

Clean Coal Power Initiative (CCPI)

Demonstration Projects

- *Overview*
- *Business & Management*
- *Benefits*

March 12, 2003

at

*28th International Conference
on Coal Utilization and
Fuel Systems*

National Energy Technology Laboratory - Michael Eastman



Mission

To realize substantial environmental and economic public benefits by facilitating, in partnership with industry, movement of Fossil Energy's core coal technologies for generating electricity and co-producing fuels and/or chemical feedstocks into the marketplace

- **Performance Goals**

- Successful technology demonstrations
- Reduce SO₂, NO_x, mercury and particulate emissions
- Increase carbon management/reduce CO₂ emissions
- Commercial applications
- Repay federal cost share

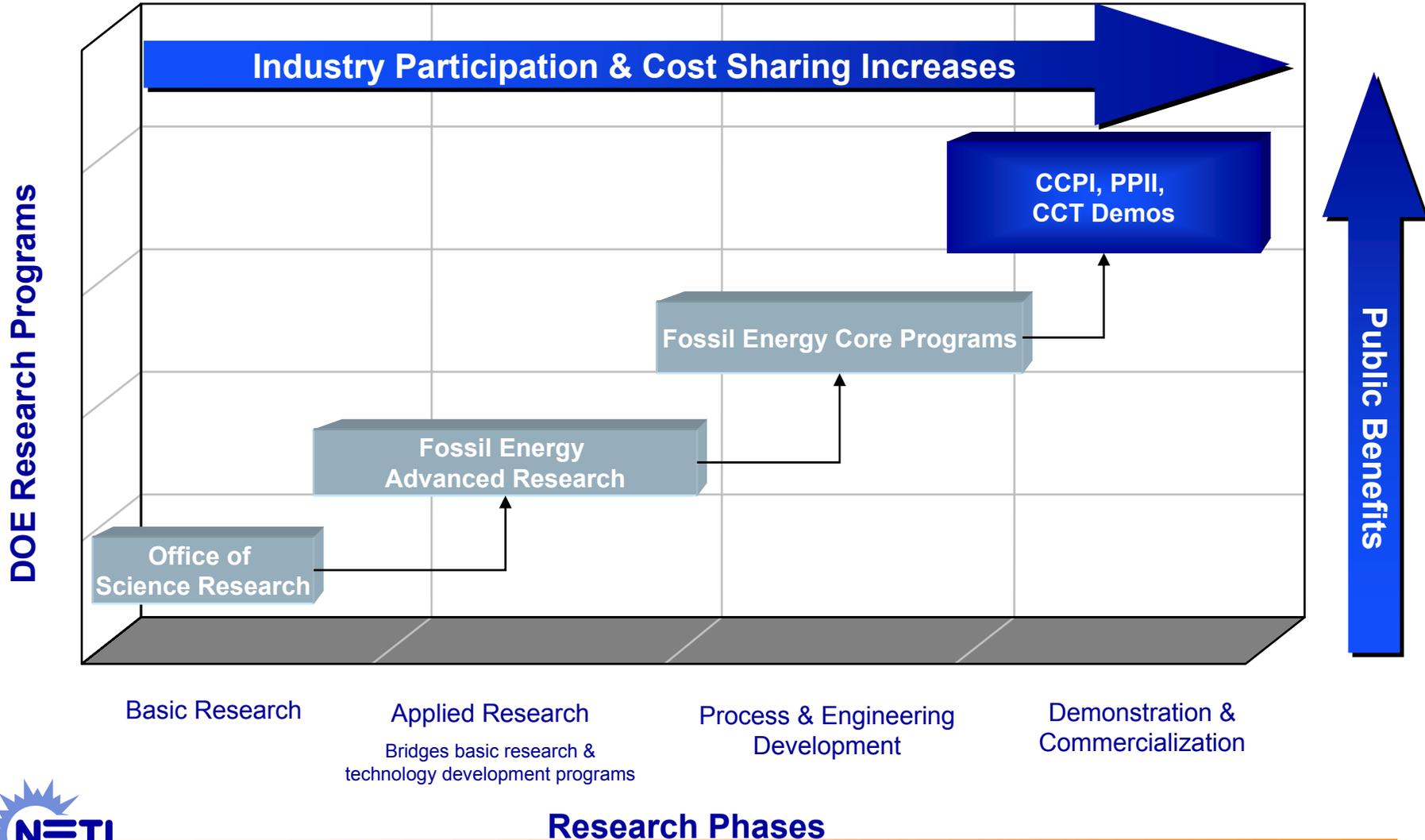
- **Uniqueness:**

- Private/Federal partnership
- 50/50 cost sharing



Stages of Energy RD&D

Technology demonstrations play an enabling role



Program Funding by RD&D Activity

(in thousands)

	FY2002 Enacted	FY2003 Conference	FY2004 President
CCPI	146,065	150,000	130,000

*AHPC at Otter Tail 's
Big Stone Station*



Clean Coal Power Initiative (CCPI)

- **Drivers**

- Clear Skies Initiative
- Reduced carbon intensity
- Zero emissions technology goals
- Energy/economic security

Round 1 (Broad)

- Advanced coal-based power generation
- Efficiency, environmental & economic improvements

Round 2 (next up)

- **Technology Demonstration Opportunities**

- 3P control systems (SO₂, NO_x and Mercury)
- High-efficiency electric power generation
 - Gasification
 - Advanced combustion
 - Fuel Cells and Turbines
- Retrofit, Repowering and new Merchant Plants



Clean Coal Power Initiative

Technical, Economic & Market Barriers/Hurdles

- Securing minimum 50% private sector cost-sharing for demonstrating first-of-a-kind technologies (high risk)
 - On high-interest technologies needed to meet coal program performance goals
- Repayment obligations dampen commercialization goals
- Achieving a fair balance of federal/private sector interest in intellectual property
- Uncertain mid- and long-range market conditions (e.g. energy prices, environmental regulations, global climate change policies)
- Deregulation inhibits risk-taking -- drives industry away from R&D and higher-risk investments



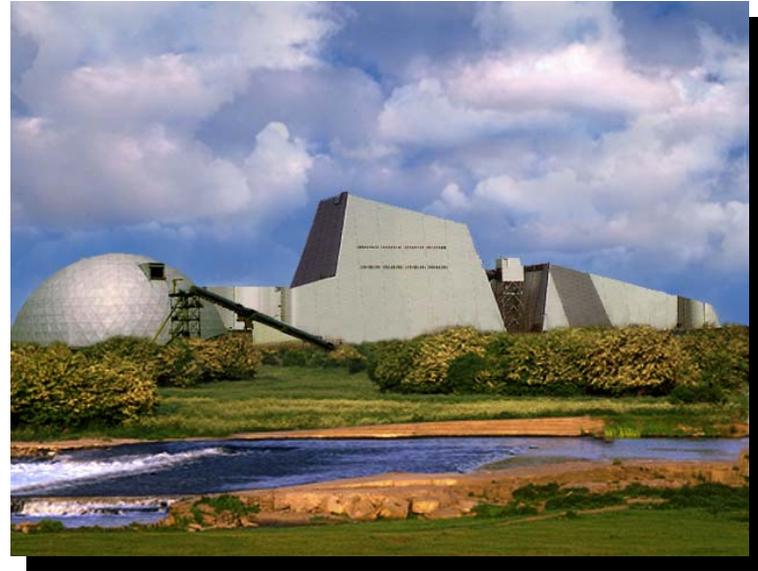
Coal RD&D program Technology Roadmap-- Charts road ahead for coming Demonstrations



Coal Power Program Roadmap

Addresses Near- and Long-range Needs

- **Short-term: existing fleet**
 - Cost-effective environmental control technologies to comply with current and emerging regulations
- **Long-term: Vision 21**
 - Near-zero emissions power and clean fuels plants with CO₂ management capability



Coal Power Program Roadmap Embodies Vision 21 Objectives

- **Remove environmental concerns associated with fossil fuel use for electricity & transportation fuels through better technology**
 - “Near-zero” emissions (coal as clean as gas)
 - CO₂ management
 - High efficiency
 - Water use
 - By-product utilization
 - Sustainable
 - Flexible (feedstocks, products, siting)
 - Timely deployment of new technology
 - Affordable, competitive with other energy options



Coal Power Program Roadmap

Approach

- **Review DOE & industry energy plant performance & cost targets**
 - CURC, EPRI, DOE product lines, Vision 21
- **Assess targets & develop unified roadmap to capture common objectives**
 - Support NEP & Presidential Initiatives
 - Span state-of-art through 2020
 - Address existing fleet improvements & new plants
 - Incorporate current & emerging regulations
 - Address carbon management
- **Quantify program benefits**
 - Compare benefits with RD&D investment costs
- **Reach consensus with industry**
 - CURC, EPRI



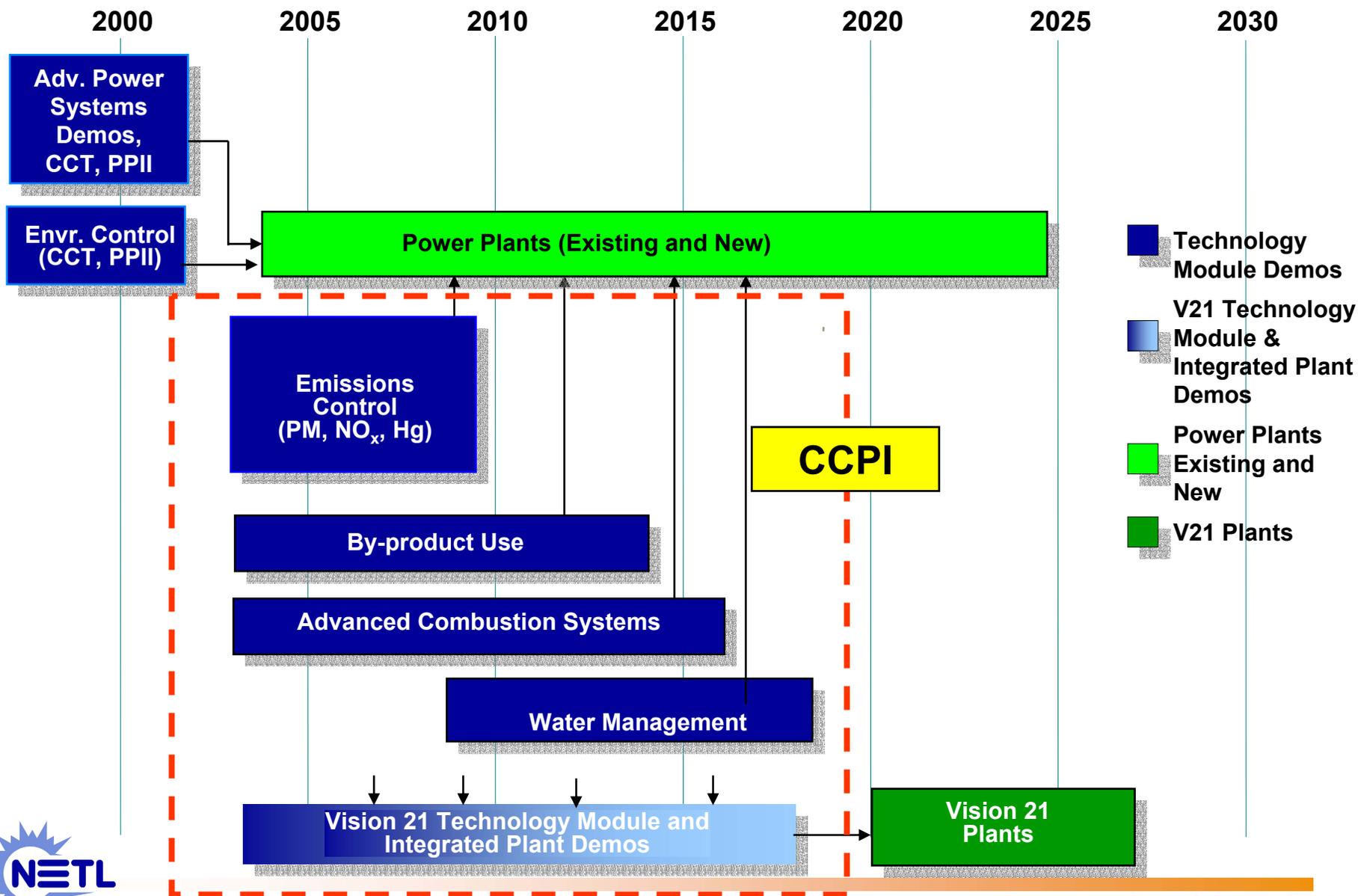
Coal Power Program Roadmap

Key Assumptions

- **Innovative, new technologies needed to achieve goals**
 - Today's technologies not designed for near-zero emissions or carbon management
 - Incremental improvements will not meet future requirements
 - Adding on equipment to existing plants too complex & costly
- **Effectively managing transition to new technologies is critical**
 - 60% of available U.S. capacity 20-40 years old
 - New technologies needed in 10-15 years to replace retiring plants
 - Must meet electricity demand & minimize disruptions



Demonstration Targets – Existing Plants



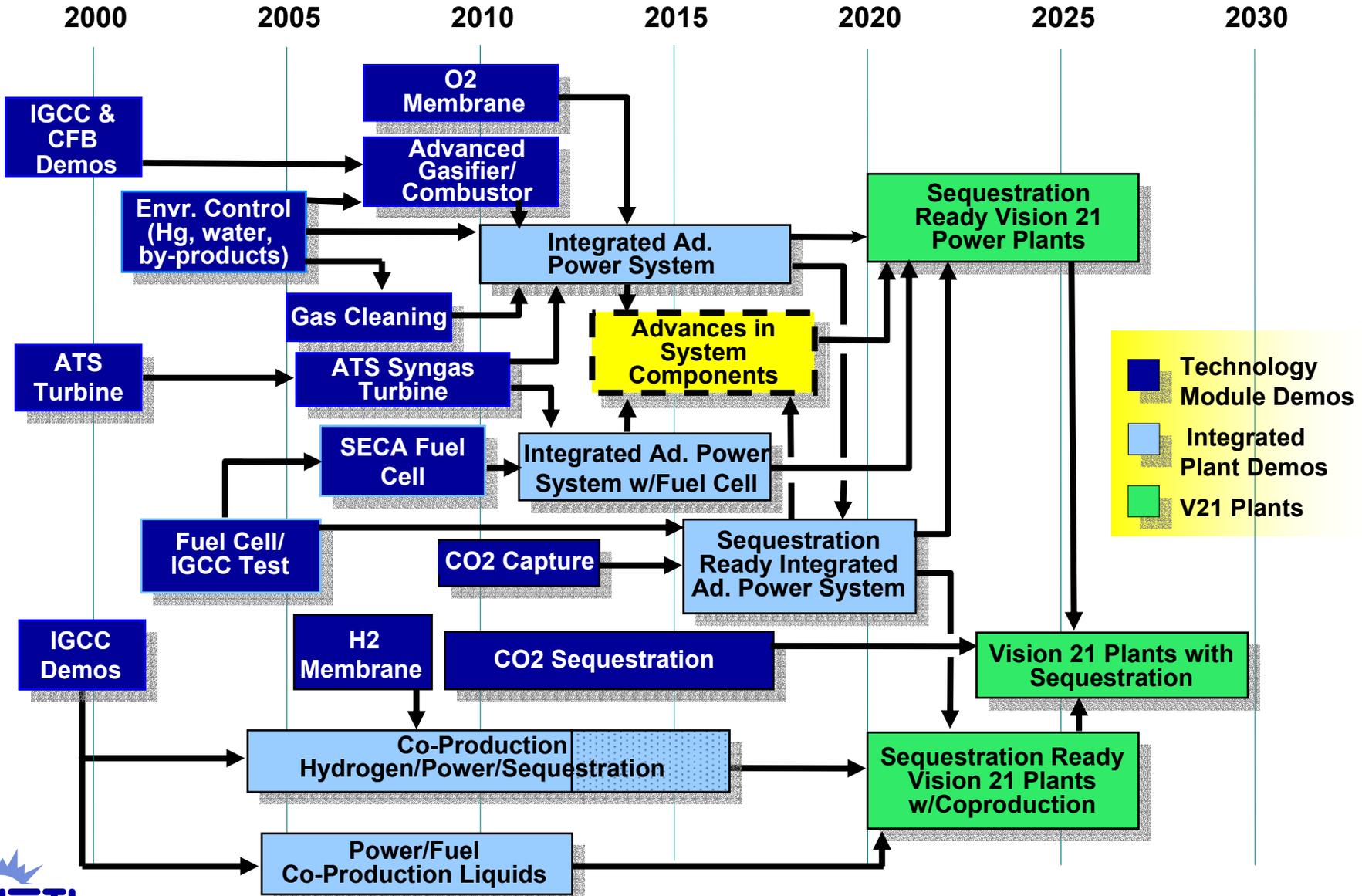
Demonstration Targets - Existing Plants

Roadmap Performance Objectives

- Reduced Cost for NO_x Control
- Reduced Cost for High-Efficiency Hg Control
- Achieve PM Targets in 2010: 99.99% capture of 0.1 – 10 μ Particles



Demonstration Targets to Vision 21 Plants



Coal Power Program Roadmap

New Plant Performance Targets

(Represents best integrated plant technology capability)

	Reference Plant	2010	2020 Vision 21
Air Emissions	98% SO₂ removal	99%	>99%
	0.15 lb/10⁶ Btu NO_x	0.05 lb/10⁶ Btu	<0.01 lb/10⁶ Btu
	0.01 lb/10⁶ Btu Particulate Matter	0.005 lb/10⁶ Btu	0.002 lb/10⁶ Btu
	Mercury (Hg)	90% removal	95% removal
By-Product Utilization	30%	50%	near 100%
Plant Efficiency (HHV)	40%	45-50%	50-60%



Coal Power Program Roadmap

New Plant Performance Targets¹

(Represents best integrated plant technology capability)

	Reference Plant	2010	2020 Vision 21
Availability⁽³⁾	>80%	>85%	≥90%
Plant Capital Cost⁽²⁾ \$/kW	1000 – 1300	900 – 1000	800 – 900
Cost of Electricity⁽⁴⁾ ¢/kWh	3.5	3.0 - 3.2	<3.0

- (1) Targets are w/o carbon capture and sequestration and reflect current cooling tower technology for water use
- (2) Range reflects performance projected for different plant technologies that will achieve environmental performance and energy cost targets
- (3) Percent of time capable of generating power (ref. North American Electric Reliability Council)
- (4) Bus-bar cost-of-electricity in today's dollars; Reference plant based on \$1000/kW capital cost, \$1.20/10⁶ Btu coal cost



CCPI Round 1 Project Selection --- *Activity Summary Status*

- **Project selections announced**
 - Selection announcement Techline issued
 - Project descriptions posted on CCPI website
- **Pre-Award activities in progress**
 - Fact-finding, NEPA review, and benefits and repayment analysis underway
 - Pre-Award meeting held with participants in Pittsburgh on February 5, 2003 (70+ attendees), all 8 projects represented



CCPI Round 1 Project Selections --- *Clean Energy Technologies*

- **Waste Management and Processors Incorporated ---**
Build and operate new gasification plant using anthracite wastes to produce electricity, clean liquid fuels and process heat; **\$100M DOE/\$612M total**
- **Western Greenbrier Co-Generation, LLC ---** Build and operate an innovative circulating fluid bed 75MW power plant with advanced multi-pollution control systems using coal refuse to produce electricity and steam for industrial use and district heating; **\$107M DOE/\$215M total**



CCPI Round 1 Project Selections --- *Clear Skies Technologies*

- **City of Colorado Springs** --- SO₂, NO_x and mercury control on a new 150MW CFB; **\$30M DOE/\$301M total**
- **LG&E Energy Corporation** --- Retrofit advanced SO₂, NO_x and mercury Airborne control process on existing 524MW plant; **\$31M DOE/\$120M total**
- **Wisconsin Electric Power Company** --- Retrofit advanced TOXECON mercury control process on existing 270MW plant; **\$25M DOE/\$50M total**



CCPI Round 1 Project Selections --- *Higher Efficiency Processes*

- **Great River Energy** ---- Integrated system using waste heat from a 546MW power plant to reduce moisture of lignite feed coal; **\$11M DOE/\$22M total**
- **NeuCo., Incorporated** --- Use integrated on-line computer control techniques to optimize performance of multiple systems on a 600MW boiler; **\$8M DOE/\$19M total**
- **University of Kentucky Research Foundation** --- Install carbon recovery/ash beneficiation process to reduce plant wastes and produce useful by-products at 2,200MW plant; **\$4.5M DOE/\$9M total**



Preliminary NEPA Evaluation Results

- **Probable Environmental Impact Statements (EIS)**
 - City of Colorado Springs
 - Waste Management & Processing, Inc.
 - Western Greenbrier Co-Gen LLC
- **Probable Environmental Assessments (EA)**
 - Great River Energy
 - Louisville Gas & Electric Corporation
 - University of Kentucky Research Foundation
 - Wisconsin Electric Power Company
- **Probable Categorical Exclusion**
 - NeuCo, Inc.



CCPI Round 1 Project Selections --- *Cost-sharing Summary (\$1,000's)*

<i>Project</i>	<i>DOE</i>	<i>Private</i>	<i>Total</i>	<i>Private/DOE</i>
City of Colorado Springs	30,000	271,500	301,500	90/10
LG&E Energy Corp.	31,000	89,000	120,000	74/26
Wisconsin Electric	25,000	25,000	50,000	50/50
Great River Energy	11,000	11,000	22,000	50/50
NeuCo., Inc.	8,000	11,000	19,000	58/42
Univ. of Kentucky	4,500	4,500	9,000	50/50
WMPI	100,000	512,000	612,000	84/16
Western Greenbrier	107,500	107,500	215,000	50/50
Total	317,000	1,031,500	1,348,500	76/24

Figures are rounded



Business Management Experiences with Round 1 Applications



CCPI Round 1

Business Management Perspectives

- **Solicitation was clear in its specific information requests;**
 - host sites
 - marketing plans
 - commercialization plans
 - financial capability
 - financial statements
 - repayment plans and descriptions
 - funding commitments
 - budget information



CCPI Round 1

Business Management Perspectives

- **Solicitation requirements were consistent with requirements of**
 - banks
 - capital markets funds providers
 - other government agencies, such as
 - U.S. Export-Import Bank
 - Overseas Private Investment Corporation
 - U.S. Small Business Administration



CCPI Round 1

Business Management Issues

- **Some responses were disappointing, lacking level of detail requested with respect to**
 - budget information provided
 - financial information provided
 - financial plan for commercialization
 - proposed repayment
 - host site documentation



CCPI Round 1

Business Management Issues

- **Some did not include requested financial information**
- **Funding commitments differed widely with respect to conditions and did not follow requested format**
- **Interim financial statements were generally not provided**
- **Generally, level of budget detail was less than requested**
 - Subcontractor level of detail lacked supporting documentation.



CCPI Round 1

Business Management Issues

- **Some applicants proposed feasibility studies or long R&D periods as phases prior to phases allowed in solicitation**
 - Allowed phases are design, construction and operations
 - A project definition phase, if needed, to complete financing, NEPA, & Project Management Plan (PMP) can be included
 - PMP includes technology, schedule & cost baselines and management controls & procedures



CCPI Round 1

Business Management Issues

- **Some applications included straightforward commitment letters -- However,**
 - Some were vague and heavily conditioned
 - Some were unclear as to which corporate entity actually planned to provide project funding

- It is important for funding commitments to be both **specific** and **definite**
 - Particularly with respect to funding for Project Definition Phase (if proposed)
 - Minimum funding conditions should be set out



CCPI Round 1

Business Management Issues

- **Responses related to applicant's willingness to cover cost increases covered wide a range**
 - no response at all -- to broad statement that any and all cost increases would be covered

- Serious project developers arranged a combination of reserves and other types of support to cover at least a portion of cost increases
- Commitment letters should describe how cost increases will be covered, in what amounts, and by whom



CCPI Round 1

Business Management Issues

- In some applications, Sources of Funds and Uses of Funds were difficult to reconcile, particularly during Project Definition phase

- Application should include a Sources and Application of Funds statement--describe how funds from specific sources will be used



CCPI Round 1

Business Management Issues

- **Some applicants failed to seriously address commercialization**
 - Superficial marketing information
 - Business and financial assumptions were not clearly stated and frequently unrealistic
 - Economic analysis of value of technology to potential users not presented
 - Full economic benefits of demonstration project to members of project team were generally not quantified--left to be imagined by reviewers



CCPI Round 1

Business Management Issues

- **Some Repayment Plans lacked credibility, because of superficial economic and business analysis**
- **Full repayment of DOE cost share appeared speculative in some responses**
 - Repayment was point-scored in evaluation

- In a competitive solicitation applicants cannot afford to give points away



CCPI Round 1

Business Management Issues

- **Host site could not be evaluated in some applications because site documentation was inadequate**
 - A site, or alternate sites, were not identified
 - No evidence provided that proposed site was available to project
 - No discussion of appropriateness of site for planned demonstration

- If applicant is not site owner, a legally binding fully definitized Host Site Agreement must be in place prior to award (can be time-consuming)

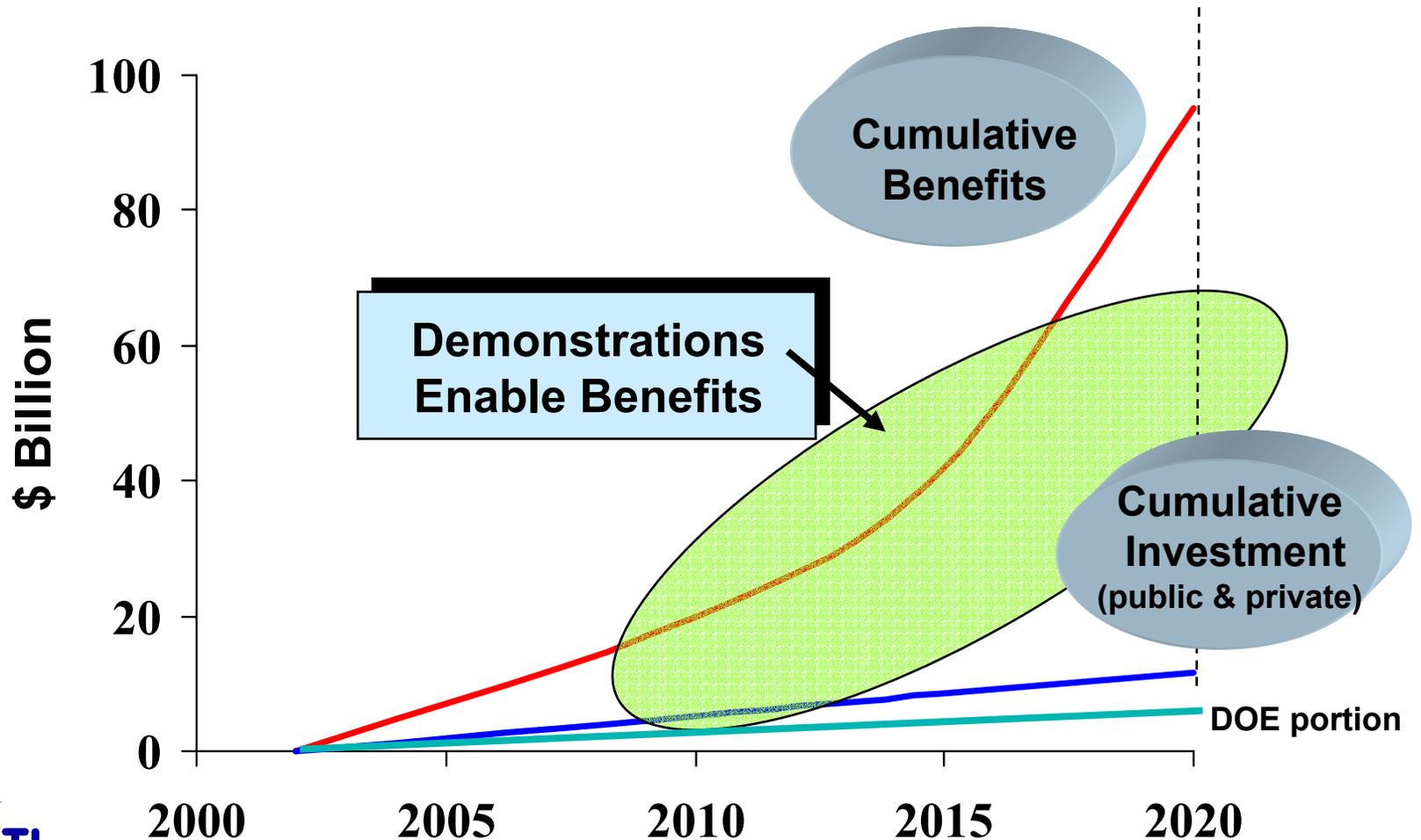


On To Program Benefits!



Demonstration Initiatives are Key Pathway to Benefits

Coal Program - Benefits/Investment



Coal Power Program (RD&D) – Economic Benefits

Savings Categories	Cumulative Benefits (\$ billions, thru 2020)
Fuel Cost	10
Capital Cost (New Plants)	12
Control Technology Cost (Existing Plants)	32
Avoided Environmental Costs	10
Technology Export	36
Total Benefit	100

Other Benefits

- Increased jobs from technology export – estimate 75,000 new jobs in 2010 increasing to 200,000 in 2020
- Additional \$500 billion to \$1 trillion savings through 2050 if loss of coal option results in 1-2 ¢/kWh increase in cost of electricity



Project Benefits Focus of CCPI Round 1 Projects (cont.)

	Project				
Savings Category	Great River Energy Underwood, ND	NeuCo Inc. Boston, MA	Uni. of KY Research Foundation, Lexington, KY	WMPI Gilberton, PA	Western Greenbrier Co-Generation WV
Fuel Cost (Efficiency)	Enhance Lignite Fuel value	Advanced computational control		Power, diesel fuel and industrial heat from coal waste	Power, industrial heat and district heat from coal waste
Capital Cost (New Plants)				X	X
Emission Control Technology Cost		Advanced computational control	By-Product use (upgrade ash for improved use)		By-Product Use
Avoided Environmental Cost		X		X	X
Technology Export	X	X	X	X	X

X- Project contributes benefits



Project Benefits Focus of CCPI Round 1 Projects

Savings Category	Project		
	City of Colorado Spring, CO	LG&E Energy Corp. Louisville, KY	Wisconsin Electric Milwaukee, WI
Fuel Cost (Efficiency)			
Capital Cost (New Plants)			
Emission Control Technology Cost	98% SO ₂ 90% Hg Control NO _x	99.5% SO ₂ 90% NO _x 90% Hg By-Product Use	90% Hg SO ₂ NO _x
Avoided Environmental Cost	X	X	X
Technology Report	X	X	X

X- Project contributes benefits



Coming CCPI Solicitation *Planning Opportunities*

- **28th International Technical Conference on Coal Utilization and Fuel Systems, Clearwater, Florida, March 10-13, 2003 - Completed**
- **Pittsburgh Coal Conference, Pittsburgh, PA, September 15-19, 2003**
- **Clean Coal and Power Conference, Washington, D.C., November 17-19, 2003**

**Monitor
www.fe.doe.gov or
www.netl.doe.gov/coalpower/ccpi
websites for coming events**

