# Advanced Research

## University Coal Research and Historically Black Colleges, Universities/Other Minority Institutions Annual Review

**June 3-4, 2003**

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**National Energy Technology Laboratory**

# Advanced Research - Power Systems

## *Ingenuity, innovation and implementation*

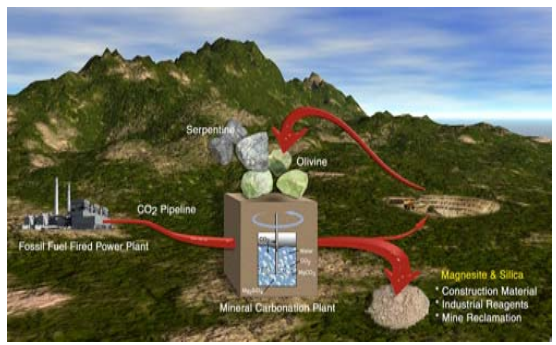
### ***Mission***

Extend state of knowledge in fossil energy technology by developing innovative systems capable of improving efficiency and environmental performance while reducing costs

### ***Program Emphasis***

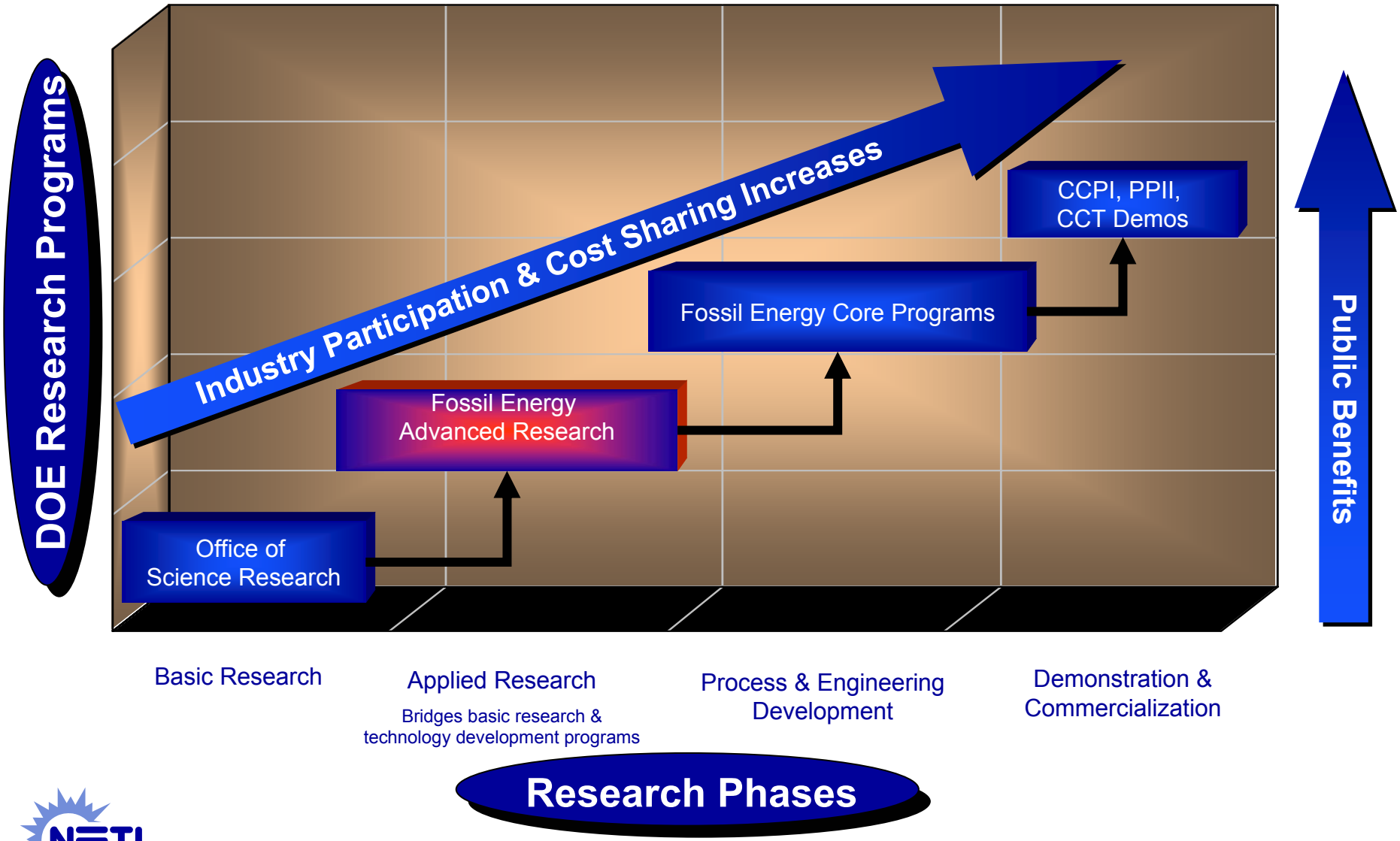
- Advanced Materials
- Novel Sensors & Controls
- V21 Plant Simulation & Technologies
- Bio/Mineral Technologies
- Educational Foundation Programs

*Advanced materials consortium for ultra-supercritical power plants - NETL/ORNL/EPRI/CURC /OCDO*

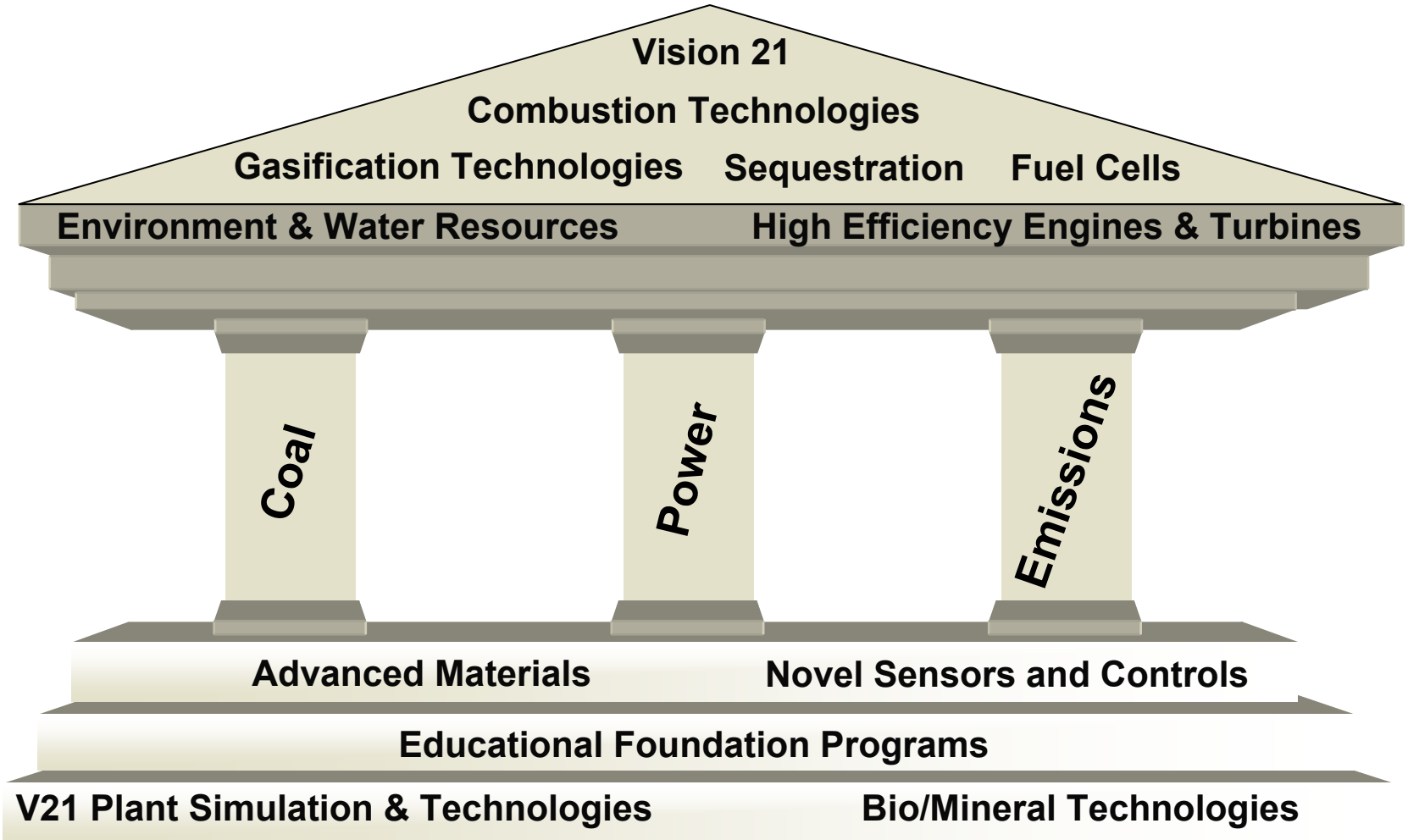



*Mineral carbonation at NETL, Albany Research Center, LANL, and ASU*

# Stages of Energy RD&D

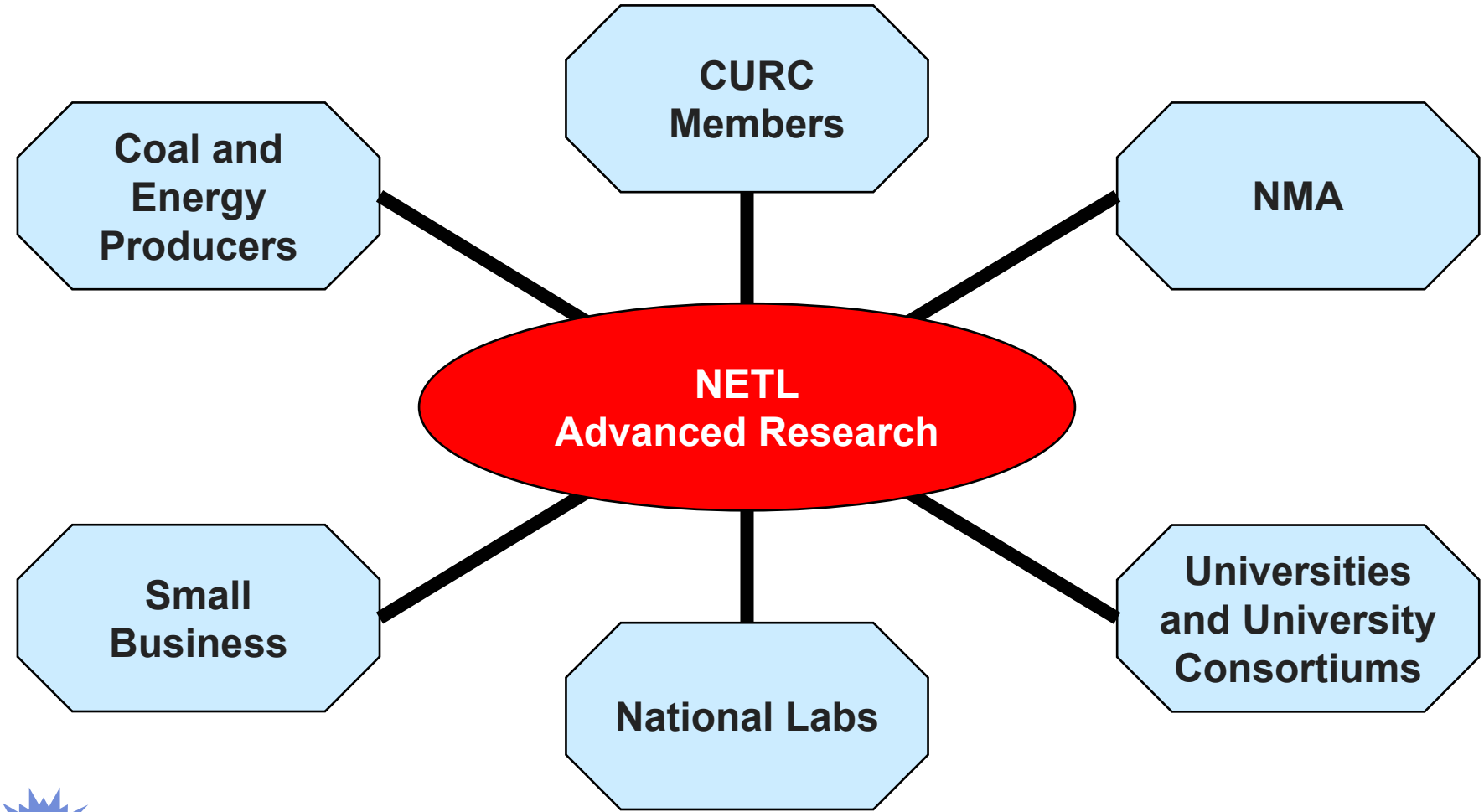


# Advanced Research Development Foundation



# Advanced Research Stakeholders

## *Fundamental Research & Innovative Concepts*



# Program Strategic Performance Goal (PSPG) R&D Activities

- **By 2010, develop a suite of enabling technologies that support the goal of an advanced Vision 21 power system through the Advanced Research cross-cutting programs**

- **R&D Activities** *(consistent with Joule/Advanced Power Systems Targets)*
  - Advanced Materials
  - Novel Sensors & Controls
  - V21 Plant Simulation & Technologies
  - Bio/Mineral Technologies
  - Educational Foundation Programs

# Vision 21 Program

Virtual Simulation

Sensors and Controls

Gasification & Combustion

Oxygen Membrane

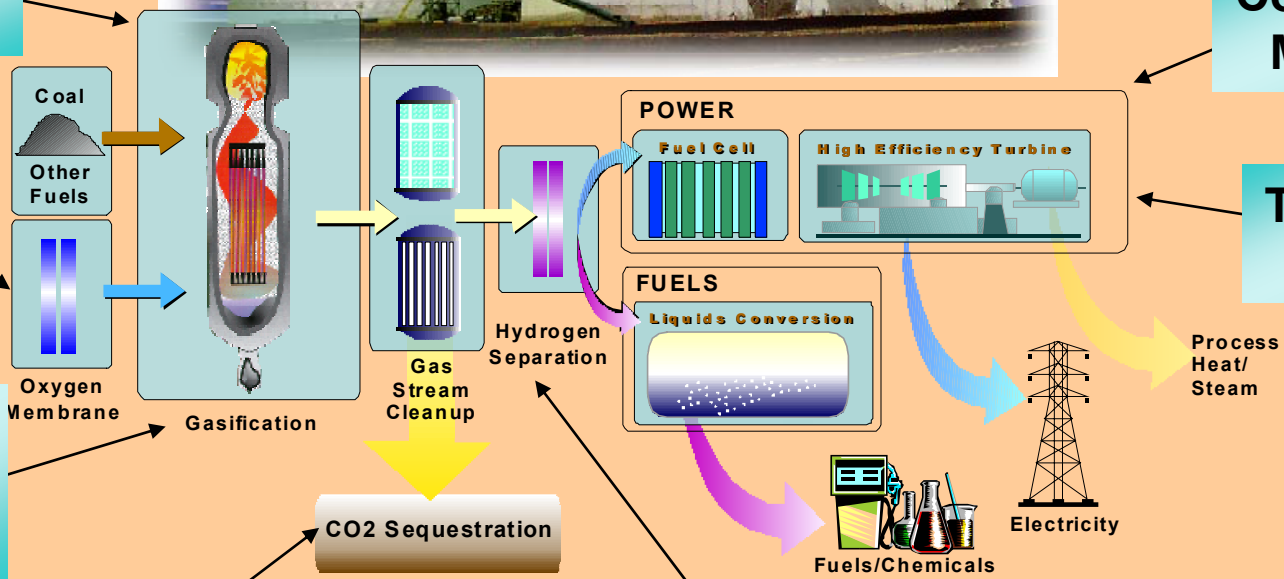
Gas/Particle Flow Modeling

Systems Integration

Advanced Materials

Combustion Modeling

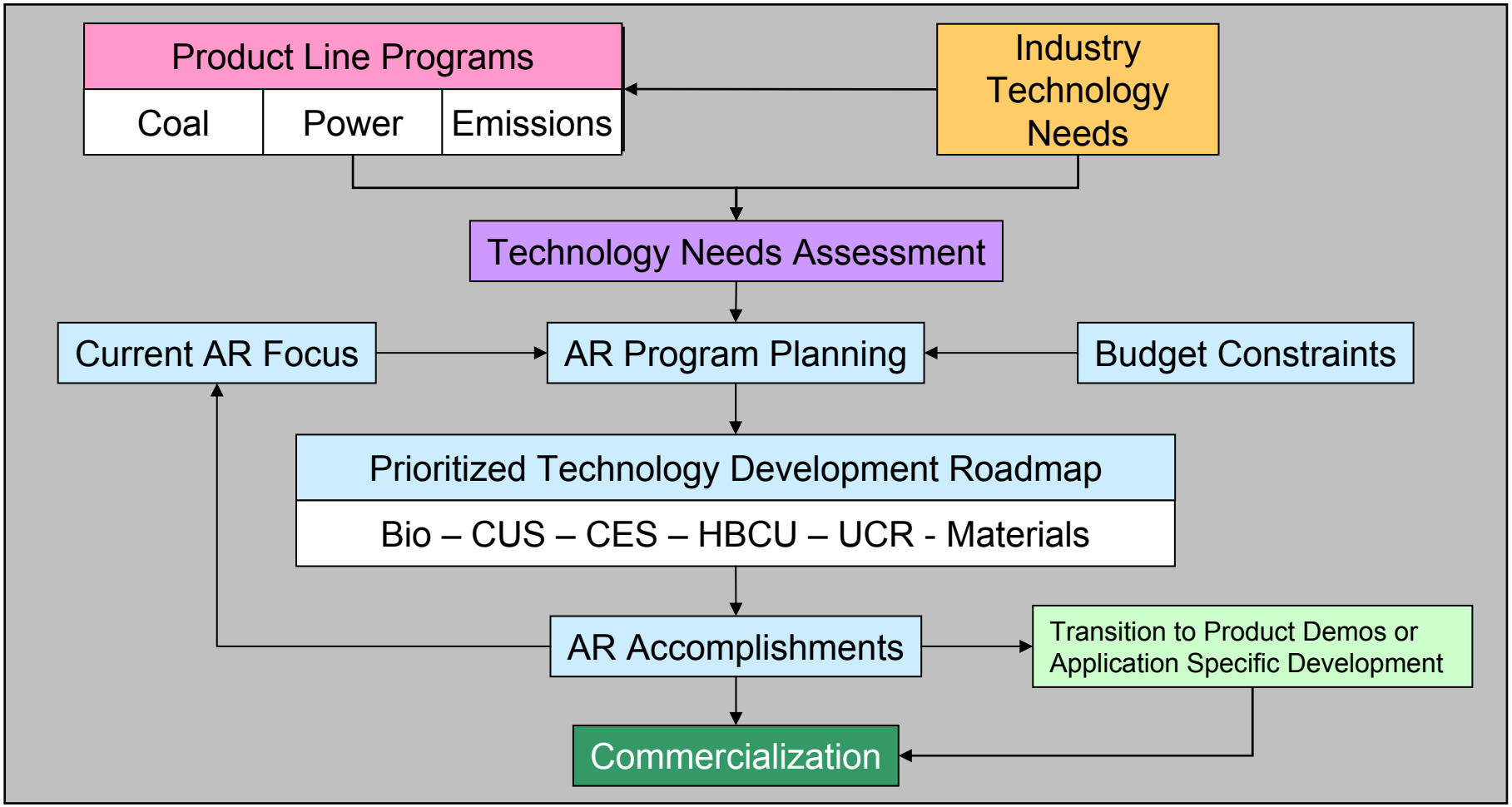
Turbines & Fuel Cells




Mineral Sequestration

Hydrogen Membrane

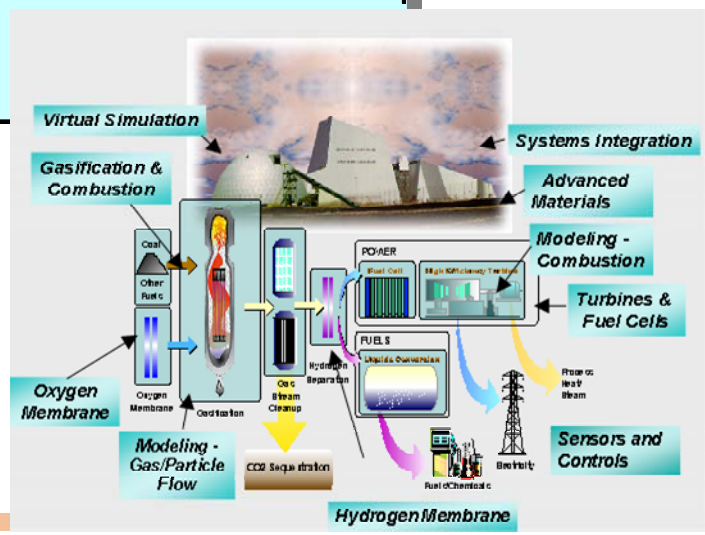
# Advanced Research Development Model




**Goal To Develop A Suite Of Research Projects That Provide Crosscutting Technology To Various Product Areas**

# Program Funding by R&D Activity

| R&D Activities | FY2002 Enacted | FY2003 Approp | FY2004 OMB |
|---|---|---|---|
| Novel Sensors and Controls | 3,637 | 5,103 | 5,603 |
| Advanced Materials | 6,821 | 9,000 | 12,000 |
| V21 Plant Simulation and Tech. | 7,367 | 8,367 | 5,867 |
| Bio/Mineral Technologies | 1,880 | 1,880 | 2,030 |
| Educational Foundation Program | 3,896 | 4,000 | 7,000 |
| **Total** | **23,601** | **28,350** | **32,500** |

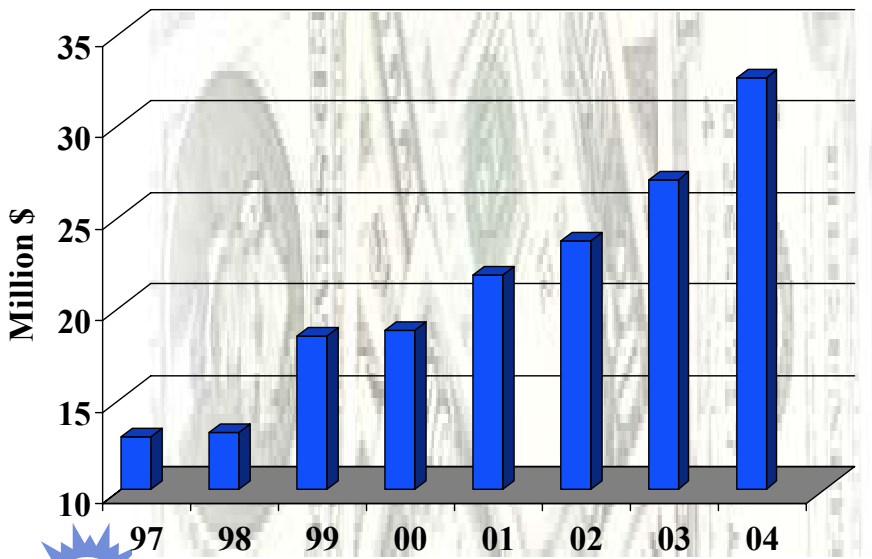


# Advanced Research Program

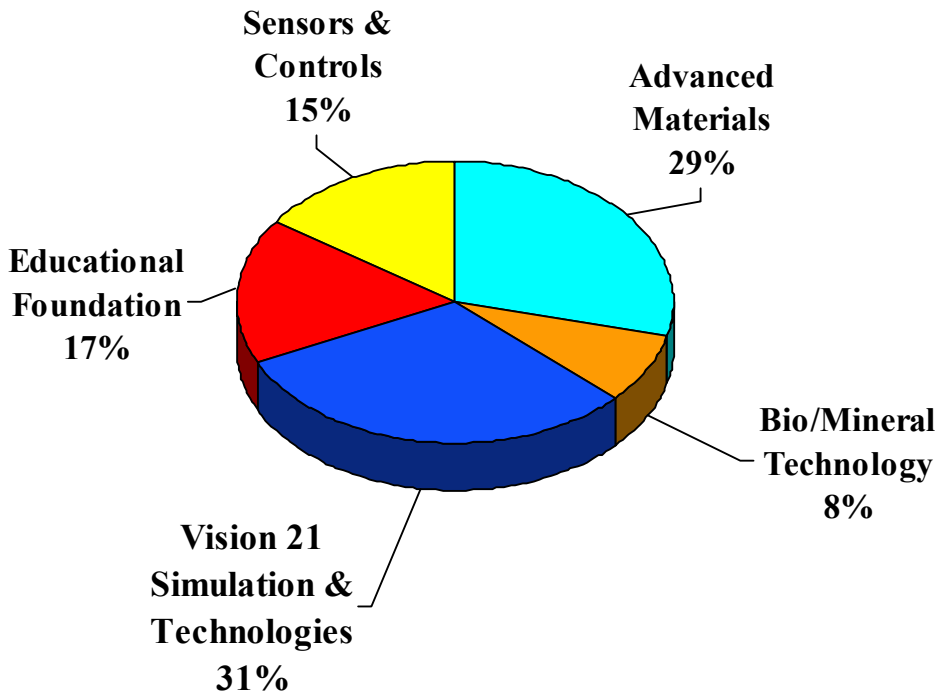
***Organizations***

| | |
|---|---|
| • Industry | 19 |
| • University | 31 |
| • National Laboratories | 8 |
| • Non-Profit | 1 |
| Total | 59 |

## Annual Budget

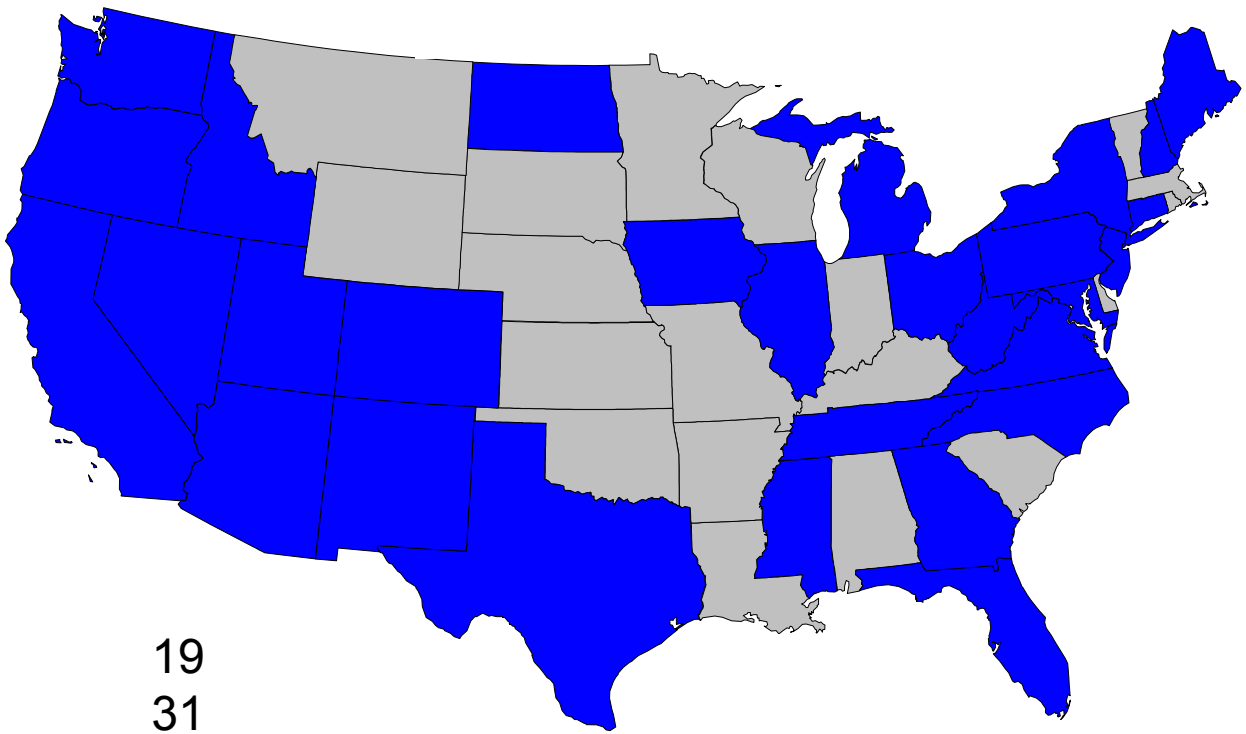



## FY02 Budget Allocation



# Advanced Research Congressional Breath

## *FY2002 Projects by State*



States with AR Projects

***Organizations***

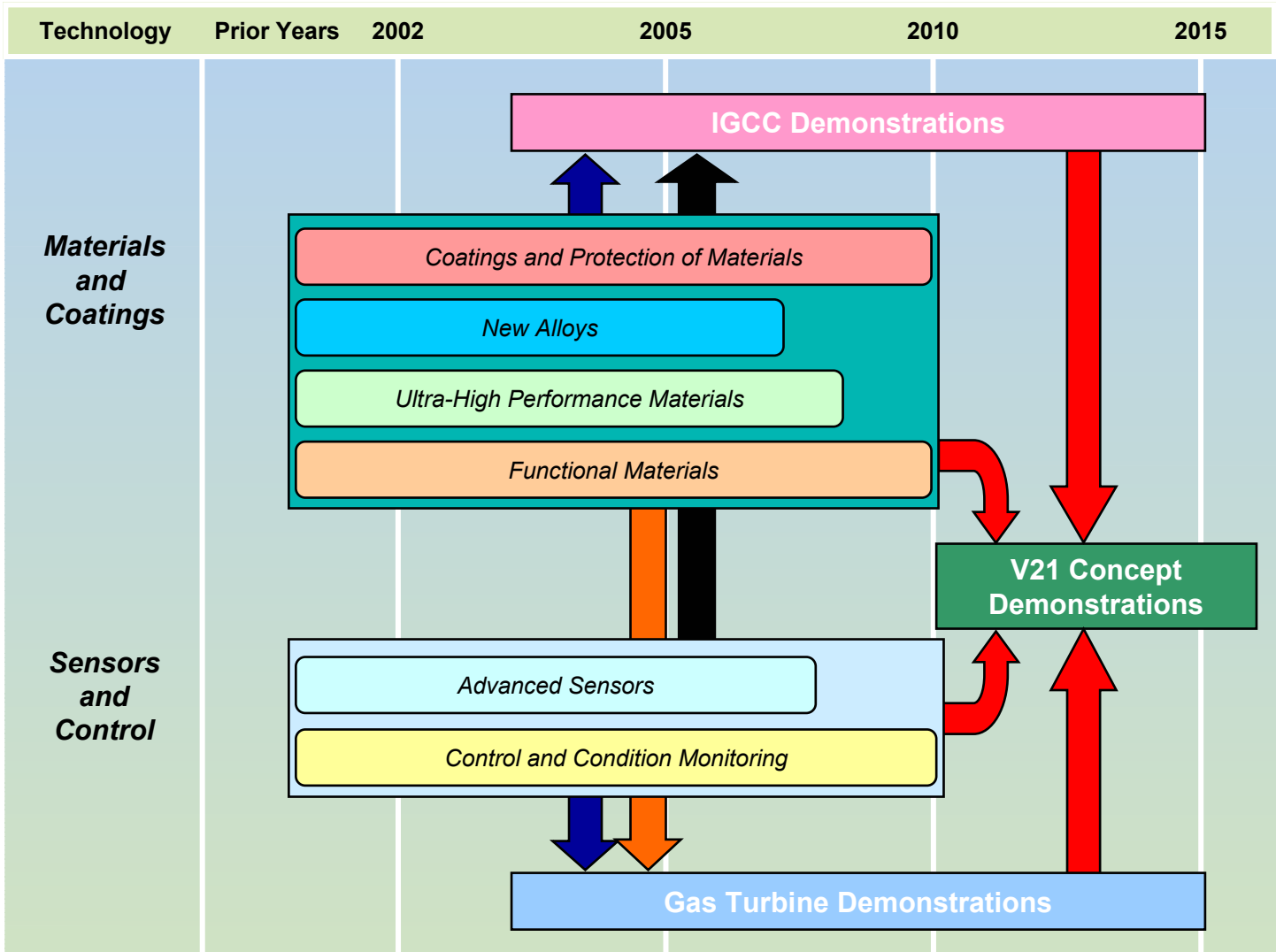
| | |
|---|---|
| • Industry | 19 |
| • University | 31 |
| • National Laboratories | 8 |
| • Non-Profit | 1 |
| Total | 59 |

# University Coal Research Statistics

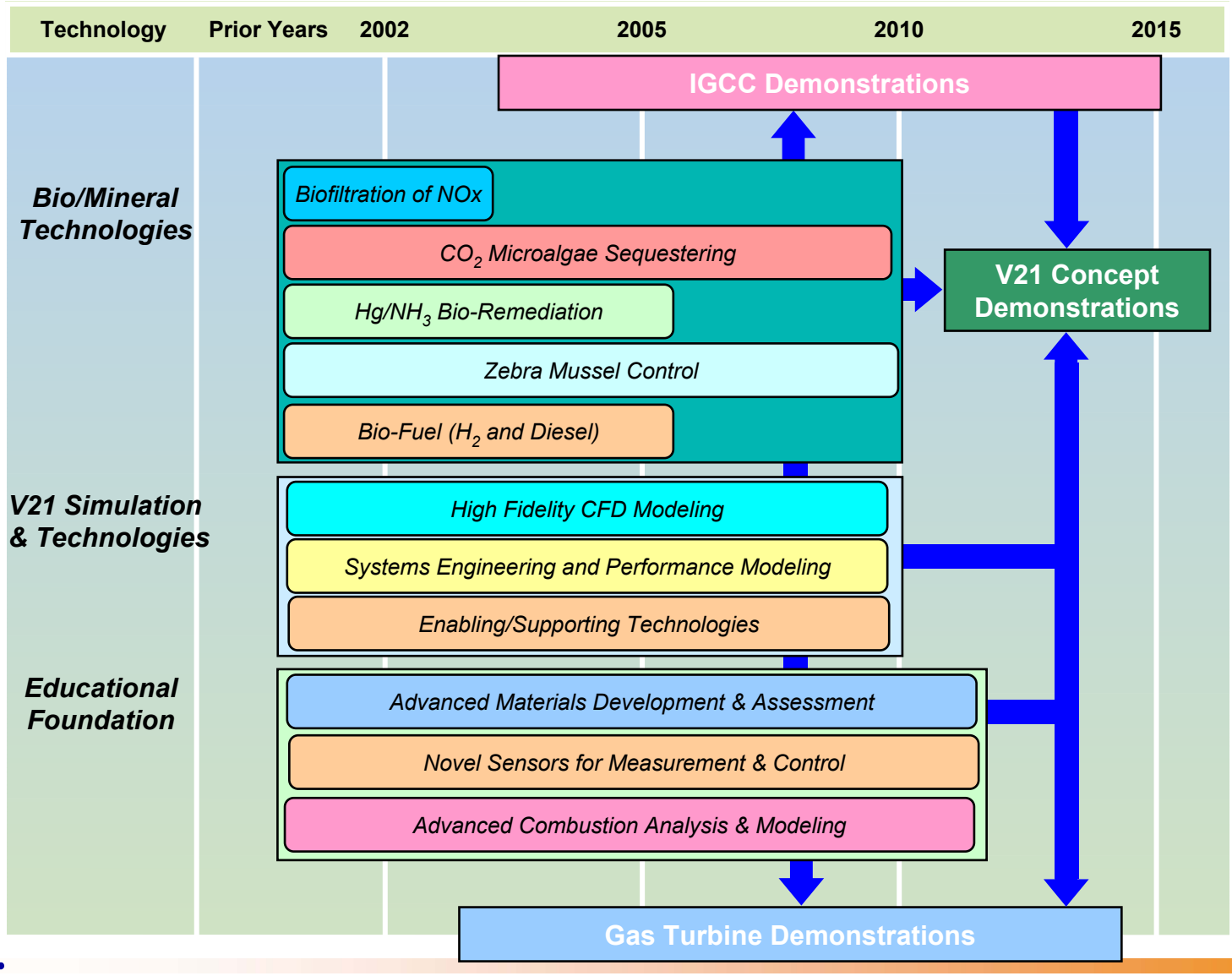
- **During the Past Seven Years:**
  - 124 institutional grants awarded in 38 states
  - 1085 technical papers published
    - Technical Awards >7
    - Patents Issued >7
  - Educational Benefits
    - B.S. graduates 9
    - M.S. Graduates 46
    - Ph.D. Graduates 95
    - Post-doctural Research 21
    - Interns 11

**Economic Benefit**
**Approximately $12 million in Annual Salary Return**

# Advanced Research Roadmap



# Advanced Research Roadmap (Continued)



# Scientific Awards

| | | |
|---|---|---|
| 1985 | Roe-Hoan Yoon | Camicia Award |
| 1988 | Irving Wender | First Lowry Award |
| 1995 | Adel Sarofim | Lowry Award |
| 1995 | Roe-Hoan Yoon | Alumni Award |
| 1998 | A. N. Murty | White House Award for Science & Technology |
| 2002 | Douglas Smoot | Lowry Award |

# Provided Basis for Commercial Technologies

(Includes spin-off technologies resulting from UCR funded research).

- **Improved laser color printing and copying.**
- **Pure pharmaceutical drugs.**
- **Fine coal cleaning (the Microcel™)**
- **Improved fly ash use in cement**
- **Sub-models used in commercial software including Fluent, CFX, and Phoenics.**

# Patents, Texts, & Publications

- AR Program research has provided seed concepts for innumerable publications, text books, and patents.