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***Energy Research for a Cleaner
Environment***

Illinois Clean Coal Research
Center for Coal Technology Research
Advisory Meeting
June 5, 2007



Discover the Power

OCD Program Funding

Coal Technology Dev. Assistance Fund

- Coal Research & Development Program
- Coal Competitiveness Program
- Coal Education & Marketing Program

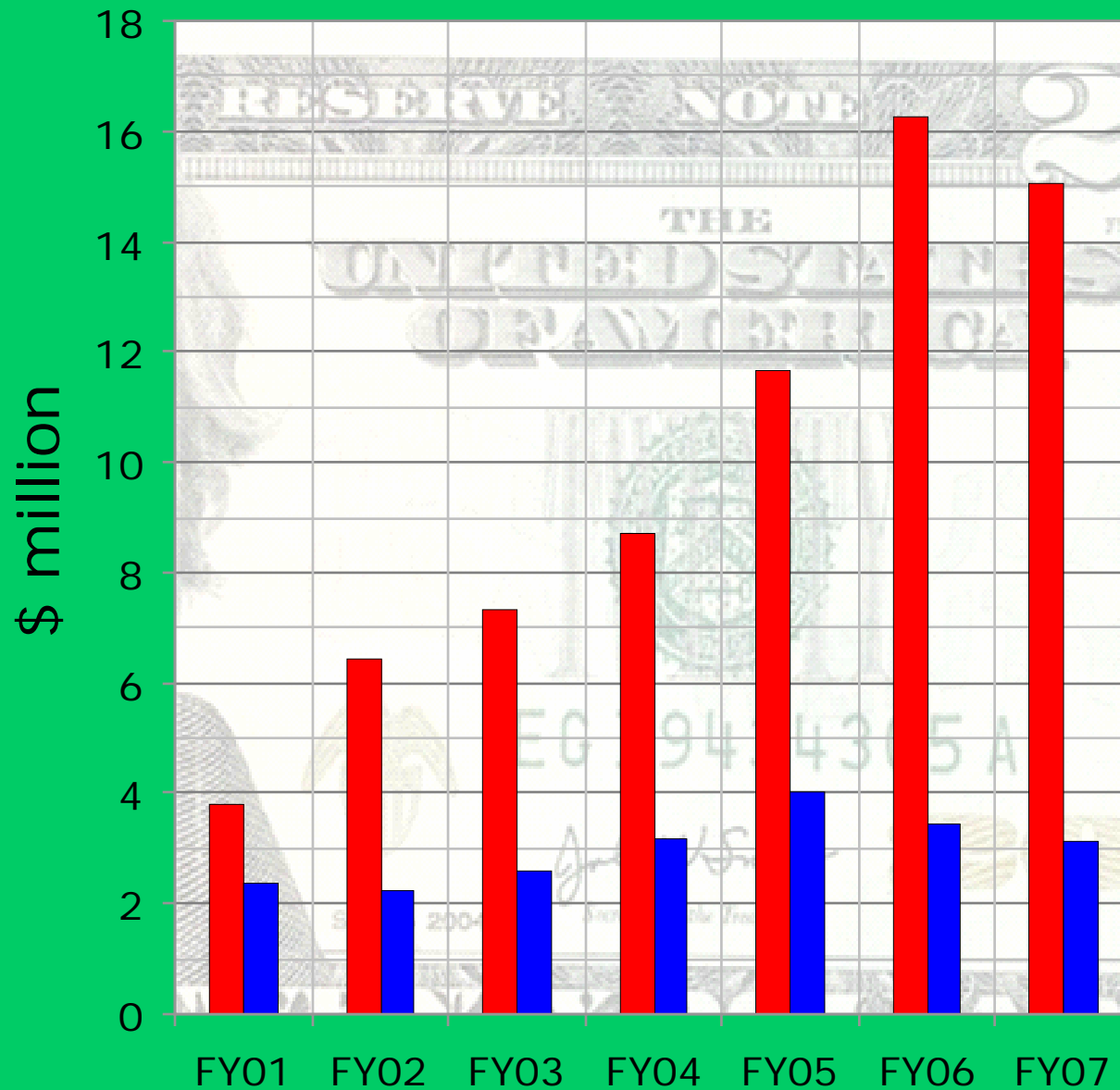
Coal and Energy Development Bond Fund

- Coal Technology Demonstration Program
- Coal Revival Program

Expenditures by Program

| DCEO Program | \$ Spent to Date | \$ Leveraged to Date | FY2007 Budget |
|--------------------------------------|------------------|----------------------|---------------|
| Coal Research and Development (ICCI) | \$72.7 M | \$9.2 M | \$4.2 M |
| Coal Technology Demonstration | \$146.3 M | \$752.7 M | \$4.9 M |
| Coal Competitiveness | \$126.7 M | \$837.2 M | \$16.0 M |
| Coal Revival | \$0 | \$0 | \$50.0 M |

Funded R&D Projects



Total Funding
ICCI Funding





Research and Development Areas

- **Coal Gasification, Hydrogen Production and other Coal Utilization Processes**
- **Carbon Management**
- **Coal Bed Methane Production**
- **Coal Residuals Management**
- **Advanced Coal Mining Technologies**
- **Coal Preparation and Other Production Business Practices**



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**Coal Gasification, Hydrogen Production
and other Coal Utilization Processes**



Coal Gasification, Hydrogen Production and other Coal Utilization Processes

Major Factors Affecting Program

- FutureGen siting
- Coal Fuels Alliance Program
- Freedom Car - Hydrogen
- Increased price of natural gas
- Mercury emissions limits
- Need for new power plants
- Flue gas cleaning for existing utilities
- Increased price of raw materials for chemical industry



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Carbon Management

Major Factors Affecting Program

- FutureGen emphasis on sequestration
- Future regulations on CO₂ emissions



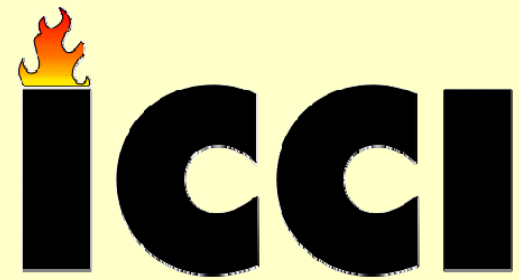
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Coal Bed Methane

Major Factors Affecting Program

- High price of natural gas
- Advancing technology for methane recovery



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Coal Residuals Management

Major Factors Affecting Program

- ICCI program must focus on byproducts in Illinois from Illinois coal
- Utilities switching from Illinois coal to western coal
- CCB challenges shifting away from F-type fly ash to FBC and FGD residues
- Logistics
- Underground mine placement
- Ponds
- Regulatory drivers



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Advanced Coal Mining Technologies

Advanced Coal Mining Technologies

National Coal Industry Trends

| | 1976 | 1986 | 1996 | 2005 |
|--|---------|---------|---------|---------|
| Number of Mines | 6,553 | 4,424 | 1,903 | 1,400 |
| Number of Miners | 202,280 | 154,645 | 83,462 | 75,000 |
| Production (millions of tons) | 685 | 890 | 1,064 | 1,133 |
| Ave. Mine Size (tons) | 105,000 | 201,000 | 559,000 | 796,000 |

Sources:

Energy Information Administration
National Mining Association

Advanced Coal Mining Technologies

Economic Impact of Coal Mining in Illinois

| | 1980 | 1990 | 2000 | 2004 |
|--|--------|--------|--------|--------|
| Employees | 18,284 | 10,129 | 3,461 | 3,252 |
| Production (millions of tons) | 62.5 | 61.7 | 33.5 | 32.3 |
| Average Salary (\$) | 22,000 | 35,000 | 45,000 | 50,000 |
| Total Payroll (millions of \$) | 402 | 355 | 156 | 163 |

Sources:

Bureau of Labor Statistics
ILDMM Annual Statistical Report

Advanced Coal Mining Technologies

The Critical Factor

Average Price of Coal
(\$/ton)

| | 1985 | 1994 | 2004 |
|----------------------|-------|-------|-------|
| Illinois | 30.80 | 23.14 | 25.72 |
| West Virginia | 33.47 | 27.42 | 35.41 |
| Wyoming | 11.36 | 6.83 | 7.12 |
| National | 25.20 | 19.41 | 19.93 |

Source: Energy Information Administration

ICCI RESEARCH OBJECTIVES

A. Increase efficiencies

- Extraction ratios, cycle times, battery use

B. Develop new mining technologies

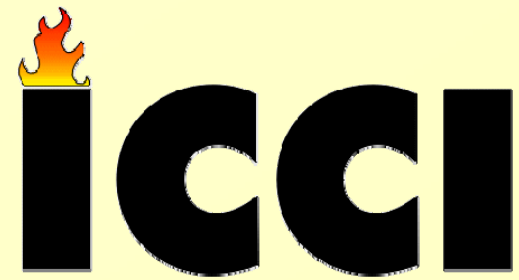
- High tech, automated, energy efficient

C. Training

- Increase and strengthen labor pool, enhance productivity

D. Improve health and safety

- Dust, noise and other environmental controls
- Engineering optimization



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**Coal Preparation and
Other Production Business Practices**

Coal Preparation and Other Production Business Practices

Major Factors Affecting Program

- 100% of coal mined in Illinois requires cleaning
- Cleaning or preparation adds \$2 per ton to production costs
- 15 operating coal preparation plants in Illinois employing approximately 300 coal miners, usually the most experienced
- Tons per manhour for plant workers is 10 times greater than for underground miners due to automated processing systems
- Incremental improvements in efficiency can have a major impact on plant productivity and cost

Coal Preparation and Other Production Business Practices

- **5 Water-based cleaning plants**
 - **Jigs, Water-only Cyclones, Spirals**
- **9 Heavy media-based cleaning plants**
 - **Vessels, Heavy Media Cyclones, Spirals**
- **1 Air-based cleaning plant**
- **Only 1 plant recovers fine coal below 100 mesh**
 - **Flotation Cells are used**
- **State-wide, plants reject 30% of tonnage processed**
- **As much as 10 million tons of coal, mostly fine coal, are discarded annually in Illinois**

Coal Preparation and Other Production Business Practices

ICCI RESEARCH OBJECTIVES

A. Improving product quality

- Precombustion removal of sulfur, mercury, and other elements
- Btu enhancement, including lowering inherent moisture

B. Increasing preparation plant efficiencies

- Development and implementation of fine coal cleaning technologies and optimization of existing plant systems

C. Waste handling

- Underground placement, water quality issues
- Monitoring and control of reclamation projects

D. Creating additional markets for Illinois coal

- Transportation, blending, emission credits

FUNDING METHODS

● Respond to Annual Request for Proposals

- Issues each year in early March
- Posted on website www.icci.org each spring

● Unsolicited

- Accepted throughout the year
- Best to submit a Statement of Interest first

Opportunities for Collaboration

- **Currently have representatives from each state on advisory boards.**
- **Illinois, Indiana, and Kentucky - Coal Fuels Alliance**
- **Possibility of issuing a joint Illinois/Indiana funded RFP – Would require specific research area.**



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