

NATIONAL ENERGY TECHNOLOGY LABORATORY



2012 UCR/HBCU Annual Review Conference

Robert R. Romanosky, Crosscutting Research Technology Manager

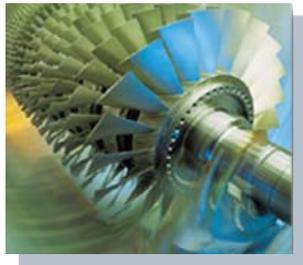
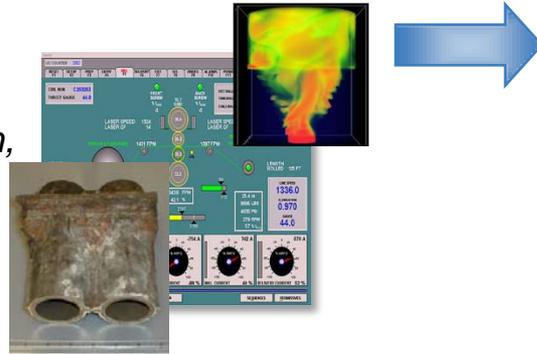
May 30, 2012



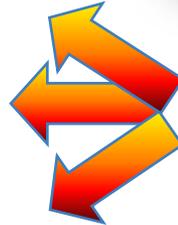
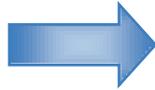
Overview

Areas of Research and Development and Key Technologies for Advanced Power Generation and Carbon Management

Cross cutting Technologies
for Design, Construction,
& Operation



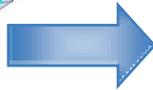
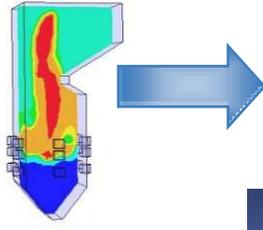
Optimized Turbines



Workforce Development



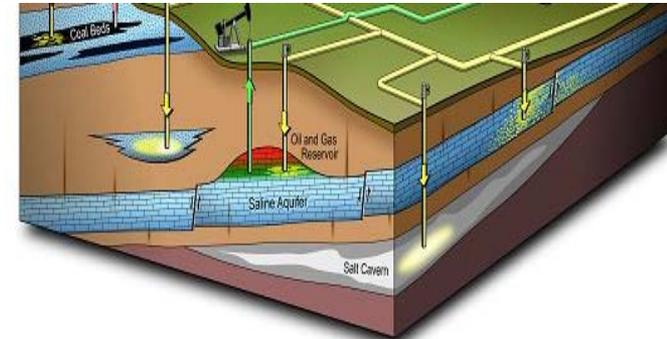
Oxy Combustion



Gasification with Cleanup Separation



Carbon Capture, Utilization, & Sequestration



Crosscutting Research Program

- Crosscutting science, tools, and technology development program
- Has a 15-25 year horizon for technology that supports breakthrough concepts, addresses gaps, and has commercial application
- Innovation through fundamental and applied developments that benefit Coal-based Fossil Energy Systems

**Bridge the gap between
fundamental & applied technology**



**Reflective of industry needs
and drives new technology**

○ **Advanced Materials**

- *Ultrasupercritical Boilers & Turbines*
- *High-strength, oxidation & corrosion resistant metallic & intermetallic alloys*
- *High Performance Materials*

○ **Sensors and Controls**

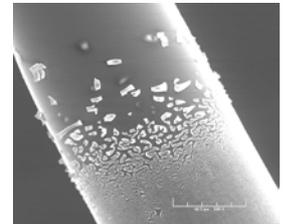
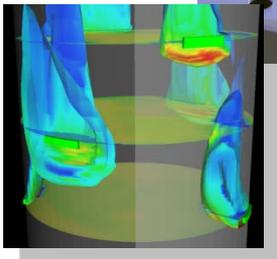
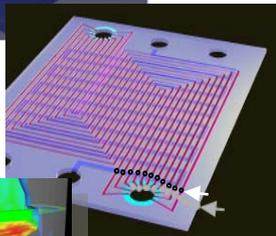
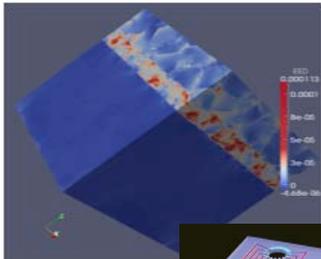
- *High Temperature Material & Sensor Designs*
- *Sensors Networks and Advanced Control*

○ **Modeling and Simulations**

- *High fidelity models of potential advanced power systems*
- *Advanced power systems using mathematical computational simulations*
- *Carbon Capture Simulation Initiative*
- *National Risk Assessment Partnership*

○ **University Training and Research (UTR)**

- **Historically Black Colleges & Universities (HBCU)**
- **Mercury and Water Control**



Harsh Environments

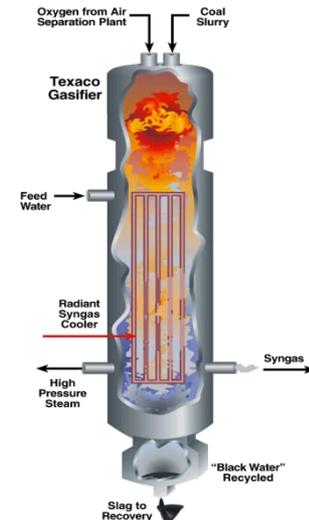
Solid Oxide Fuel Cells

- Utilizes Hydrogen from gaseous fuels and Oxygen from air
- 650 – 1000 °C temperature
- Atmospheric pressure



Advanced Combustion Turbines

- Gaseous Fuel (Natural Gas to High Hydrogen Fuels)
- Up to 1300 °C combustion temperatures
- Pressure ratios of 30:1



UltraSupercritical Boilers

- Development of ferritic, austenitic, and nickel-based alloy materials for USC boiler conditions
- Up to 760 °C temperature
- Up to 5000 PSI pressure



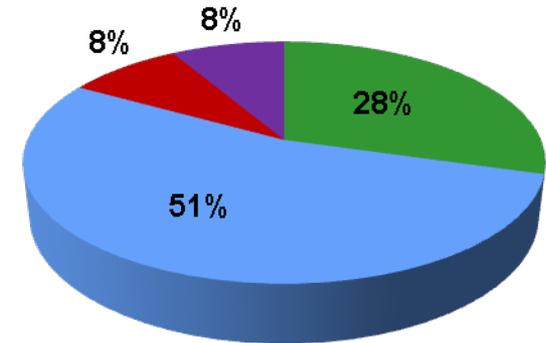
Gasifiers

- Up to 1600 °C, and 1000 PSI (slagging gasifiers)
- Erosive, corrosive, highly reducing environment
- Physical shifting of refractory brick, vibration, shifting “hot zones”

Crosscutting Research Program

Key Activity / Component	FY11 Actual Budget	FY12 Budget	FY13 President Budget
Plant Optimization Technologies	8,000	13,663	7,000
Computational System Dynamics	12,758	11,800	7,800
Computational Energy Science	12,235	13,371	9,400
System Analysis Product Integration	0	4,000	0
University Training & Research	2,395	3,000	2,400
Historically Black Colleges & Universities	848	1,000	850
Crosscutting Research TOTAL	36,236	46,834	27,450
Advanced Materials (ACS)	9,082	5,000	0

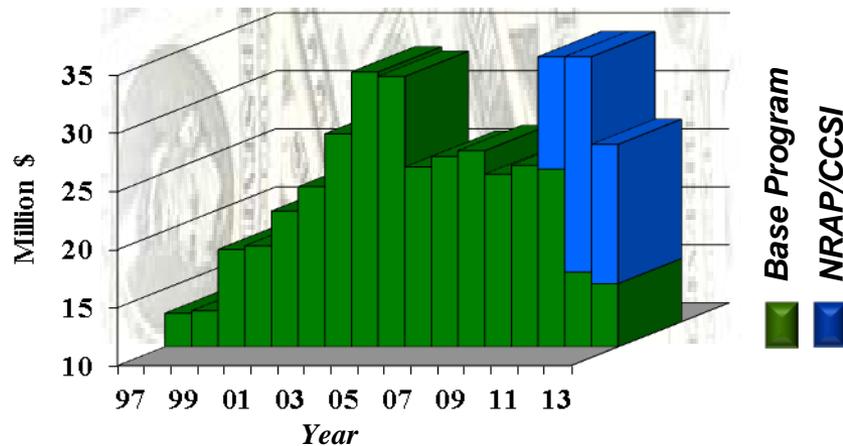
FY12 Budget Distribution among Crosscutting Research Program Elements



NETL Managed = \$46,834

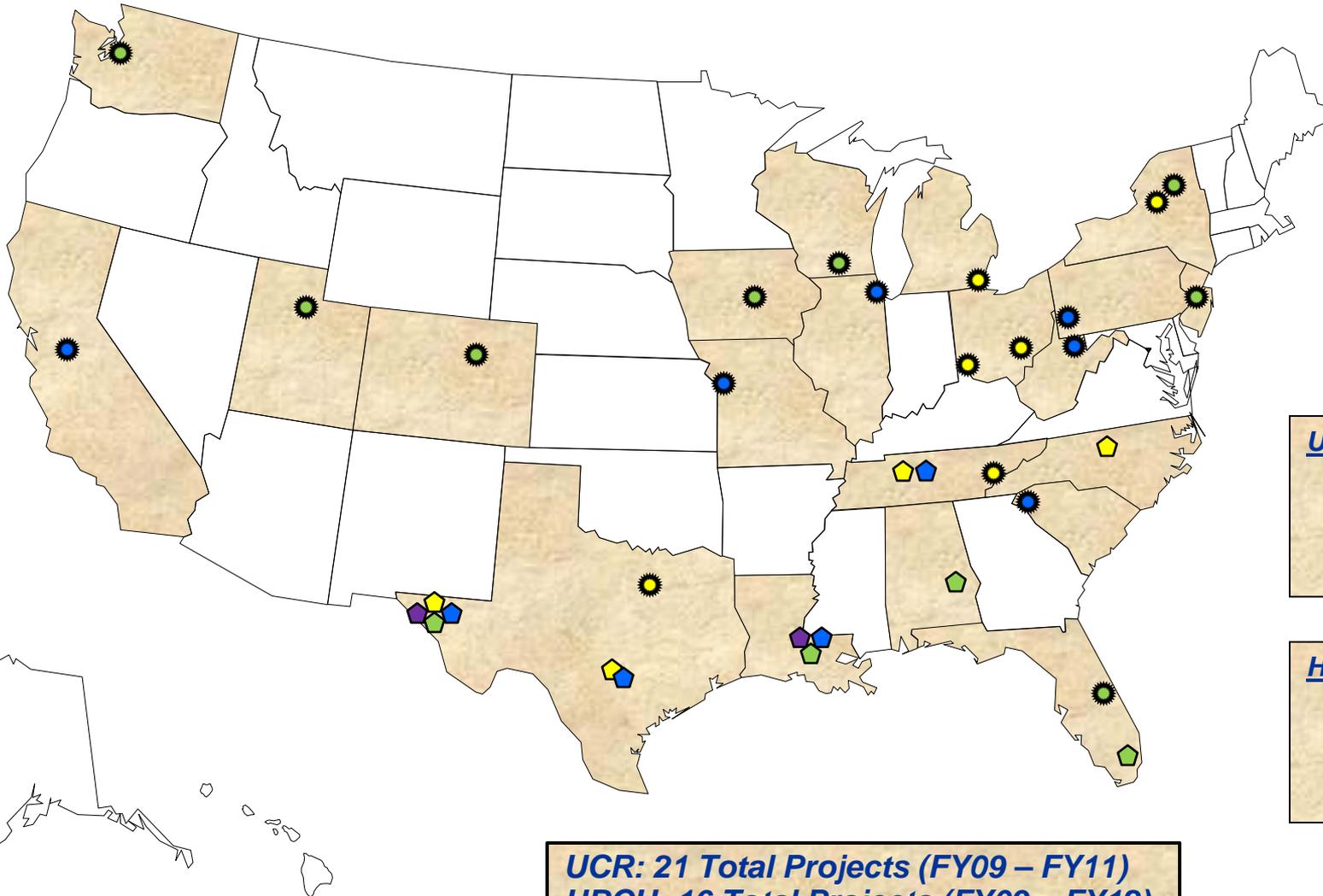
Crosscutting Research Program Budgets 1997-2012

Dollars \$K



- Plant Optimization Technologies (\$13,663)
- Coal Utilization Sciences (\$25,171)
- System Analysis Product Integration (\$4,000)
- Historically Black Colleges and Universities, University Training and Research (\$4,000)

UCR & HBCU Awards Active Project Map



<u>UCR Awards</u>	
	FY09* 6
	FY10 7
	FY11 8
	FY12 TBA

<u>HBCU Awards</u>	
	FY09 4
	FY10 4
	FY11 4
	FY12 4

UCR: 21 Total Projects (FY09 – FY11)
HBCU: 16 Total Projects (FY09 – FY12)

Conclusions

- **The U.S. power generation industry is at a critical juncture**
 - Demand, resources, workforce, reliability, regulation, grid integrity, transmission, etc.
- **Competing demands for reliable, low-cost energy and climate change mitigation appear incongruent**
- **Uncertainty of regulatory outcomes and rising costs impact industry's willingness to commit capital investment, endangering near-term production capacity**
- **The U.S. must foster new processes that address conflicting energy objectives simultaneously**
- **Our nation's dependence on liquid fuel from foreign resources will continue to remain high for the near term**



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