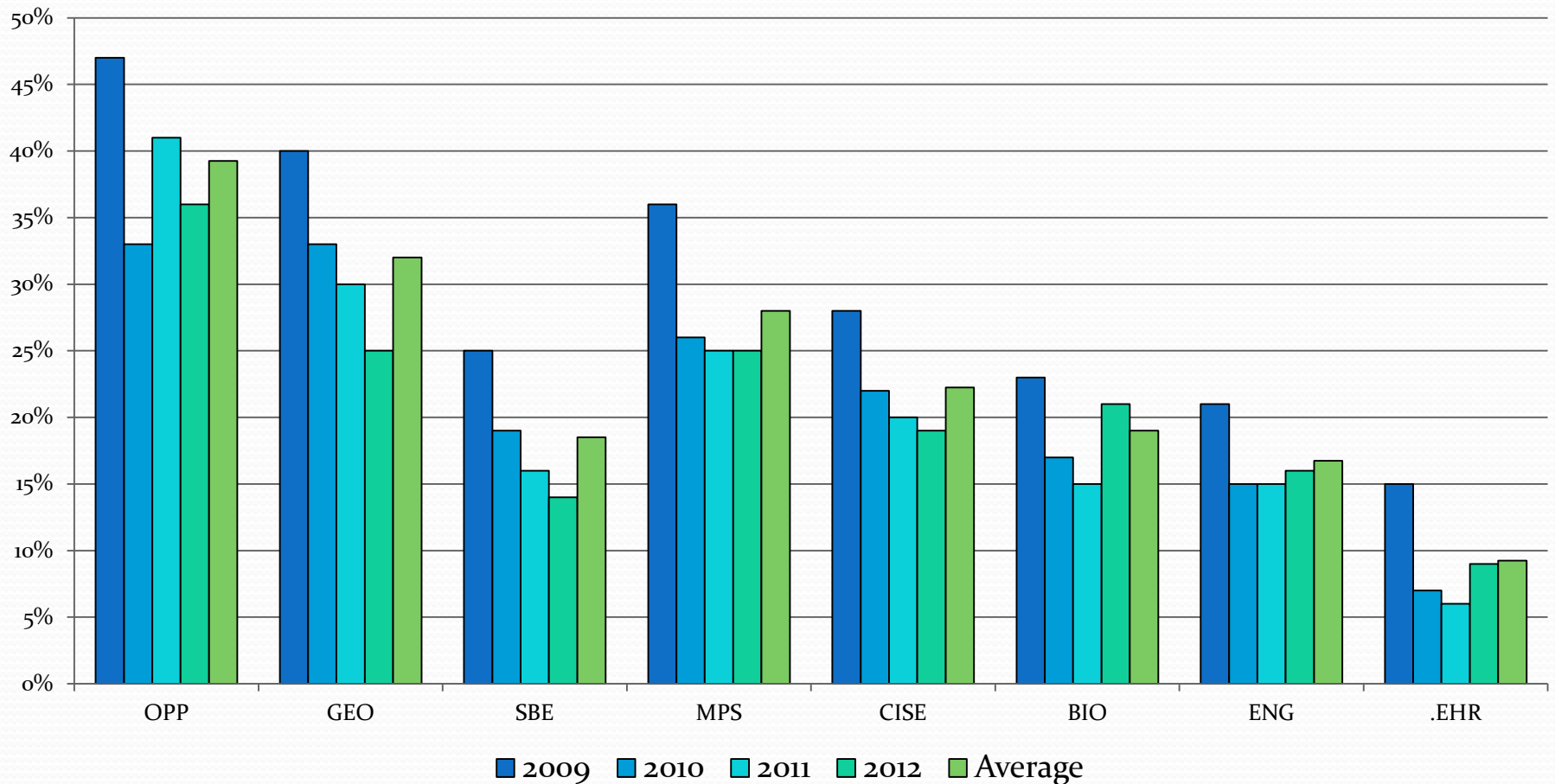


EES

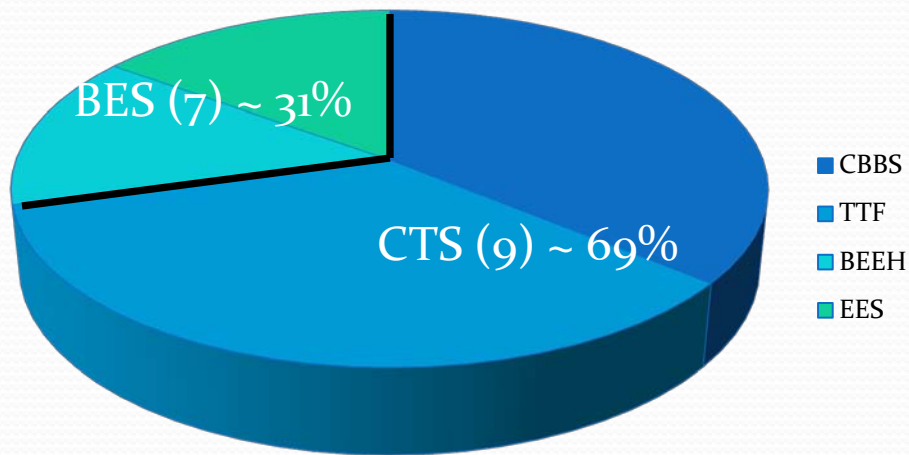


TTF

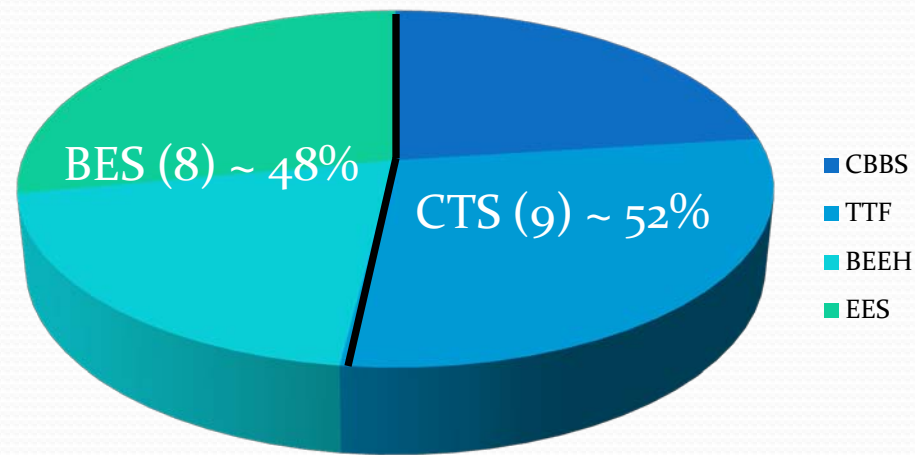
Funding Rates by Directorate indicate stresses on ENG



Trends in CBET Fund Distribution: “BES” Has increased substantially



12/2006



12/2010

Proposals by Directorate indicate stresses on ENG

