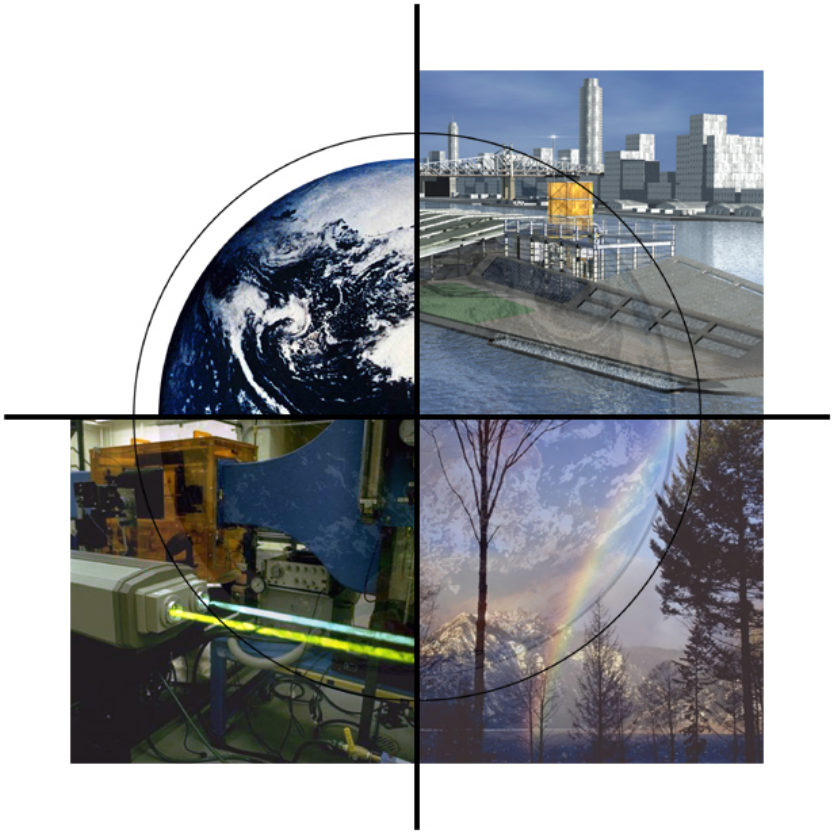
Clean Coal Power Initiative



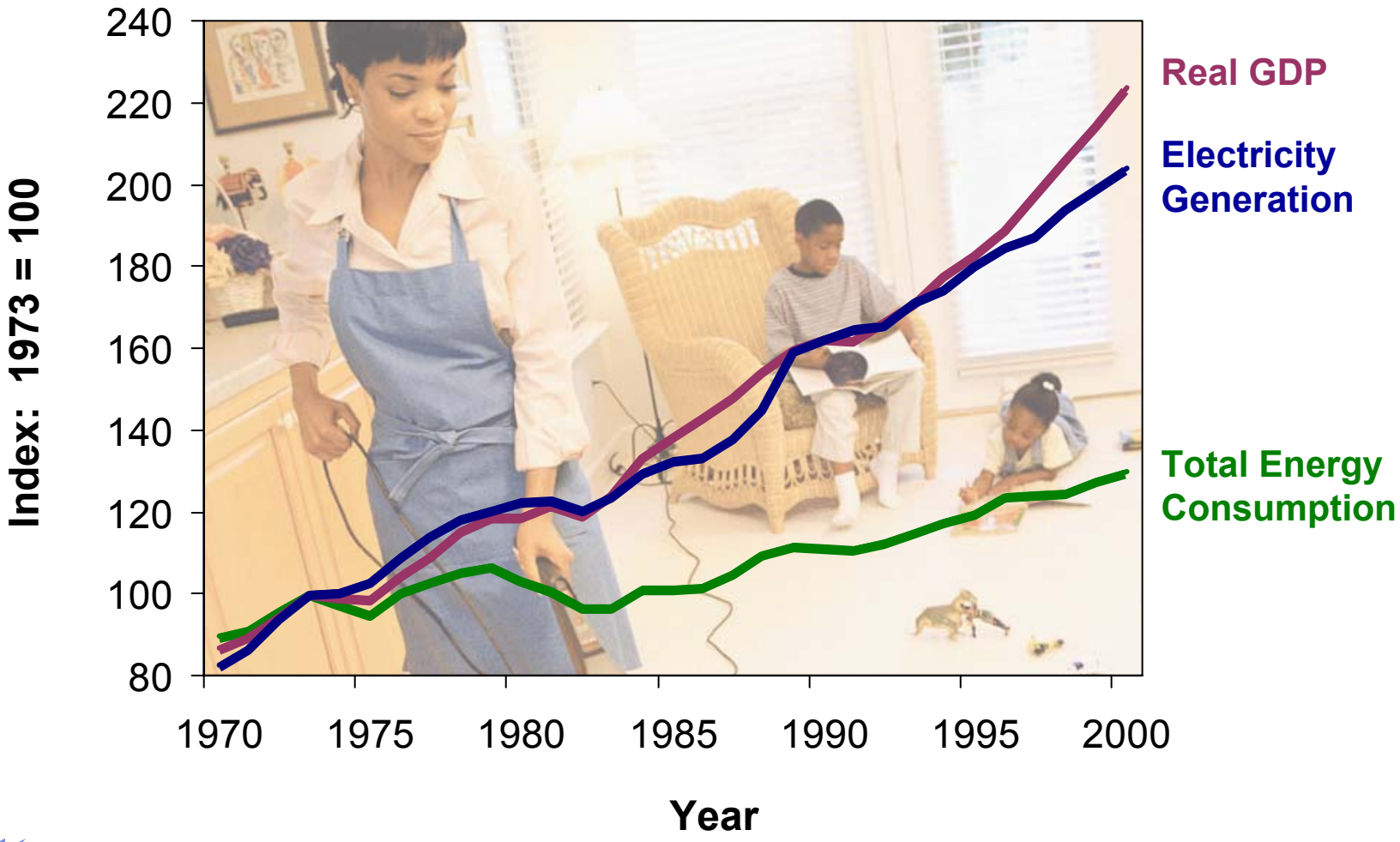
-CCPI Overview
-Round 1 Status
-Round 2 Planning

Clean Coal and Power Conference
&
2nd Joint U.S.-People's Republic of China Conference on Clean Energy

Washington, D.C.
November 17-19, 2003

Mike Eastman, Technology Manager, NETL

Economic Growth Linked to Electricity



GDP: U.S. DOC, Bureau of Economic Analysis
Energy & Electricity: EIA, AER Interactive Data Query System

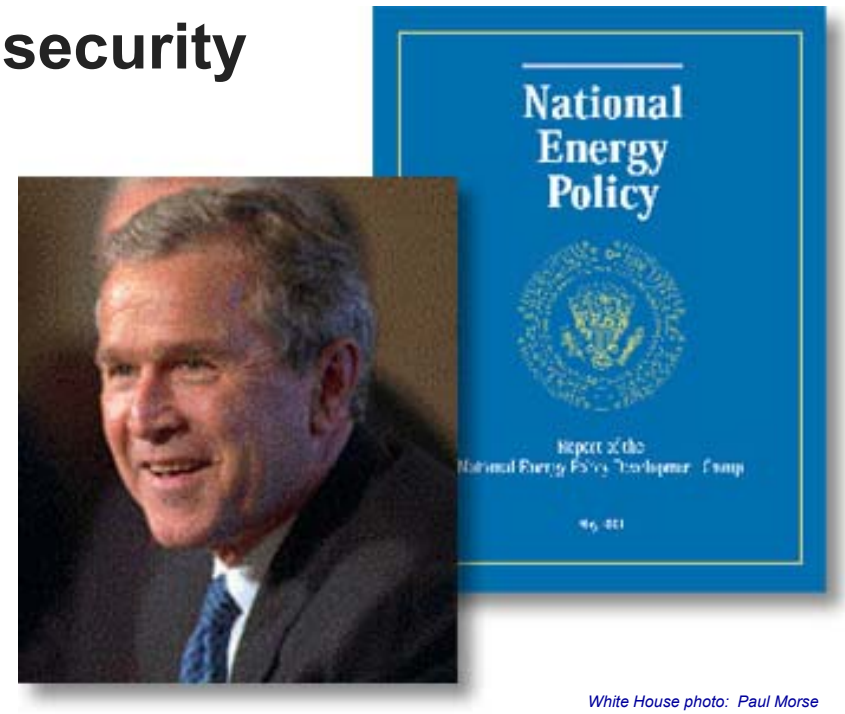
Presidential Priorities

National Energy Policy

- Increasing America's domestic energy supplies
- Protecting America's environment
- Ensuring a comprehensive delivery system
- Enhancing national energy security

Initiatives

- Clear Skies
- Climate Change
- Clean Coal Power
- FutureGen/Hydrogen

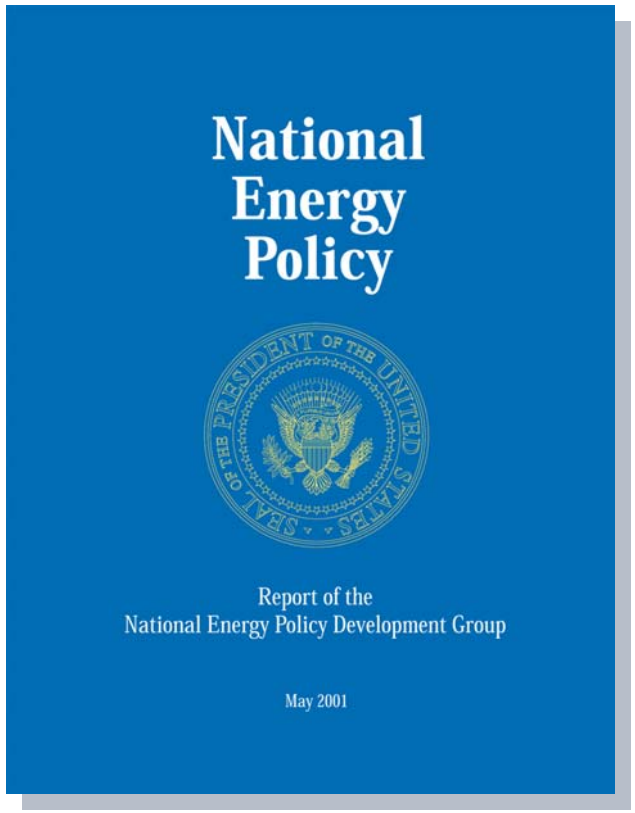


White House photo: Paul Morse

Clean Coal Power Initiative

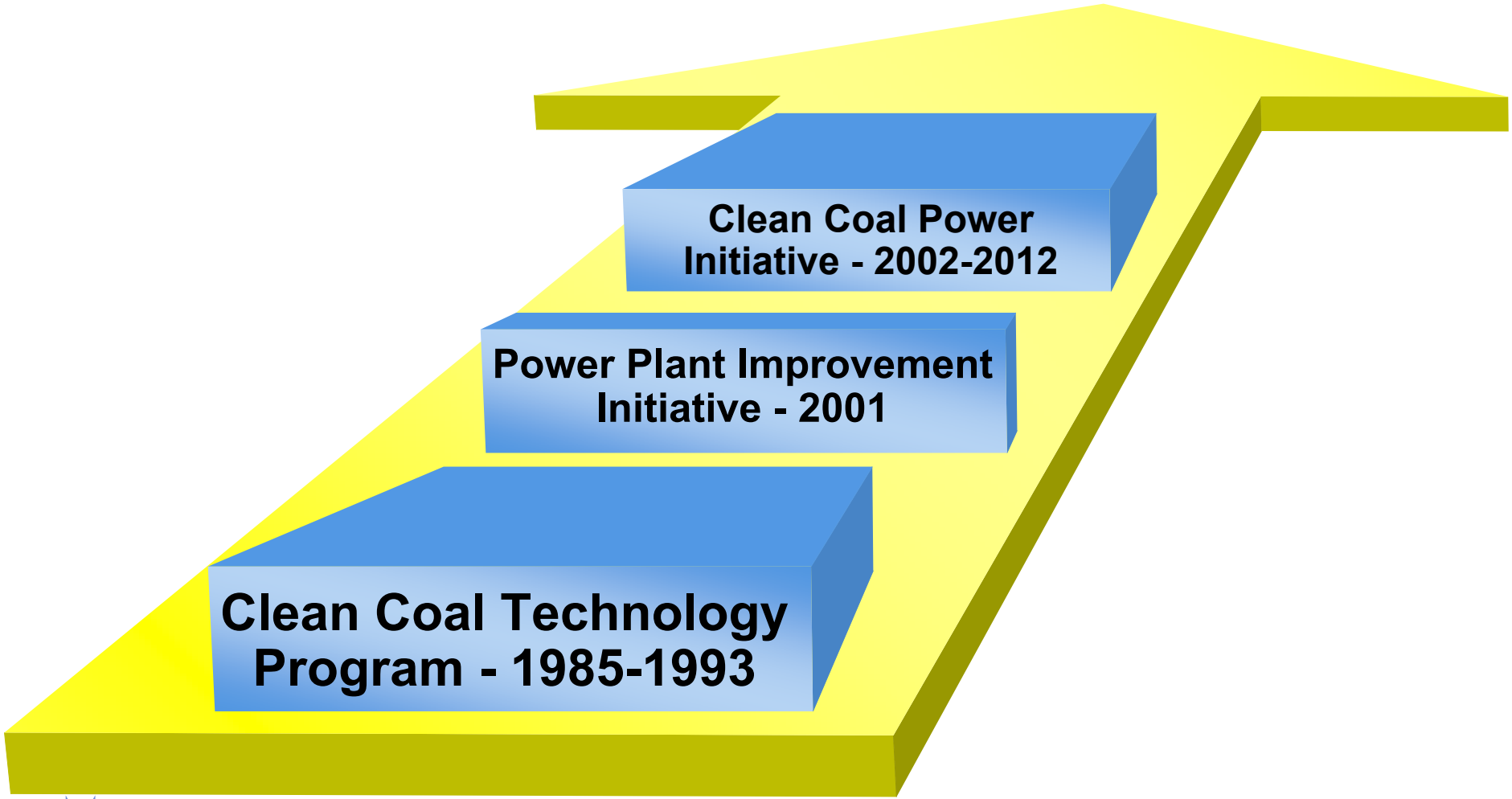
- **Implemented NEP recommendation to increase investment in clean coal technology**

- **$2 billion over 10 years starting in FY 02**
  - Anticipates series of competitive solicitations
  - Industry cost share of at least 50%

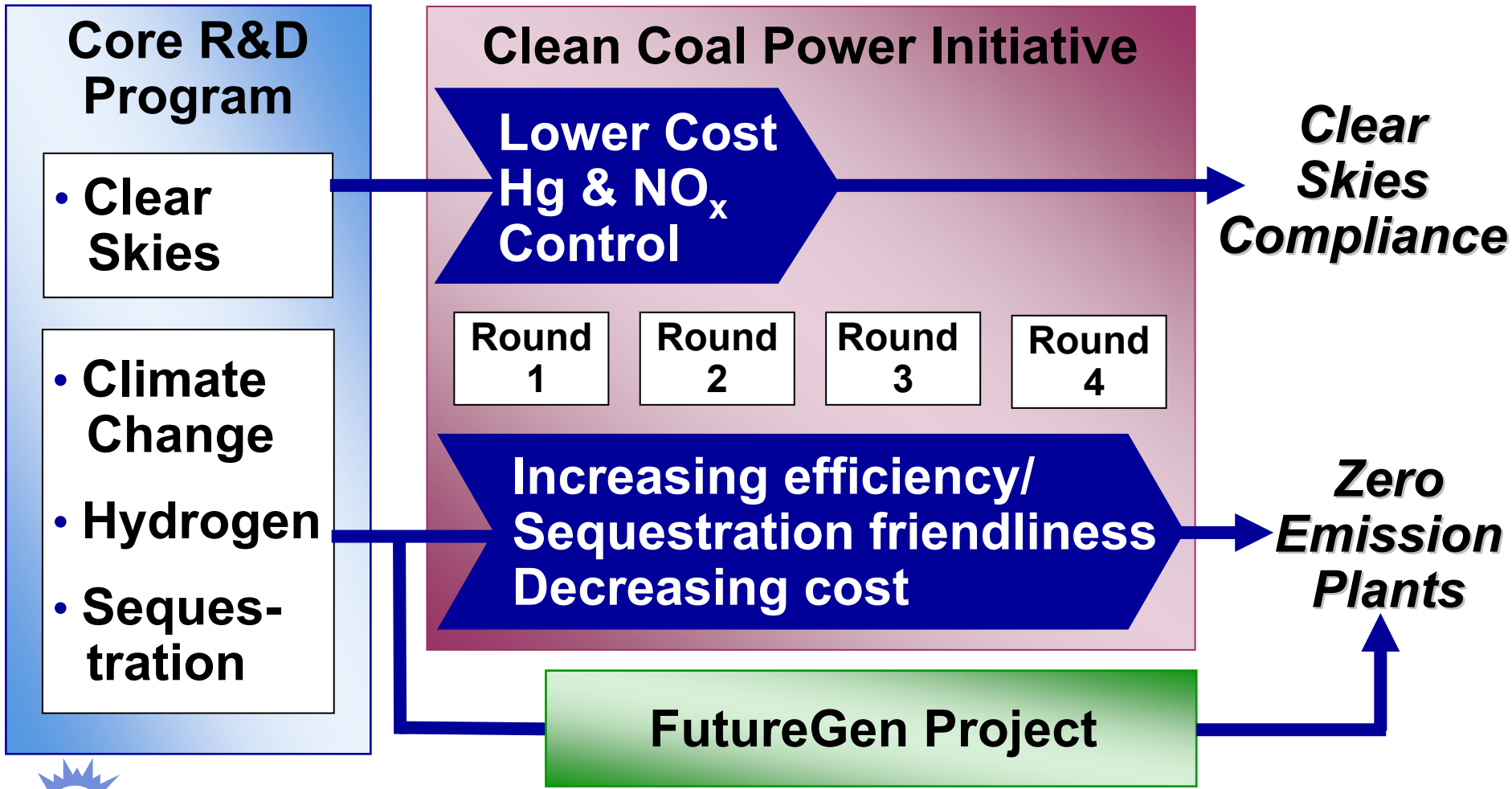


DOE's Coal Demonstration Programs

A History of Innovative Projects



Linkages
Coal and Power Programs



CCPI Philosophy

- **Demonstrations - necessary step between R&D and commercialization**
- **CCPI provides demonstration platform**
- **<u>Multiple</u> demonstrations needed for new capital intensive technologies**
  - Each demo must raise bar
  - Industry cost share commensurate with risk

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: future energy plants**
  - Near-zero emissions power and clean fuels plants with CO_2 management capability

Can be found on CURC website

www.coal.org

Existing Plants
Roadmap Performance Objectives

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

Coal Power Program Roadmap

New Plant Performance Targets

(Represents best integrated plant technology capability)

	Reference Plant	2010	2020 Vision 21
Air Emissions	98% SO_2 removal	99%	>99%
	0.15 lb/10^6 Btu NOx	0.05 lb/10^6 Btu	<0.01 lb/10^6 Btu
	0.01 lb/10^6 Btu Particulate Matter	0.005 lb/10^6 Btu	0.002 lb/10^6 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 Targets[1]

(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

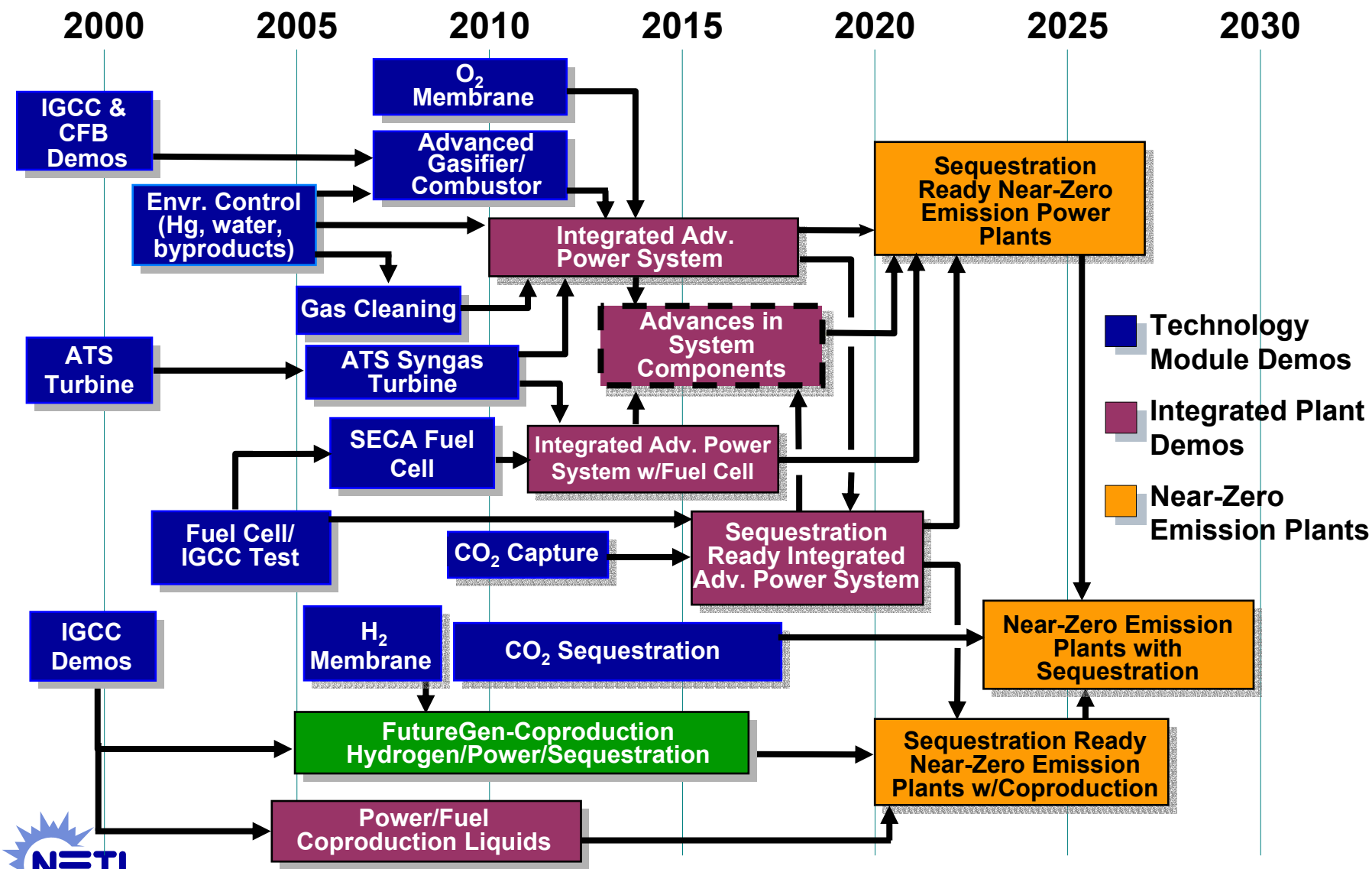
(1) Targets are w/o carbon capture and sequestration and reflect current cooling tower technology for water use

(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)

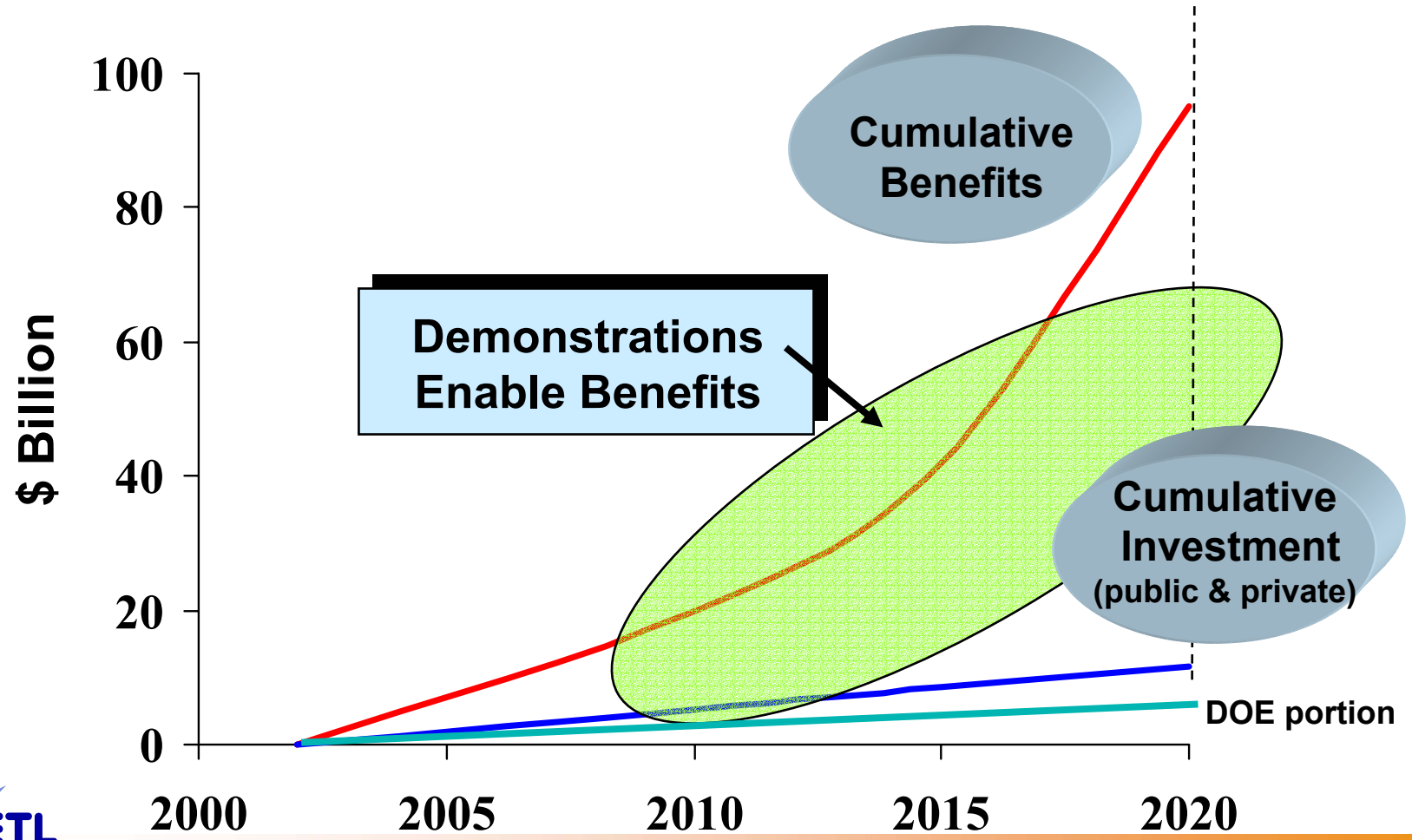
(4) Bus-bar cost-of-electricity in today's dollars; Reference plant based on $1000/kW capital cost, $1.20/$10^6$ Btu coal cost

Technology Roadmap – Future Energy Plants



Demonstration Initiatives are Key Pathway to Benefits

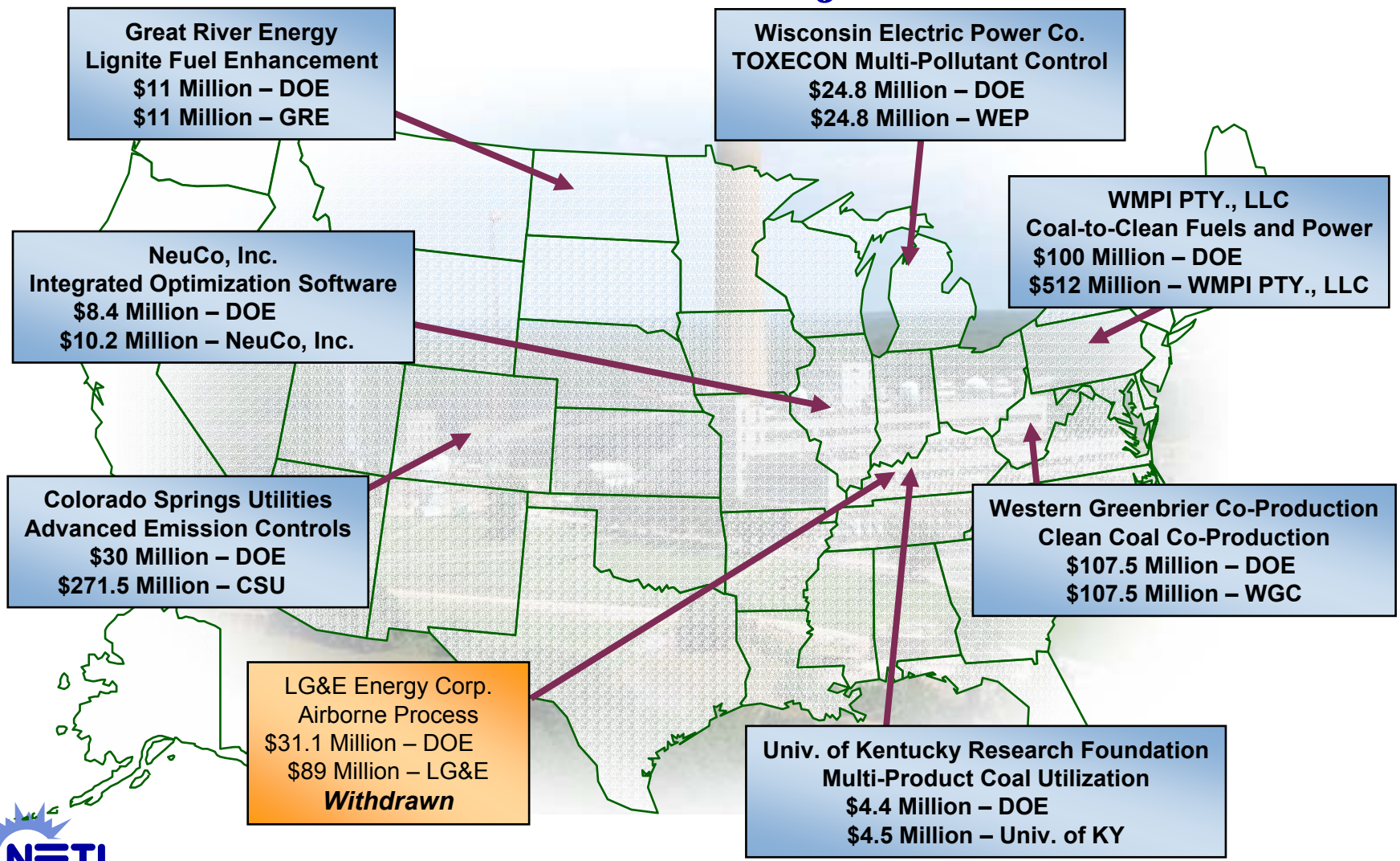
Coal Program - Benefits/Investment



CCPI – Round 1

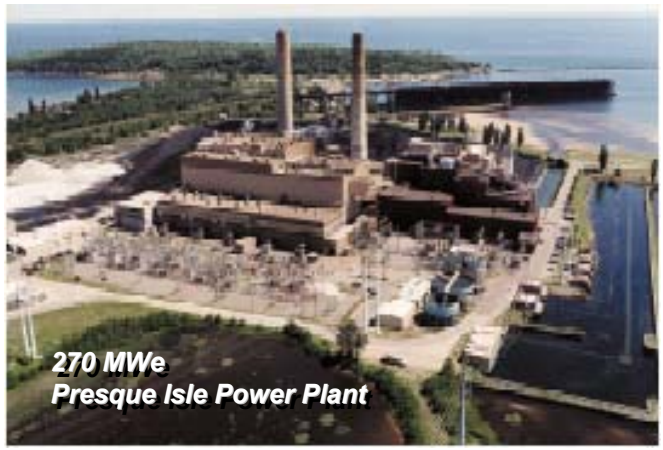
- **Competitive solicitation FY 02**
- **Broad in scope**
  - Advanced power generation
  - Efficiency, environmental, economic improvement
- **Eight projects selected January 2003 (1 withdrawn)**
  - $286M DOE cost share
  - $1.2B industry cost share

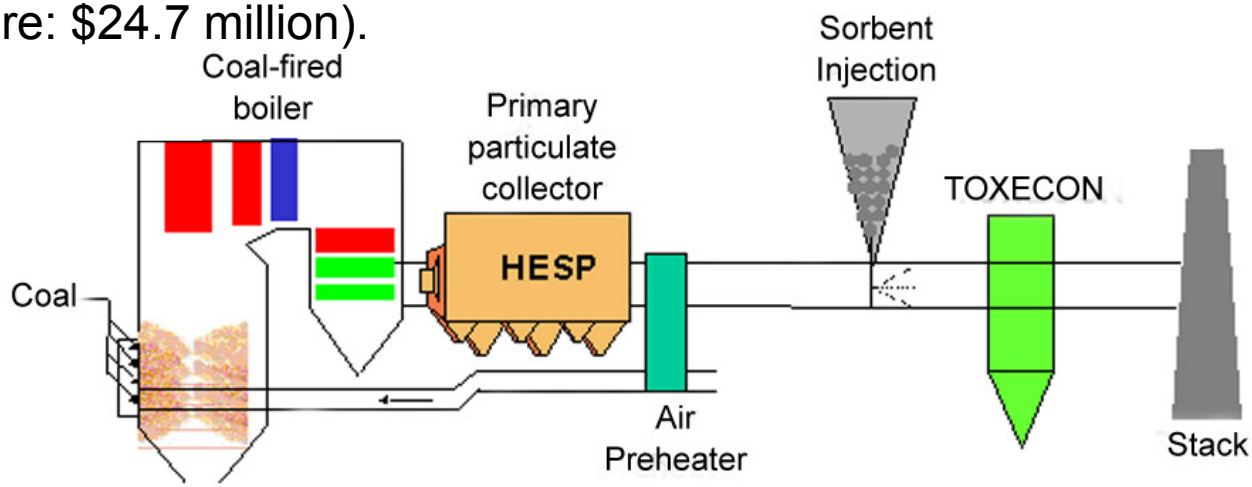
Clean Coal Power Initiative (CCPI) – Round 1 Projects



Wisconsin Electric Power Company

- An integrated emission control approach installed on combined flue gas for units 7, 8, and 9.
- Maximizes use of coal combustion by-products.
- Provides for timely compliance with future mercury regulations, such as Clear Skies Initiative.
- Total project funding: $49.5 million (DOE share: $24.7 million).

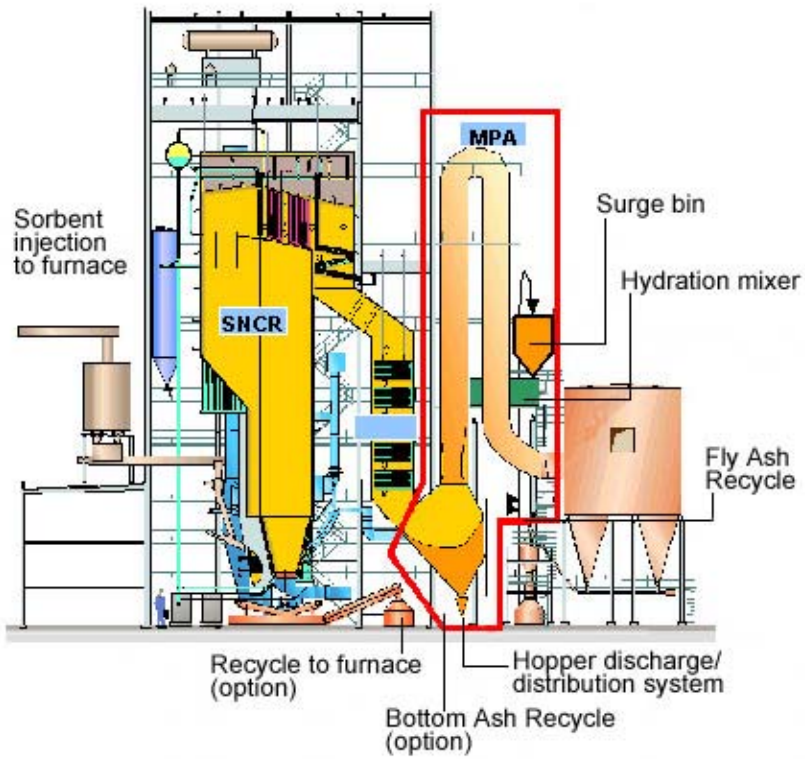


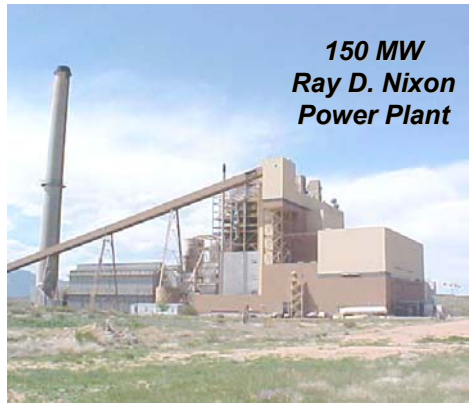


A CCPI Round 1 Project

Colorado Springs Utilities

- One of cleanest U.S. coal-fired power plants for SOx, NOx and mercury control.
- Helps achieve compliance with upcoming regulations, such as Clear Skies Initiative.
- Uses variety of fuels: bituminous, subbituminous, coal wastes, and wood wastes.
- Total project funding: $301.5 million (DOE share: $30 million).





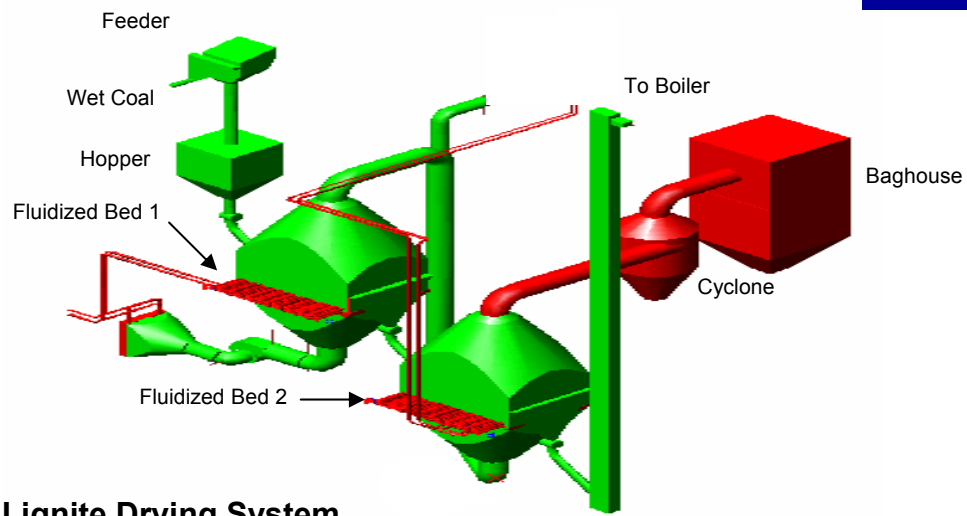
A CCPI Round 1 Project

Great River Energy

- Lignite fuel enhancement - applicable to power plants burning inherently high-moisture coals.
- Achieving higher efficiencies to help meet Climate Change goals.
- Total project funding: 22 million (DOE share: $11 million).

546 MW
Coal Creek Station
Underwood, ND

Two-Stage Fluidized Bed Dryer System using Waste Heat

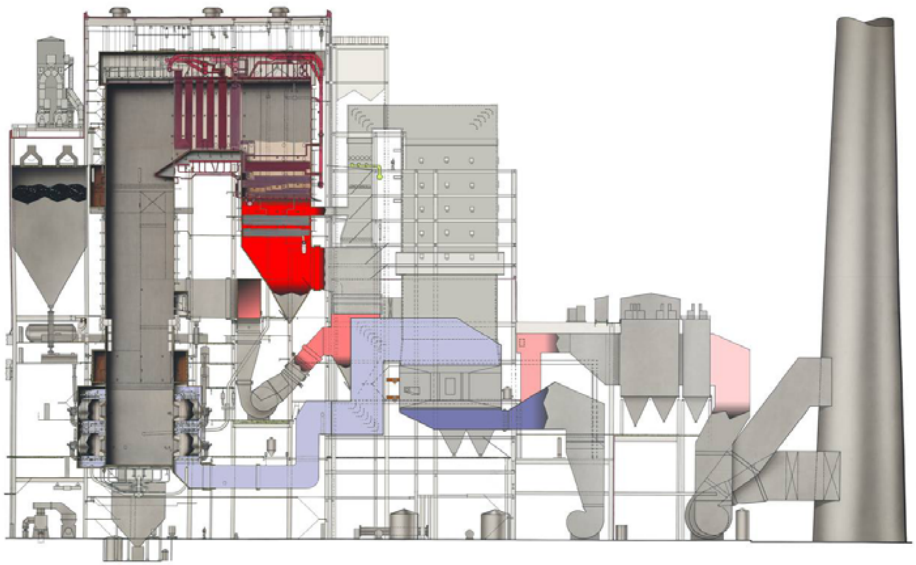


Lignite Drying System

A CCPI Round 1 Project

NeuCo, Inc.

- Integrated optimization software on three 600 MW units reduces emissions, increases efficiency, and increases reliability.
- Five optimization modules: cyclone combustion, sootblowing, SCR operations, thermal performance, and profit optimization.
- Higher efficiencies help to meet Climate Change goals.
- Total project funding: $18.6 million (DOE share: $8.4 million).



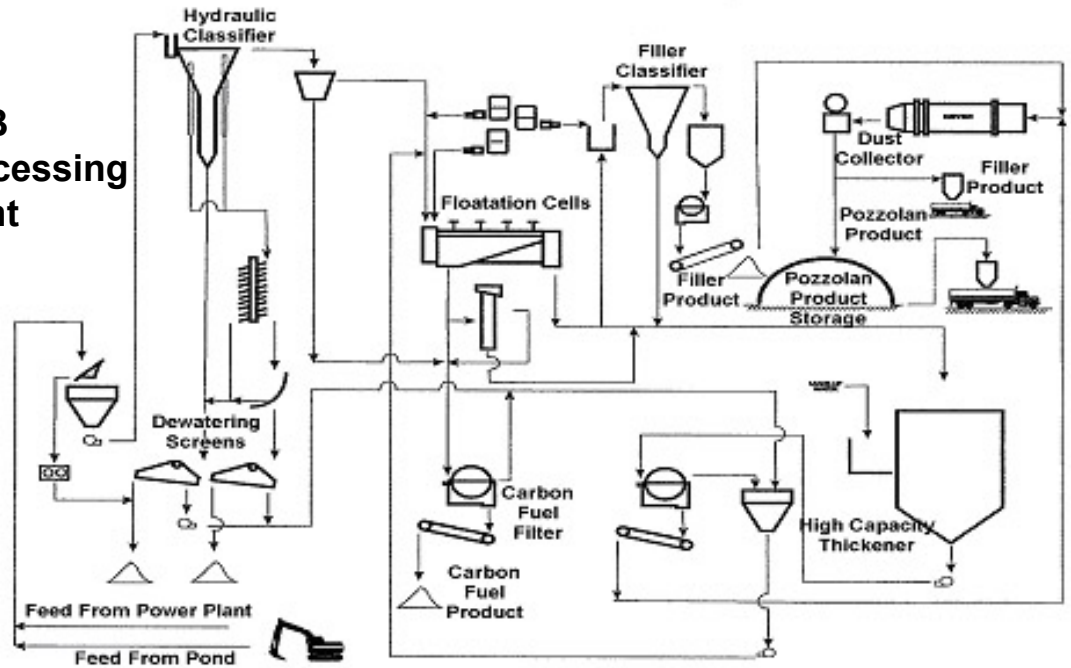
Dynegy Midwest Generation's Baldwin Energy Complex

A CCPI Round 1 Project

University of Kentucky Research Foundation

- Next generation coal ash beneficiation processing plant addressing entire coal utilization by-product (CUB) stream and producing a variety of value-added products.
- Helps meet Climate Change goals: reduces emissions in cement manufacturing.
- Total project funding: $8.9 million (DOE share: $4.4 million).

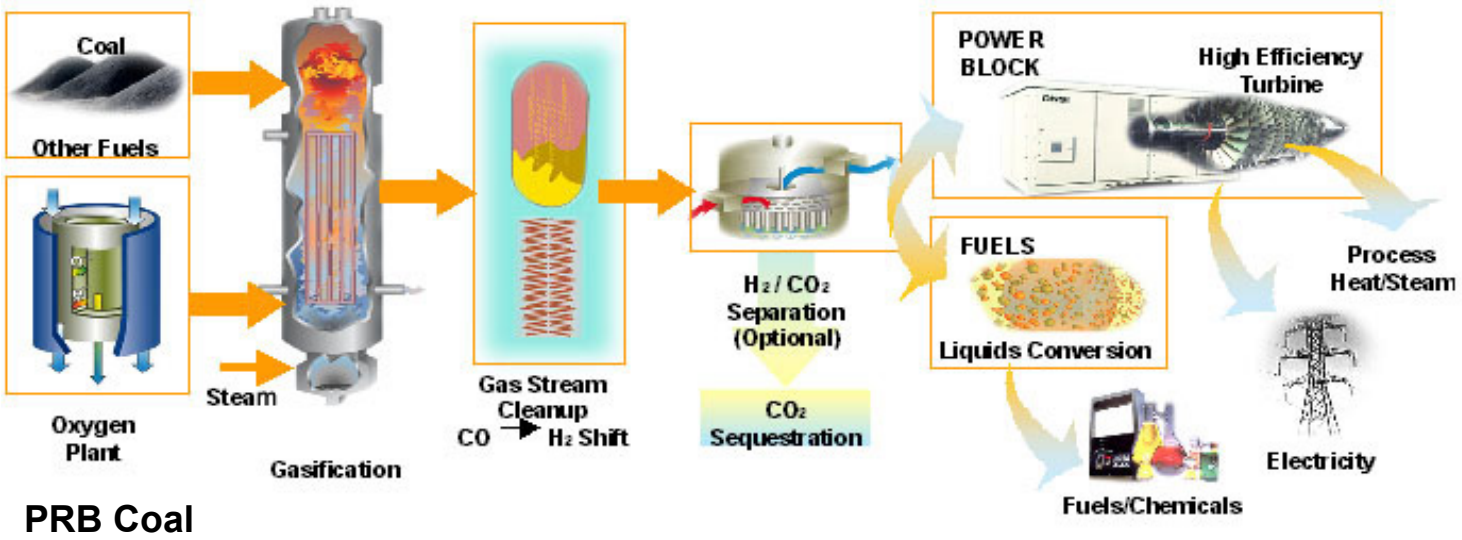
CUB Processing Plant



A CCPI Round 1 Project

Waste Management and Processors Inc. (WMPI PTY., LLC)

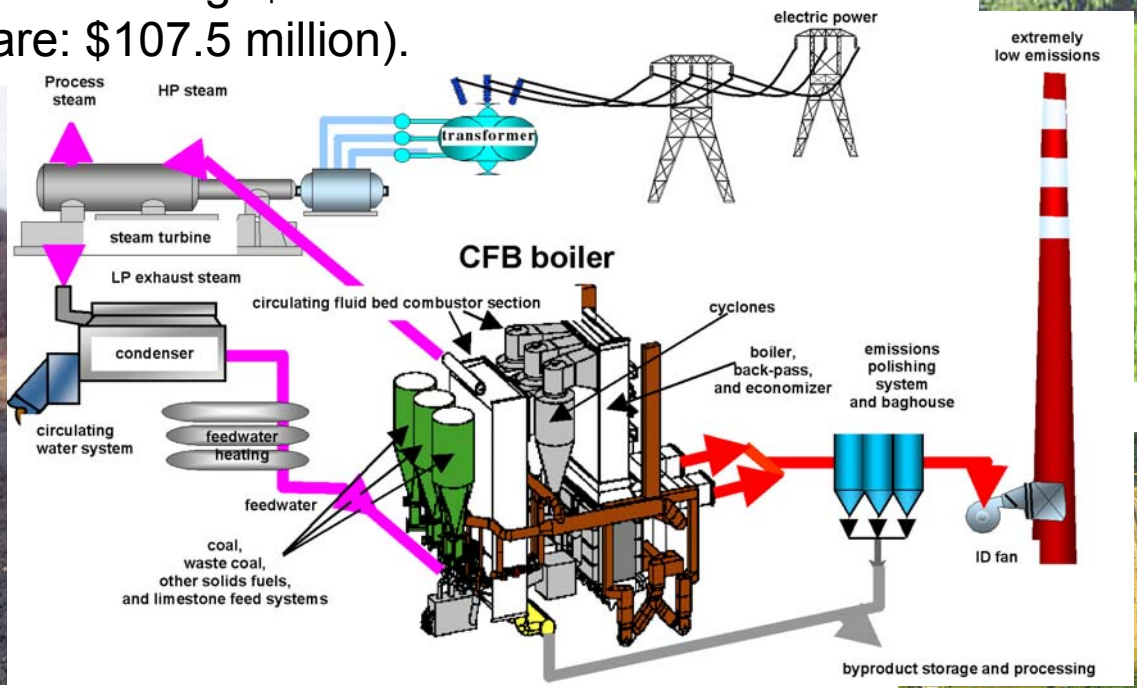
- First power plant in U.S. gasifying waste-coal and low-value resources to produce clean electrical power, thermal energy, and liquid fuels.
- Project enhances Nation's energy security by producing liquid transportation fuels.
- Converts 4,700 tpd of coal waste into 41 MWe and 5,000 bpd of fuel.
- Total project funding: $612 million (DOE share: $100 million).

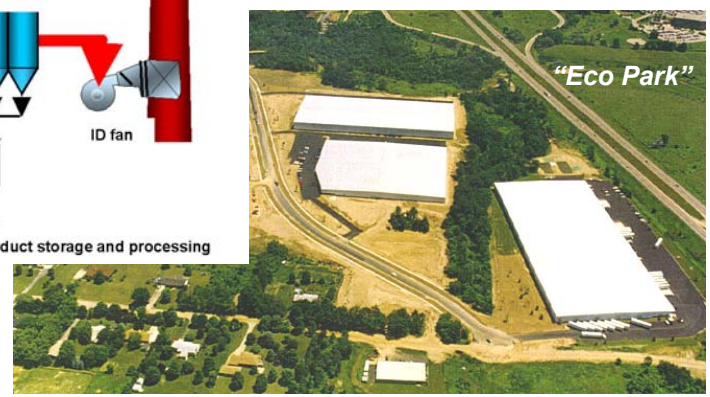


A CCPI Round 1 Project

Western Greenbriar Co-Generation, LLC

- Anchor tenant in a proposed environmentally balanced industrial “Eco Park”; remediation model for State/Local Governments.
- 85 MW waste-coal to clean energy circulating fluid bed combustor with advanced multi-pollutant control system.
- Total project funding: $215 million (DOE Share: $107.5 million).





A CCPI Round 1 Project

Preliminary NEPA Evaluation Strategy

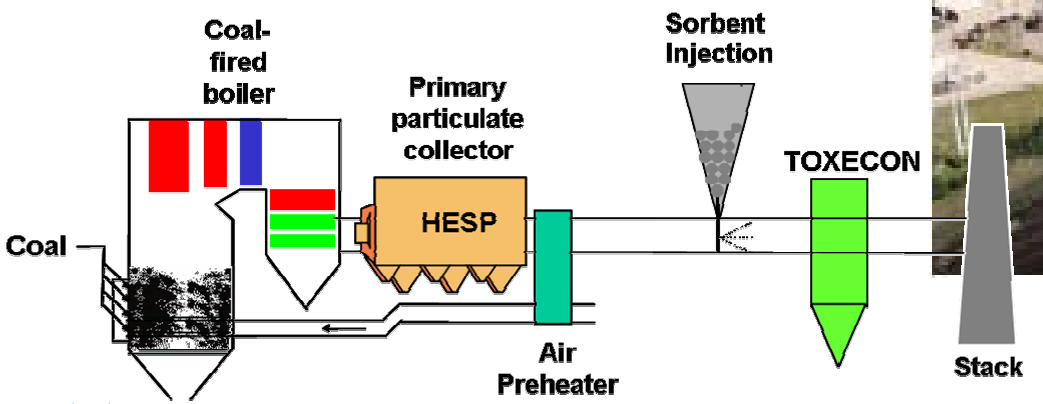
- **Environmental Impact Statements (EIS)**
  - Colorado Springs Utilities
  - Waste Management & Processors, Inc.
  - Western Greenbrier Co-Gen LLC
- **Probable Environmental Assessments (EA)**
  - Great River Energy
  - Louisville Gas & Electric Corporation
  - University of Kentucky Research Foundation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

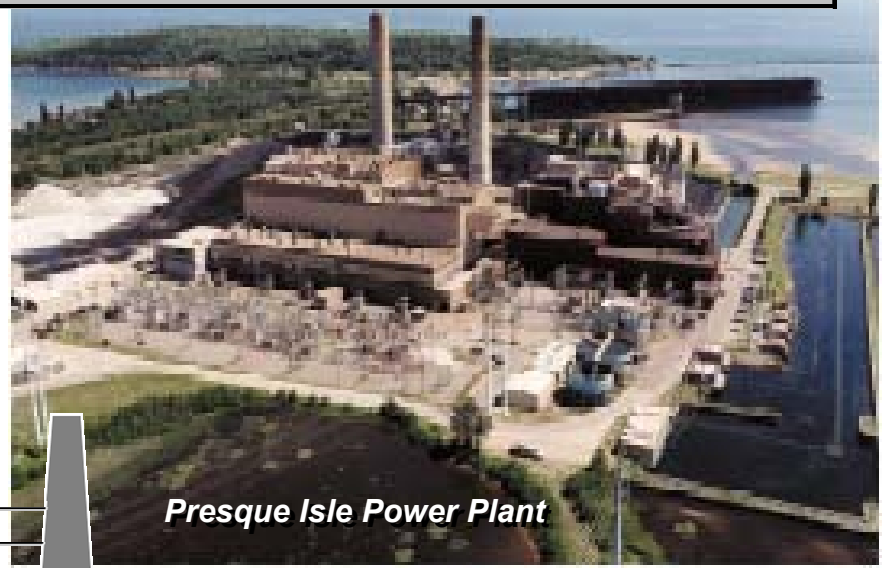
Funding
CCPI - Round 2

- **Anticipate ~ $300 million DOE funding**
  - FY 04 Appropriations
  - FY 05 Appropriations
  - Carryover from PPII and CCPI Round 1

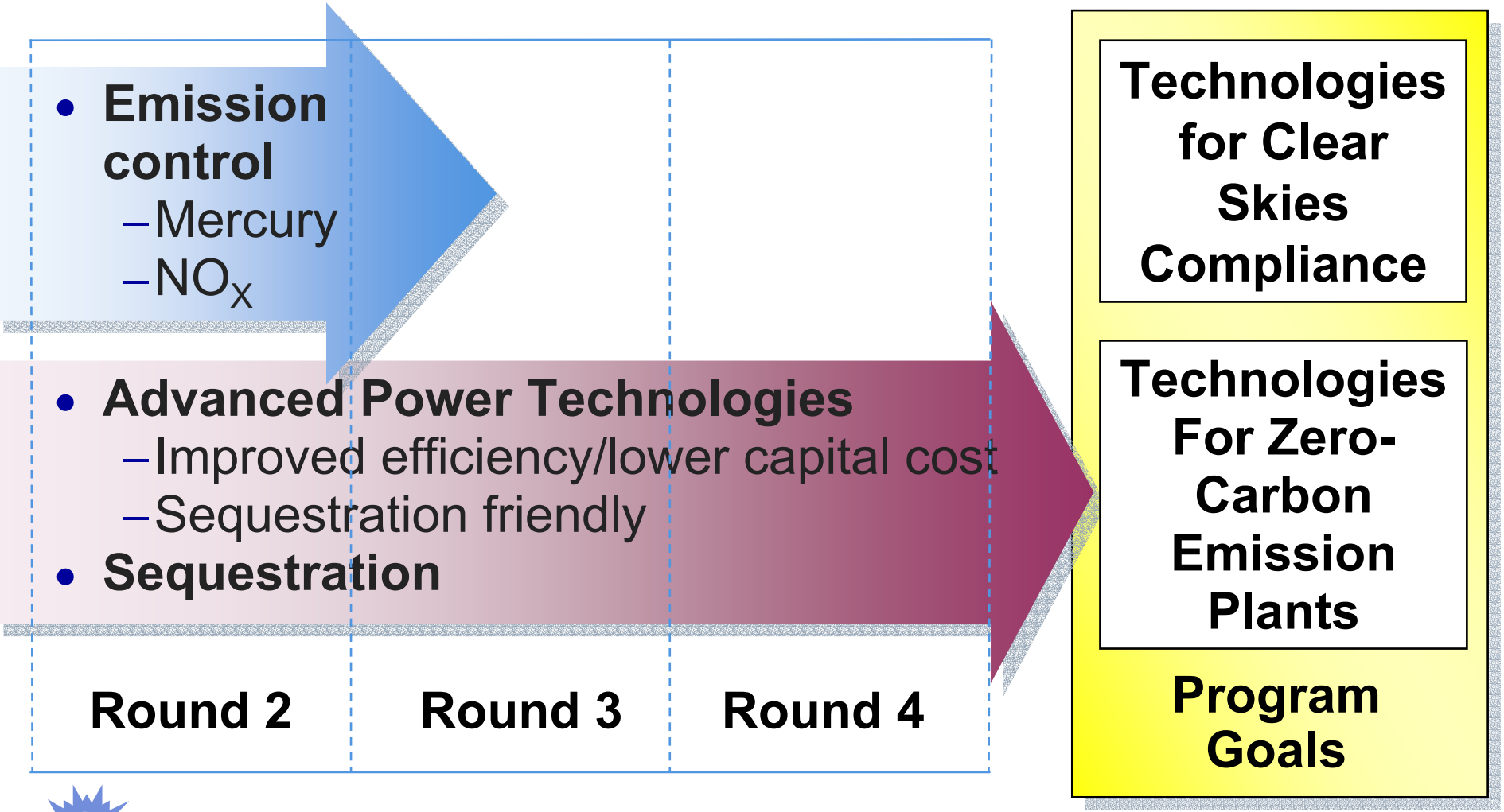
CCPI Program Funding
(in thousands)

RD&D Activities	FY2003 Enacted	FY2004 President	FY2004 House	FY2004 Senate	FY2004 Conf.
CCPI	150,000	130,000	130,000	130,000	172,000



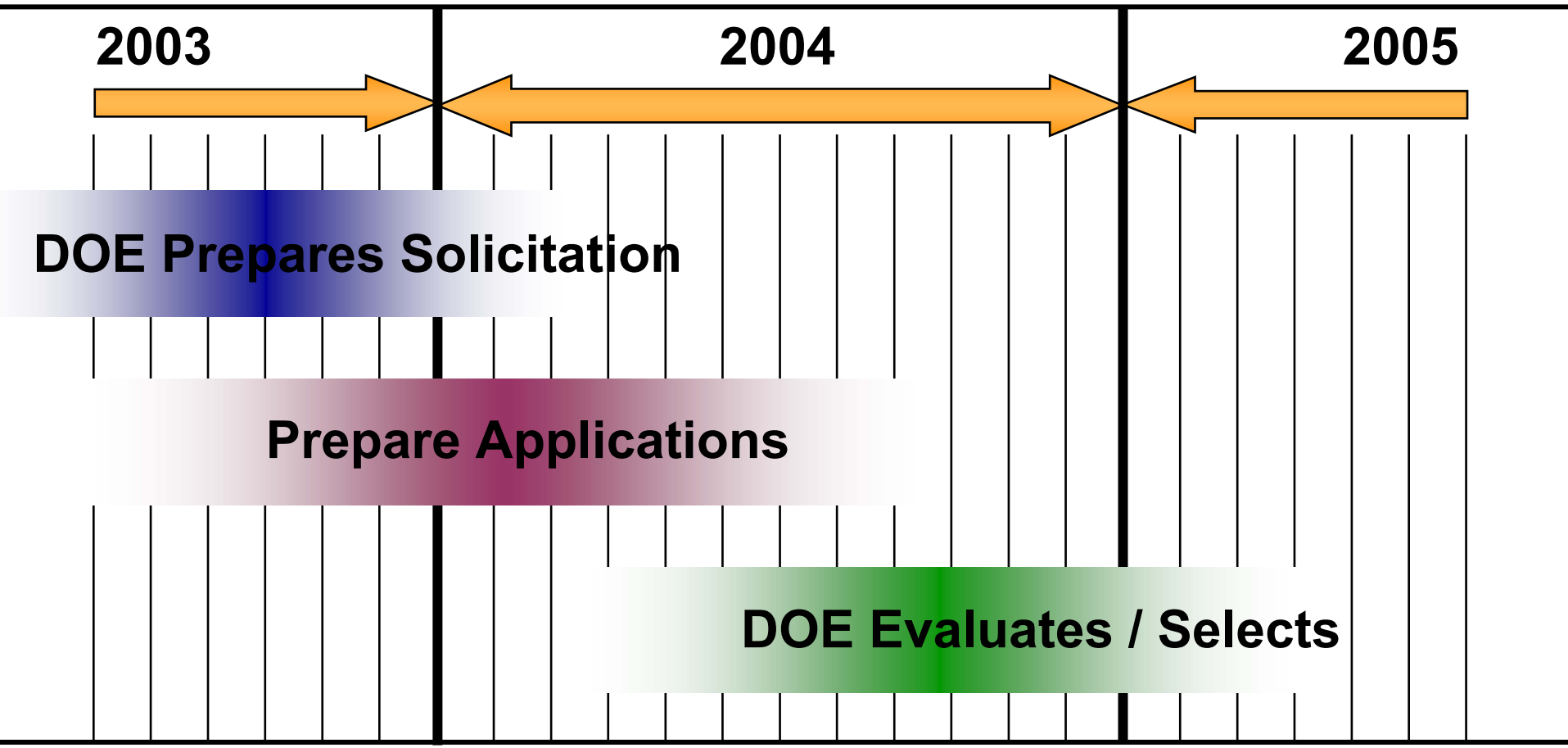


Tentative Priority Technologies
Future CCPI Rounds



CCPI Round 2 Schedule

Calendar Years



Stakeholder Feedback (1)
Round 2

- **From August 26, 2003 Workshop in Pittsburgh**
  - Do not pre-select technology (e.g. gasification vs. combustion)
  - Consider distributed sources (e.g. industrial ~50MW scale)
  - Repayment as a “zero-interest” loan is an issue
    - Some feel it discourages risk-taking and some from applying
    - Some think it attracts non-commercial type projects
  - Other than “full-scale” demos may be appropriate

Stakeholder Feedback (2)
Round 2

- **From August 26, 2003 Workshop in Pittsburgh**
  - Clarify how much electricity needs to be generated in the demo
  - No incentive for CO_2 capture now
  - Some Energy Bill provisions (i.e. loan guarantees and investment tax credits) may be more attractive than CCPI
  - Good Q&A; DOE will make some improvements in next solicitation (i.e. clarifications on Project Definition Phase)

Workshop Summary and Transcript of Q&A session now posted on CCPI website

Challenges for CCPI Program

- **Maintaining a priority for funding in a competitive budget climate**
- **Picking "winners"**
  - Technology (e.g. gasification vs. combustion systems)
  - Projects (strong vs. technically significant)
- **Need for multiple demonstrations**
  - Narrowing down solicitation scope of interest (i.e. follow roadmap)

Closing Comments

- **Coal must play a key role to secure a healthy economy**
  - Is recognized in Presidential-level initiatives; Clear Skies, Climate Change, FutureGen, Hydrogen, Sequestration
  - Coal can play an important role in a potential future carbon-constrained world
- **Regulatory uncertainty improving (e.g. NSR)**
- **Coal RD&D Roadmap charts challenging but doable path forward**
  - Best ideas needed
  - Sustain Federal and private sector investments

Visit Our NETL Website

www.netl.doe.gov

Visit Our OCES Website

www.netl.doe.gov/coalpower/

www.netl.doe.gov/coalpower/ccpi