
NSF Workforce Development Related Activities and Programs

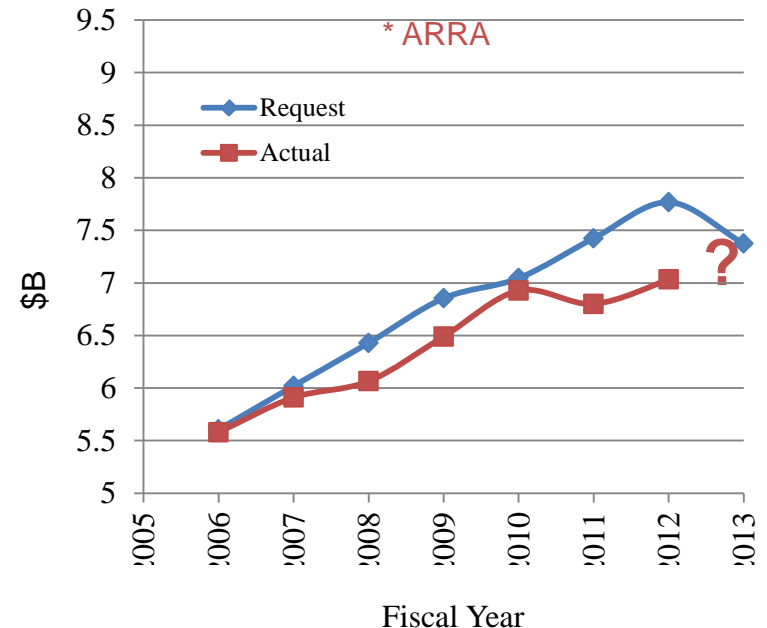
Barbara Kenny

June 11, 2012

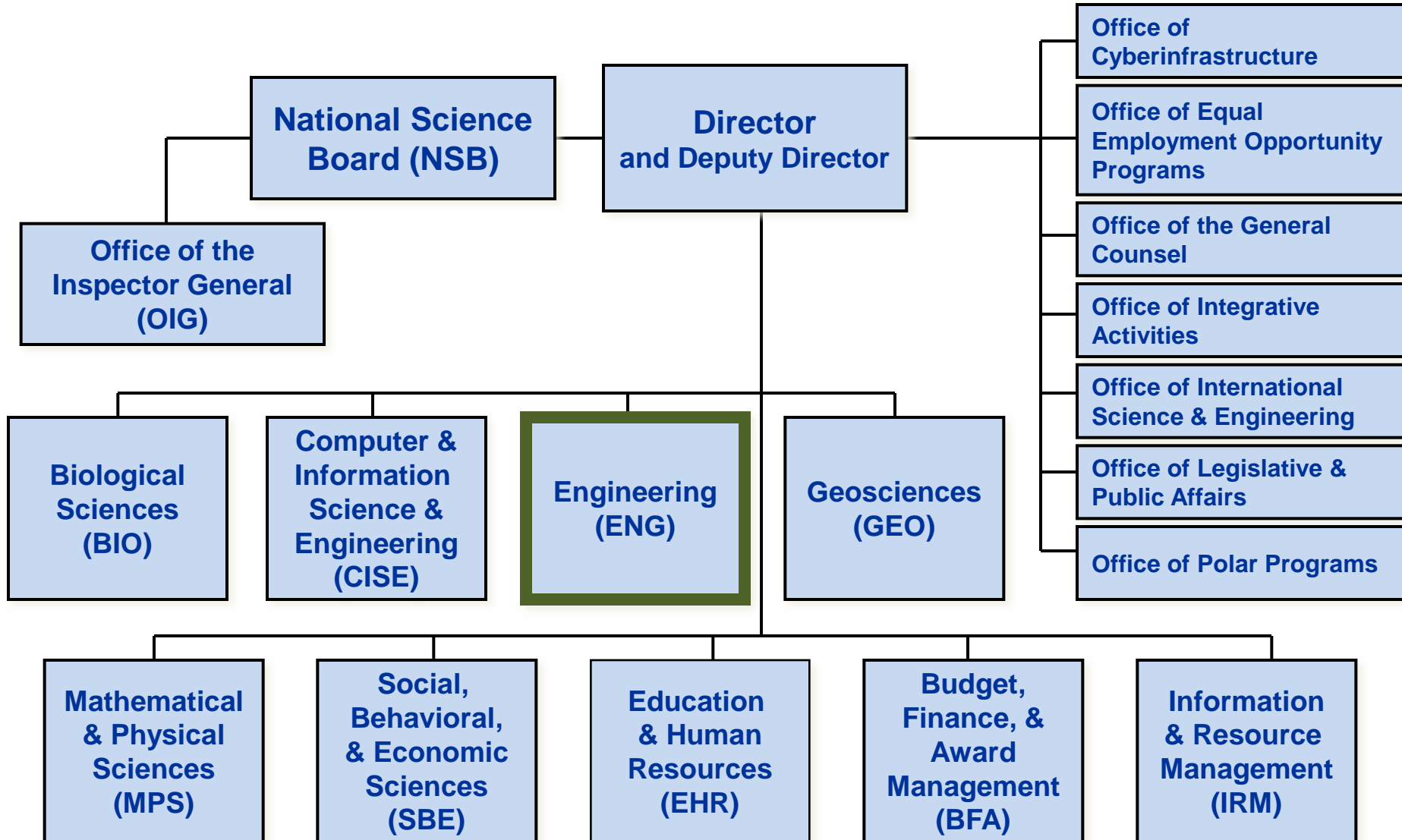
NSF Mission and Vision

- Mission: From the NSF Act of 1950: ...”To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense....”
- Vision: NSF envisions a nation that capitalizes on new concepts in science and engineering and provides global leadership in advancing research and education

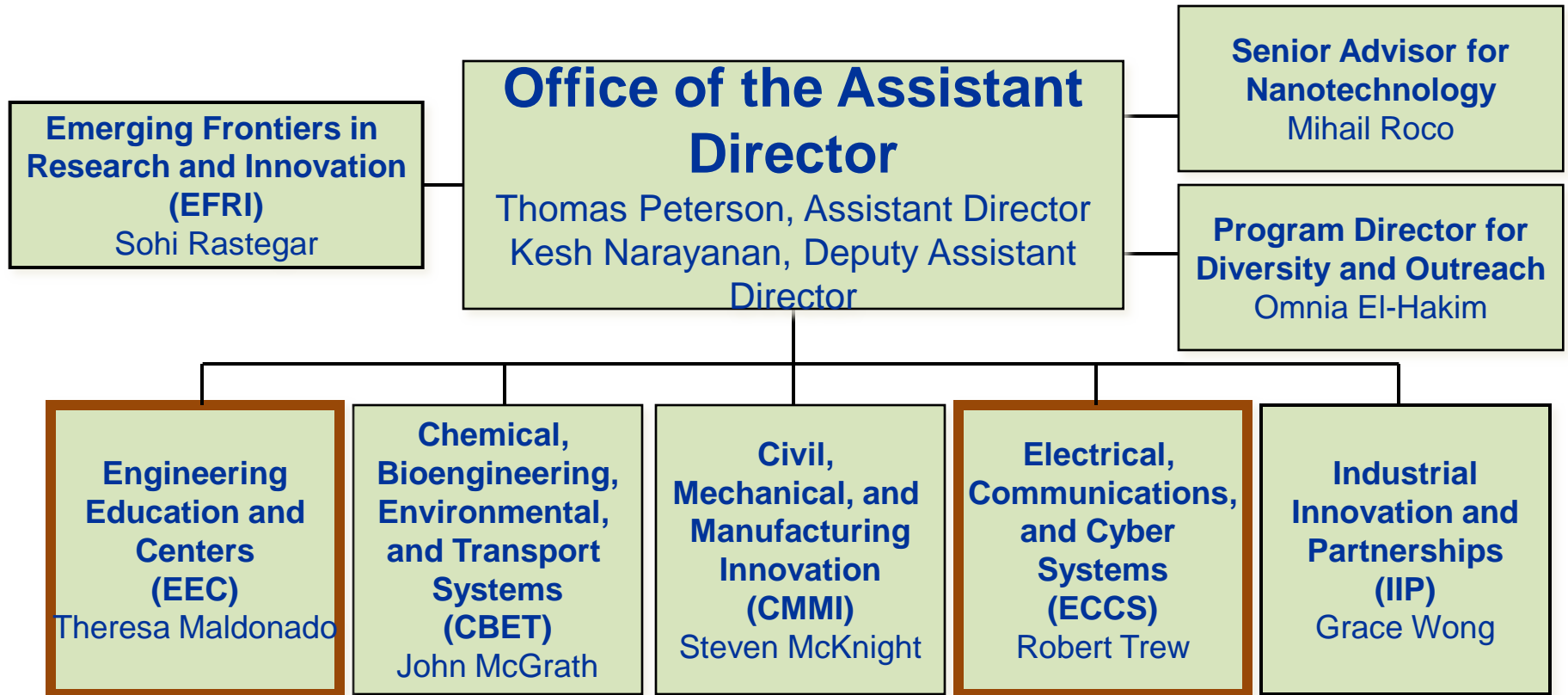
NSF Budget



National Science Foundation



Directorate for Engineering (ENG)



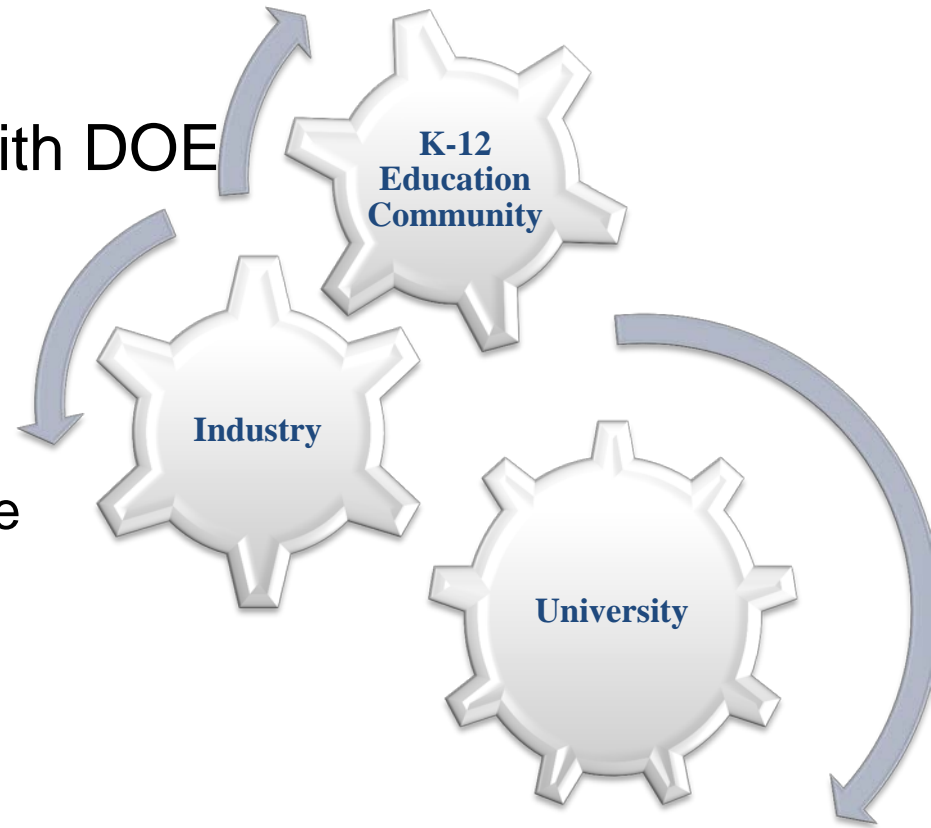
Program and Activities Snapshot

- Centers program
 - Engineering Research Centers
 - Industry/University Cooperative Research Centers
- Human Resource Development
- Program/Curriculum Development
- Engineering Education Research

Centers 1: Engineering Research Centers Program

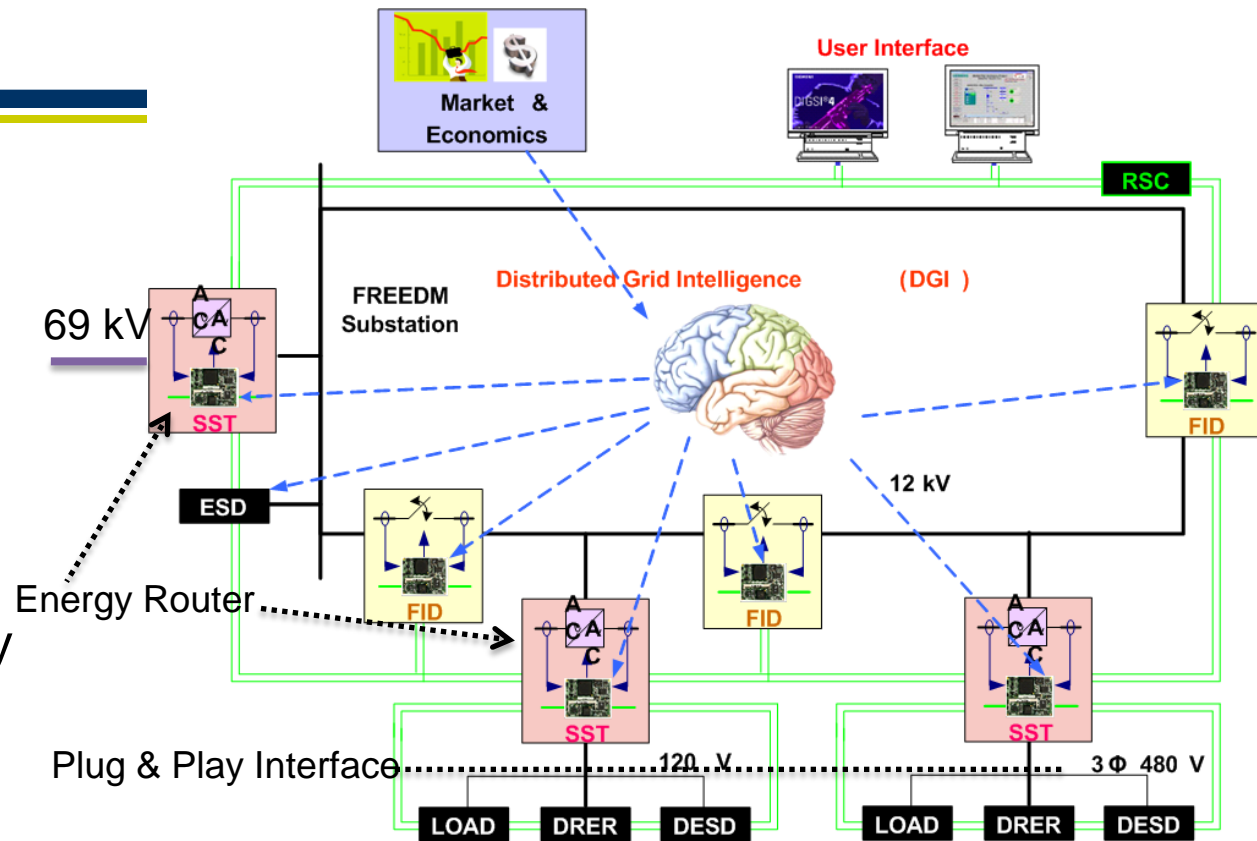
- Program initiated in 1985
- ~ \$4M/year up to 10 years
- 17 Centers funded— two joint with DOE
- Goals:

- Create and sustain an integrated, interdisciplinary research environment to advance fundamental engineering knowledge and engineered systems
- Educate a globally competitive and diverse engineering workforce from K-12 on
- Join academe and industry in partnership to achieve goals



Future Renewable Electric Energy Delivery and Management (FREEDM) System Engineering Research Center (ERC)

- “Energy Internet” concept to enable every citizen to participate in energy production, conservation and utilization
- Develop plug-and-play infrastructure to enable the use of distributed renewable energy resources



FID: Fault Isolation Device

SST: Solid State Transformer

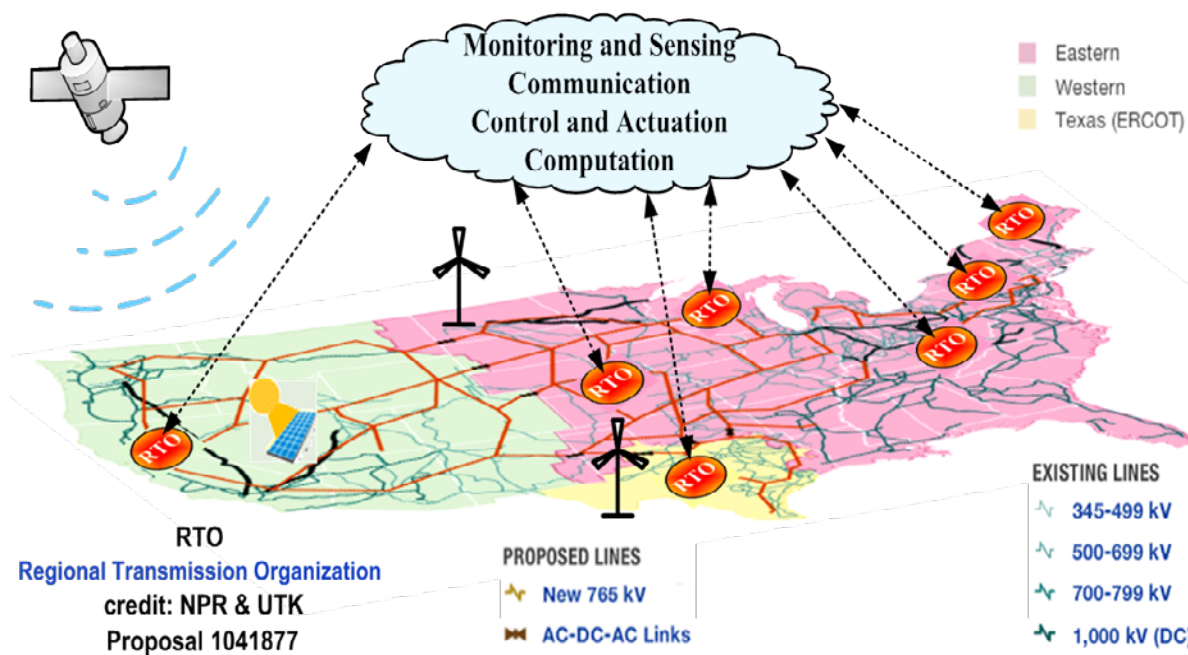
DRER: Distributed Renewable Energy Resource

DESD: Distributed Energy Storage Device

Center for Ultra-wide-area Resilient electric Energy Transmission networks (CURENT)

- A nation-wide transmission grid that is fully monitored and dynamically controlled for high efficiency, high reliability, low cost, better accommodation of renewable sources, full utilization of storage, and responsive load.
- A new generation of electric power and energy systems engineering leaders with a global perspective coming from diverse backgrounds.

Slide 1 - Vision



- University of Tennessee
- Northeastern University

- Tuskegee University
- Rensselaer Polytechnic Institute

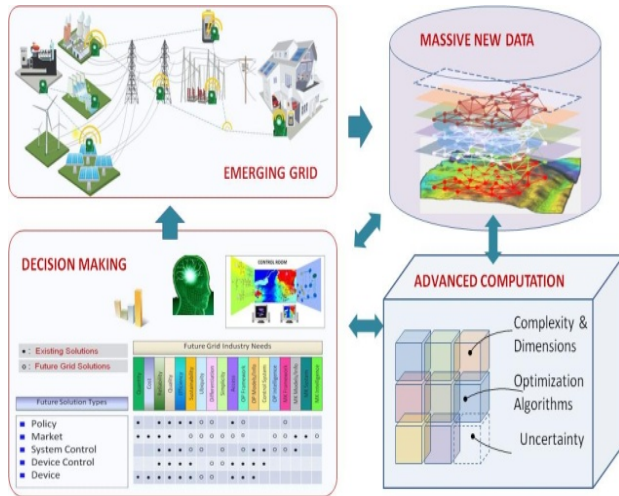
Centers 2: Industry/University Cooperative Research Centers (I/UCRC)

- Initiated in 1973:
- Catalyzed by a small investment from NSF; primarily supported by industry center members
 - Planning Grants (\$10K/year, 1 year)
 - Full Center awards (\$55-\$80K/year, 5-15 years)
- Goals:
 - To contribute to the nation's research infrastructure base by developing long-term partnerships among industry, academe and government
 - To leverage NSF funds with industry to support graduate students performing industrially relevant research
- ~60 centers currently NSF funded

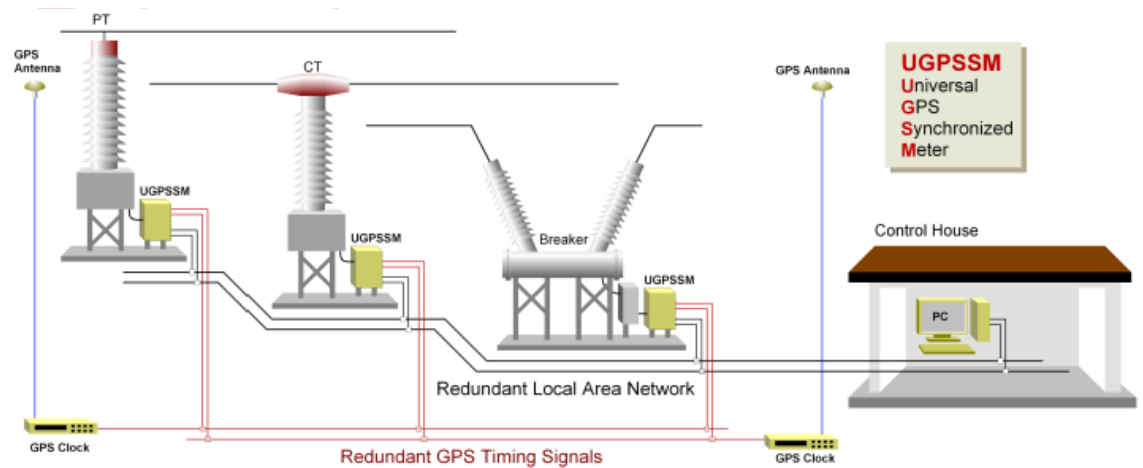
Power Systems Engineering Research Center

Empowering minds to engineer the future electric energy system

Power Systems



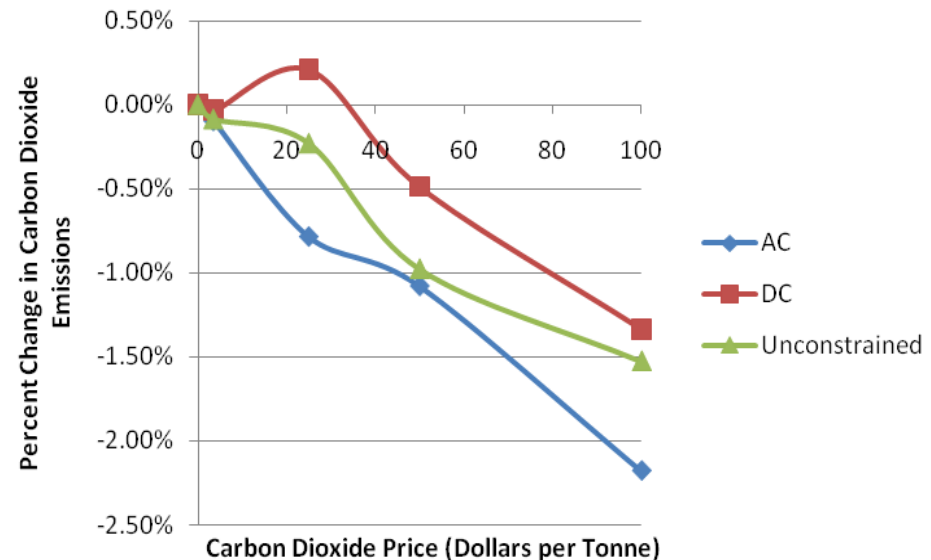
Transmission & Distribution



Organization in Brief

- NSF I/UCRC
- 37 Industry Members
- 13 Universities
- 14 on-going industry projects
- Supporting ~50 grad students
- U.S. DOE projects (Future Grid Initiative, CERTS)

Markets and Policies





GRid-connected Advanced Power Electronic Systems (GRAPES) – An NSF I/UCRC

- The mission of GRAPES is to accelerate the adoption and insertion of power electronics into the electric grid in order to improve system stability, flexibility, robustness and economy.

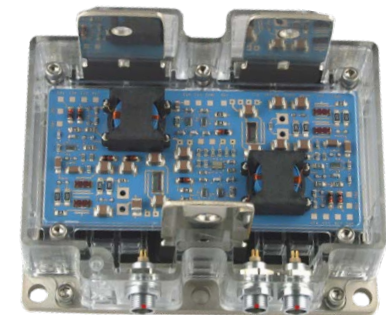
Research Areas:

- Distributed Energy Resources
- Demand Side Management
- Power Flow Control
- Power Electronic Modules
- Power Electronic Systems

Founded in 2009

18 Industrial Members

Supporting ~20 grad students



Snapshot 2: Human Resource Development Programs and Activities

- Graduate Research Fellowships (GRF)
 - ~2000 awards/year (\$30K/yr to student up to 3 yrs)
- Integrative Graduate Education and Research Training (IGERT)
 - ~18 awards per year, ~ \$3M/5 yrs
 - Sample grid-related projects
 - University of Texas—Austin “Sustainable Grid Integration of Distributed and Renewable Resources”
 - University of Vermont “Smart Grids - Technology, Human Behavior and Policy “

Snapshot 2: Human Resource Development Programs and Activities

- Research Experiences for...
 - ...Undergraduates (REU)
 - ...Teachers (RET)
 - ...Veterans (REV)
- Sample grid-related projects
 - Case Western Reserve University: REU Site: "SUR-WInD: Summer Undergraduate Research in Wind Innovation & Development" 10/summer
 - Texas A&M: REU Site: "Smart Energy and Smart Systems: Enabling the Future through Electrical & Computer Engineering"
 - Drexel: REU Site: "Computing for Power and Energy: The Old, The New and The Renewable."
 - University of Notre Dame: "RET in Engineering and Computer Science Site on Engineering a More Sustainable Energy Future" 18/summer

Snapshot 3: Program/Curriculum Development

- Transforming Undergraduate Education in Science, Technology, Engineering, and Mathematics (TUES)
 - Supports efforts to create, adapt and disseminate new learning materials and teaching strategies in STEM education (\$100-300K/yr up to 5 yrs)
- Advanced Technological Education (ATE)
 - Emphasis on two-year colleges, ATE focuses on the education of technicians for the high-technology fields that drive the nation's economy (~\$100-800K/yr up to 7 yrs)

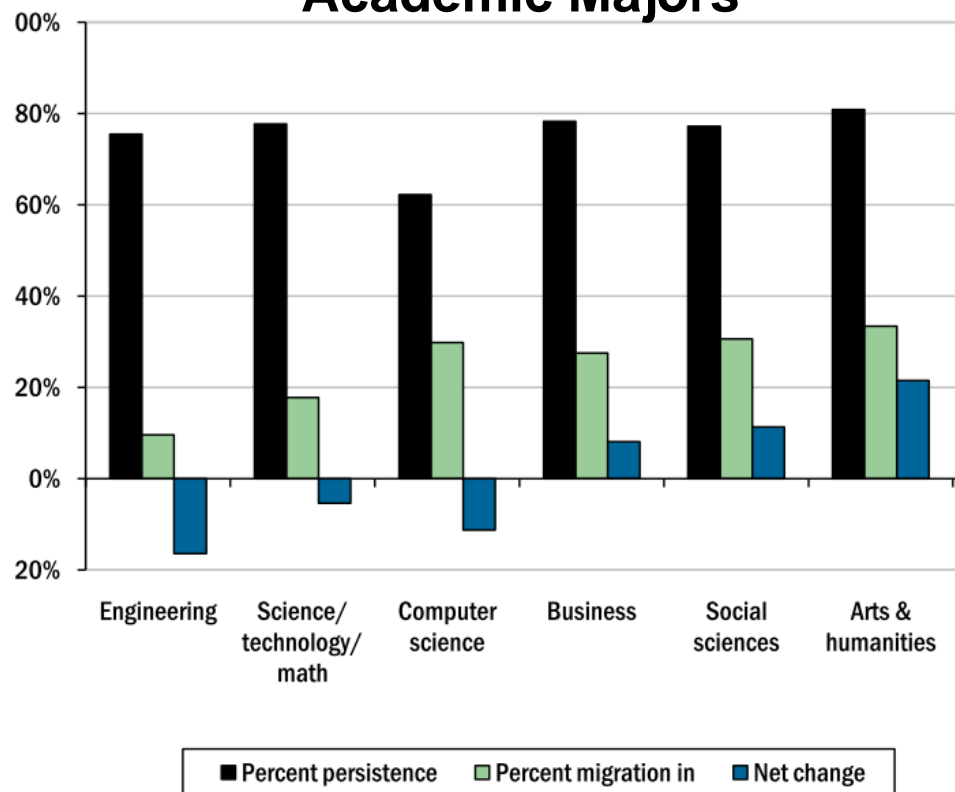
Snapshot 3: Program/Curriculum Development

- **Sample grid-related projects**
 - TUES: University of Arkansas—Little Rock, “Development of Novel Learning Materials for Green Energy Education Centered Around a Photovoltaic (PV) Test Station”
 - ATE: El Paso County Community College “Renewable Energy Program”
 - ATE: Suffolk Community College “Leading Innovation through Green High Tech Engineering & Sustainability”
- **Faculty workshops in power education**
 - Ned Mohan (ONR/NSF funded), Univ of Minnesota
 - Electrical and Computer Engineering Department Heads Association (ECEDHA) workshops to cross-train faculty

Snapshot 4: Engineering Education Activities

- Engineering Education Research areas
 - Diversifying pathways for engineering degree programs
 - Exploring credentialing in engineering education
 - Understanding how to scale engineering education innovations

Persistence and Migration into Academic Majors*



*From "Enabling Engineering Student Success," Final Report for the Center for the Advancement of

Engineering Education" NSF Grant ESI-0227558, www.engr.washington.edu/caee/

Final Thoughts

- Collaborate, leverage, partner
 - Other industry sectors, other agencies
 - Focus on the industry or focus on the discipline?
- Stimulate interest
 - K-12 Outreach
- Understand the system
 - Modeling STEM Education as a Complex System
 - <http://msce.sri.com/index.html>

Aerospace and US Workforce Age Distribution

