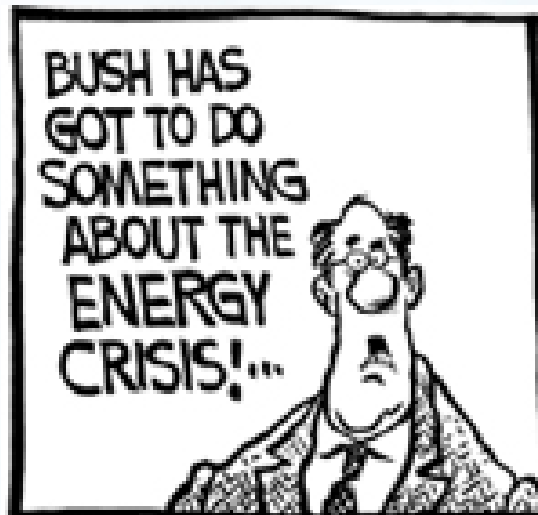


# Future Opportunities for Coal Power

Science, Regulations, &  
Technology

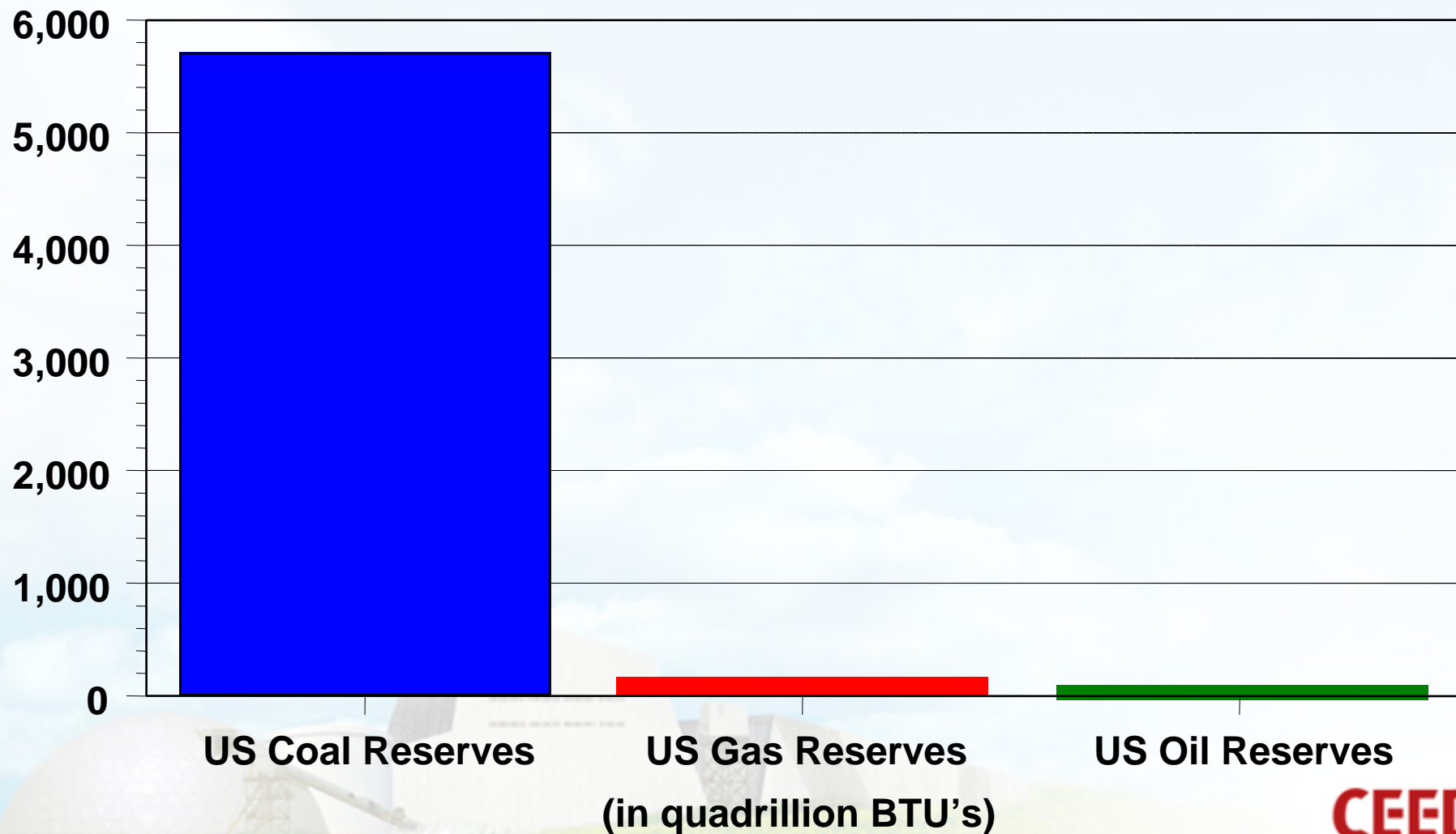


# Energy Crisis!



# Comparing U.S. Energy Reserves

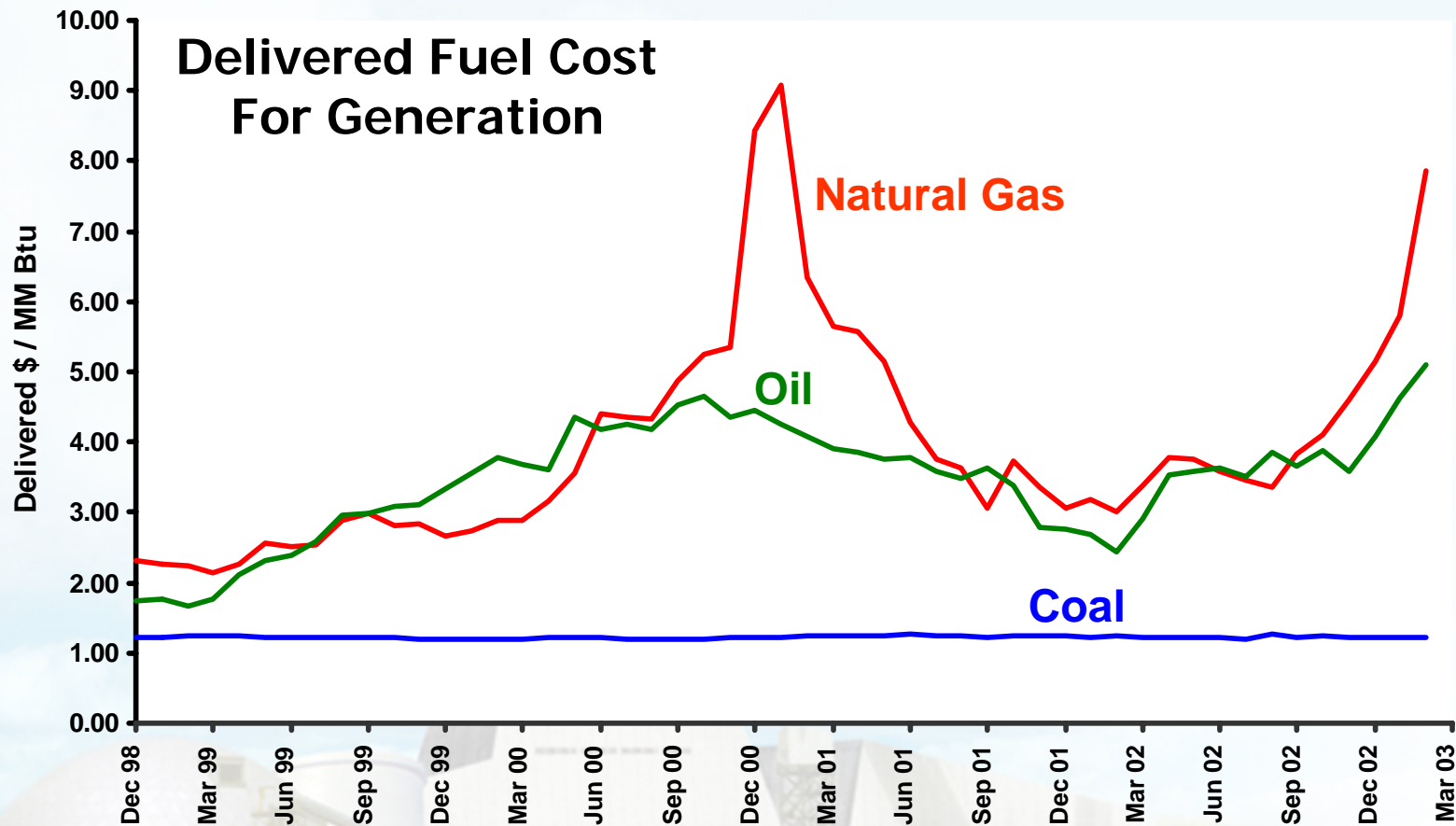
## Abundant Resources Relate to Stable Prices



Source: EIA, 2000

# Delivered Fuel Cost – U.S.

## Coal's Stable Pricing Makes it Ideal for Generation



Source: EIA Electric Power Monthly, February 2003

# Louisiana Costs - 2003

## ■ Fuel Cost

- Coal \$1.34 mmbtu
- Natural Gas \$5.50 mmbtu
- Oil \$5.84 mmbtu

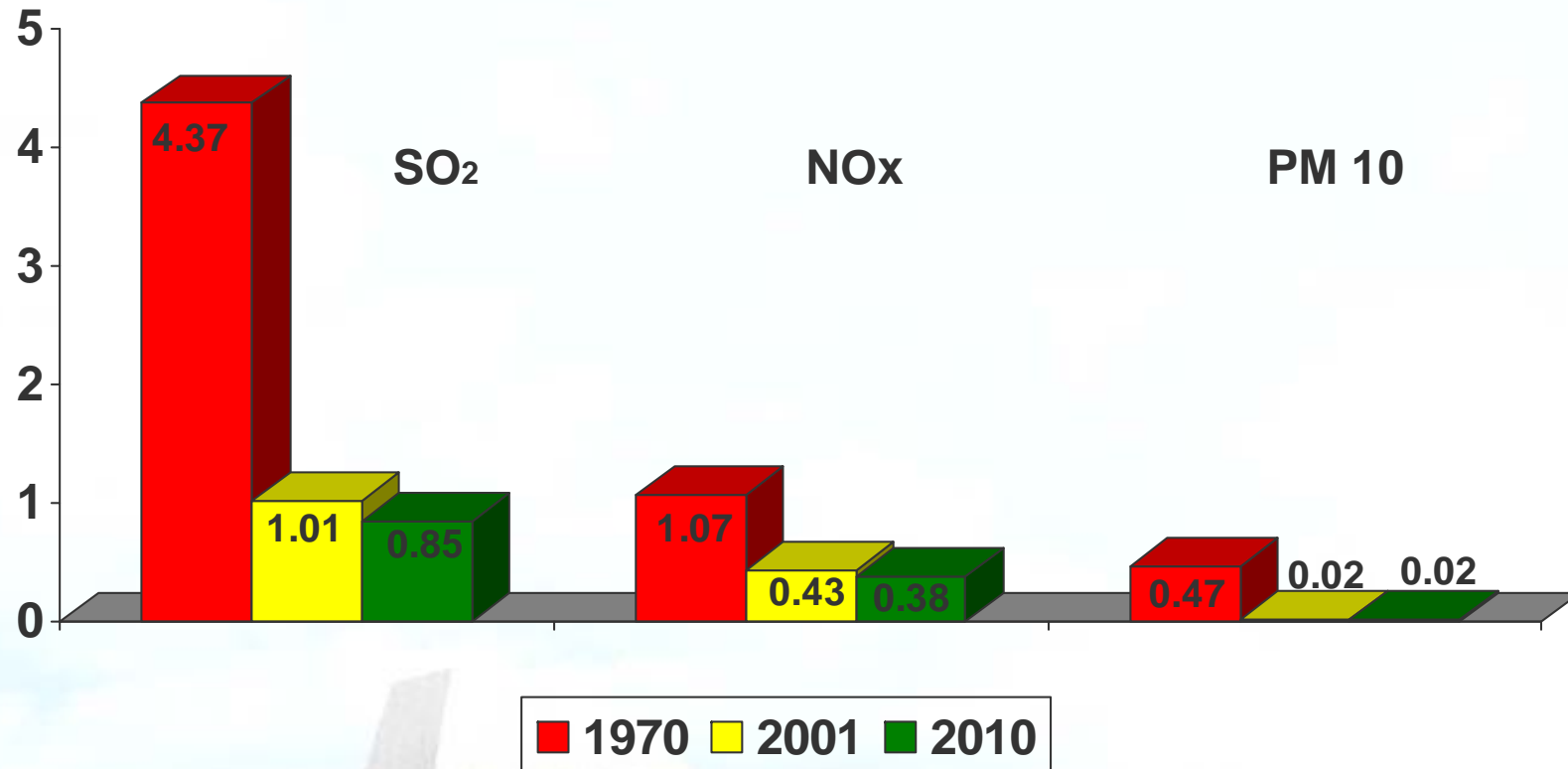
Average electric cost in the state is \$0.069/kwh – 6% below the national average.

# Louisiana Electric Generation Mix

■ Natural Gas	45%
■ Coal-based	26%
■ Nuclear	18%
■ Renewable	4%
■ Oil	3%

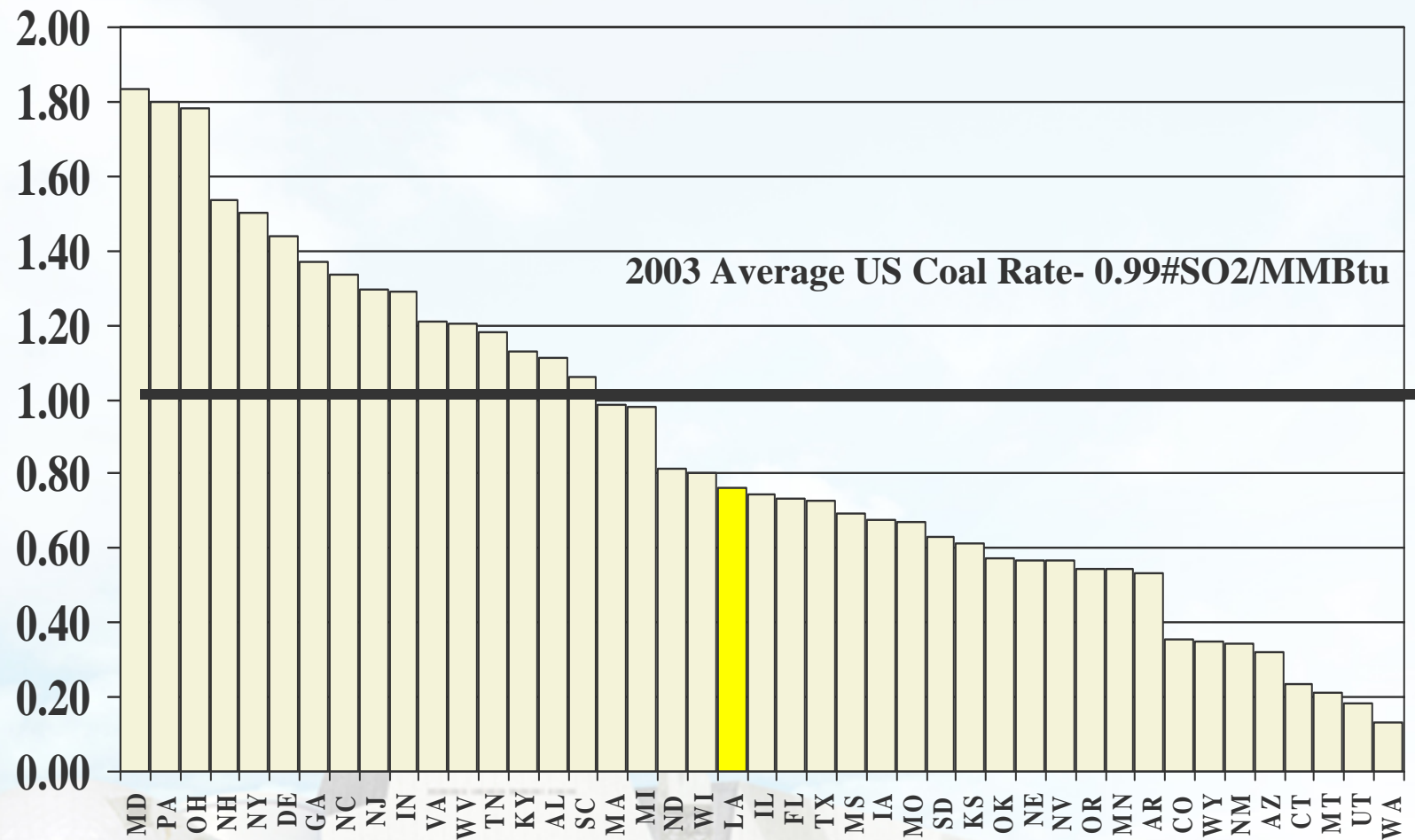
# Environmental Progress

## Increasingly Clean Power



Source: U.S. Environmental Protection Agency and Department of Energy, 2002

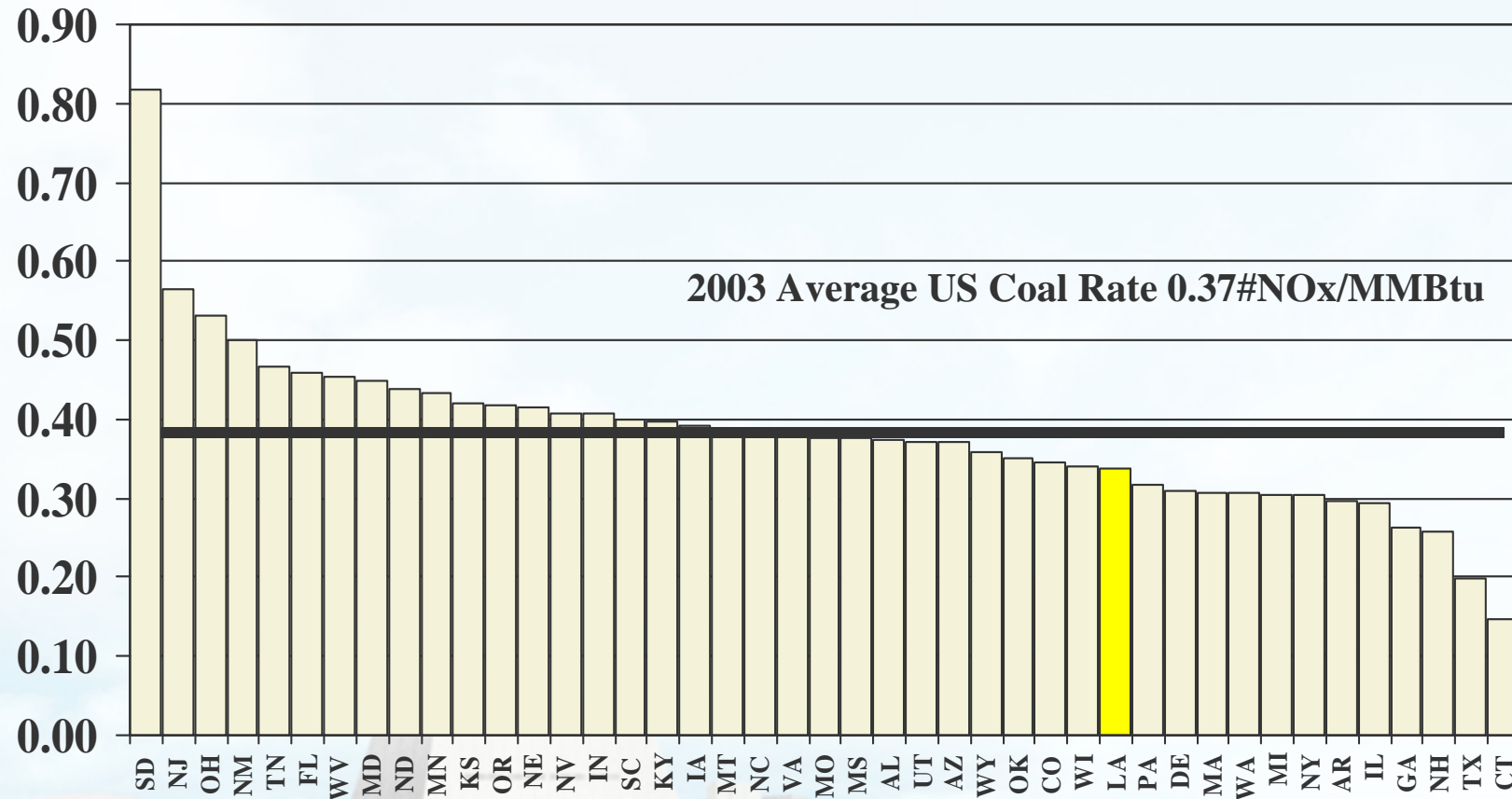
# 2003 Average State Coal Fired SO2 Emission Rates



Source: EPA 2003 CEMS Data

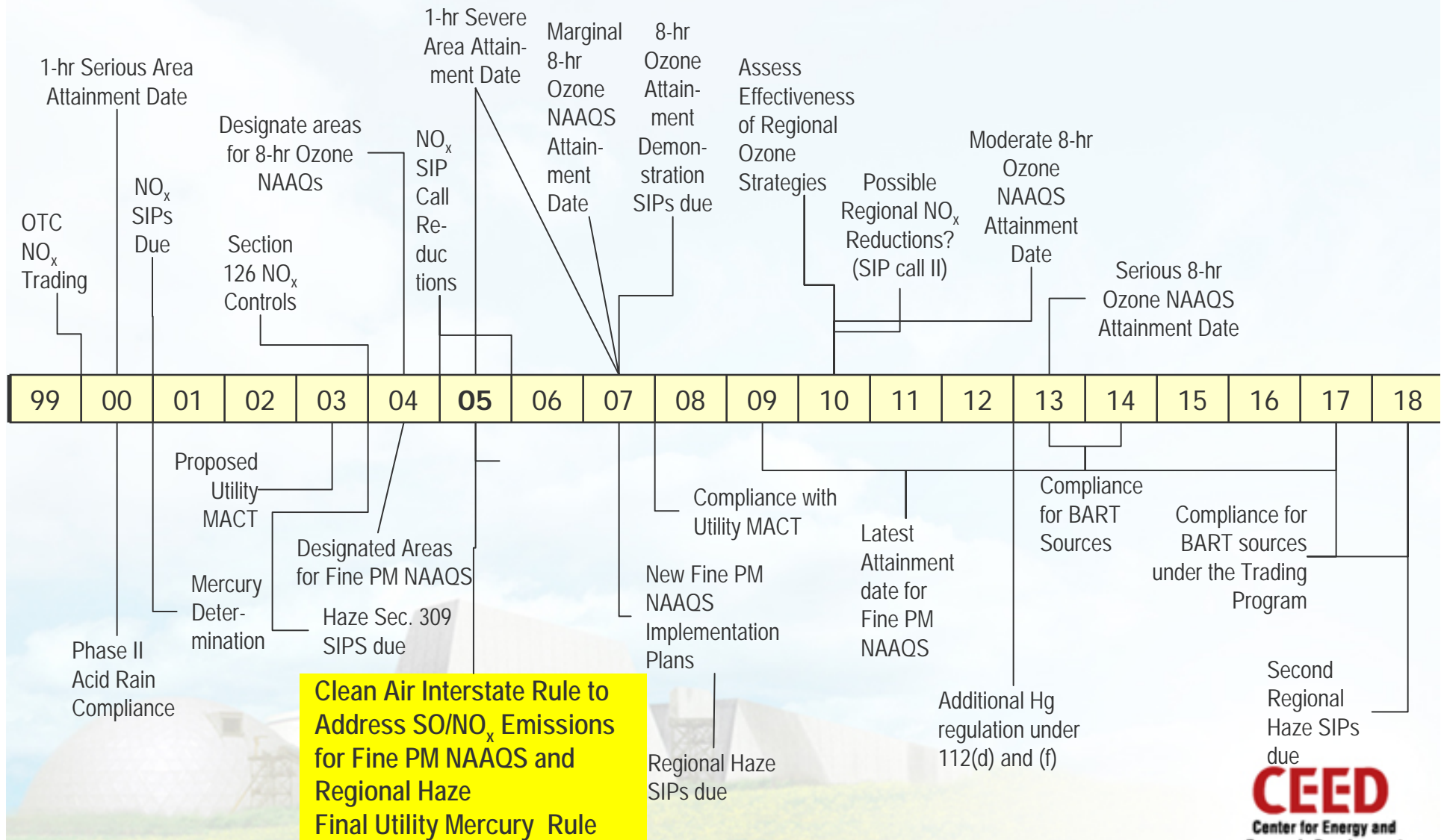


# 2003 Average State Coal Fired NOx Emission Rates

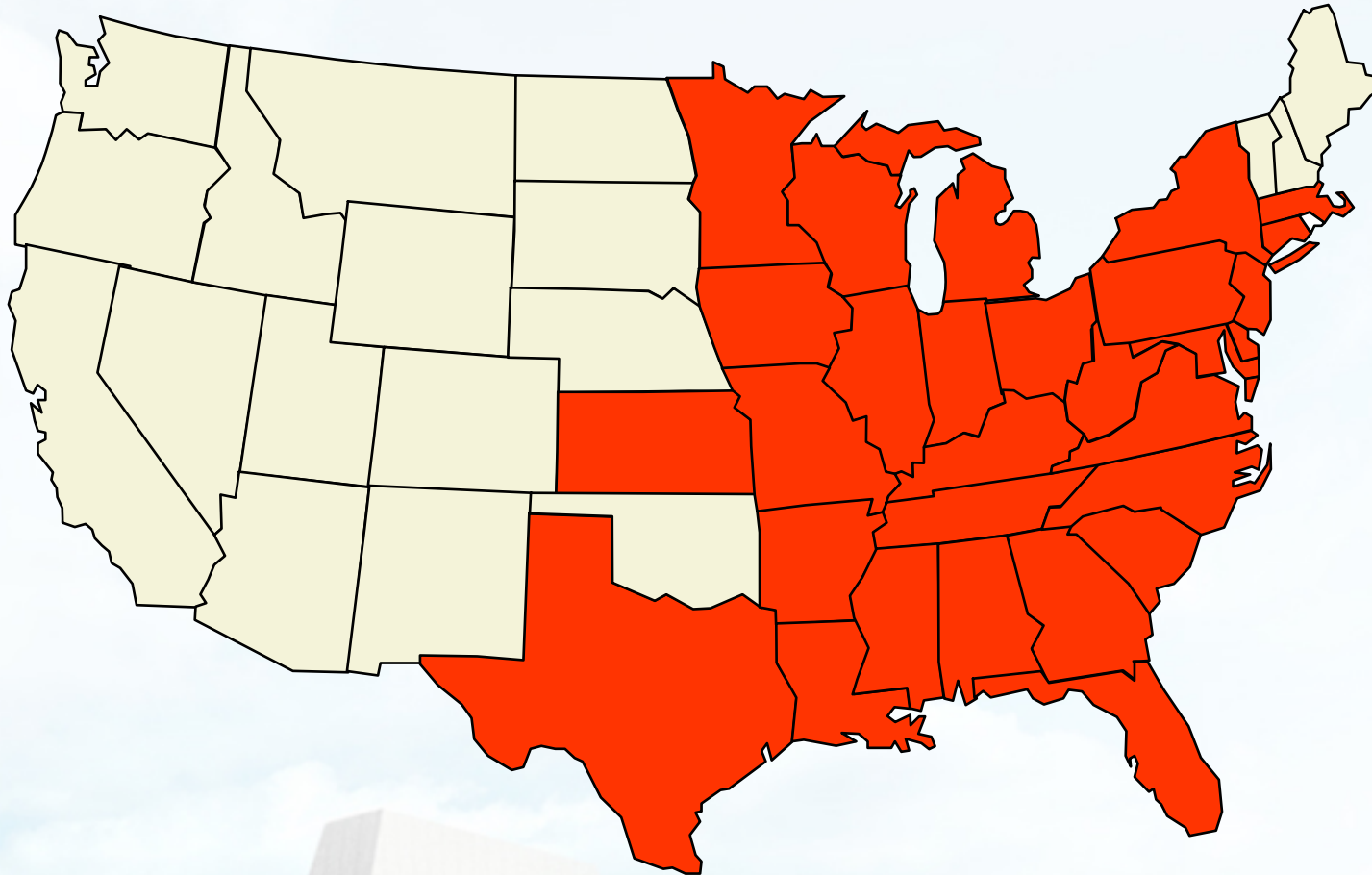


Source: EPA 2003 CEMS Data

# Regional Transport Rule



# Proposed Federal Clean Air Interstate Rule



## Further Reductions Required by Texas by 2015:

SO<sub>2</sub> – 70% reduction

NO<sub>x</sub> – 65% reduction

# Clean Air Interstate Rule

- NOx
  - 68,498 tons 2003
  - 39,444 tons 2015
- SO2
  - 119,930 tons 2003
  - 41,976 tons 2015

# Proposed Utility Mercury Reduction Rule

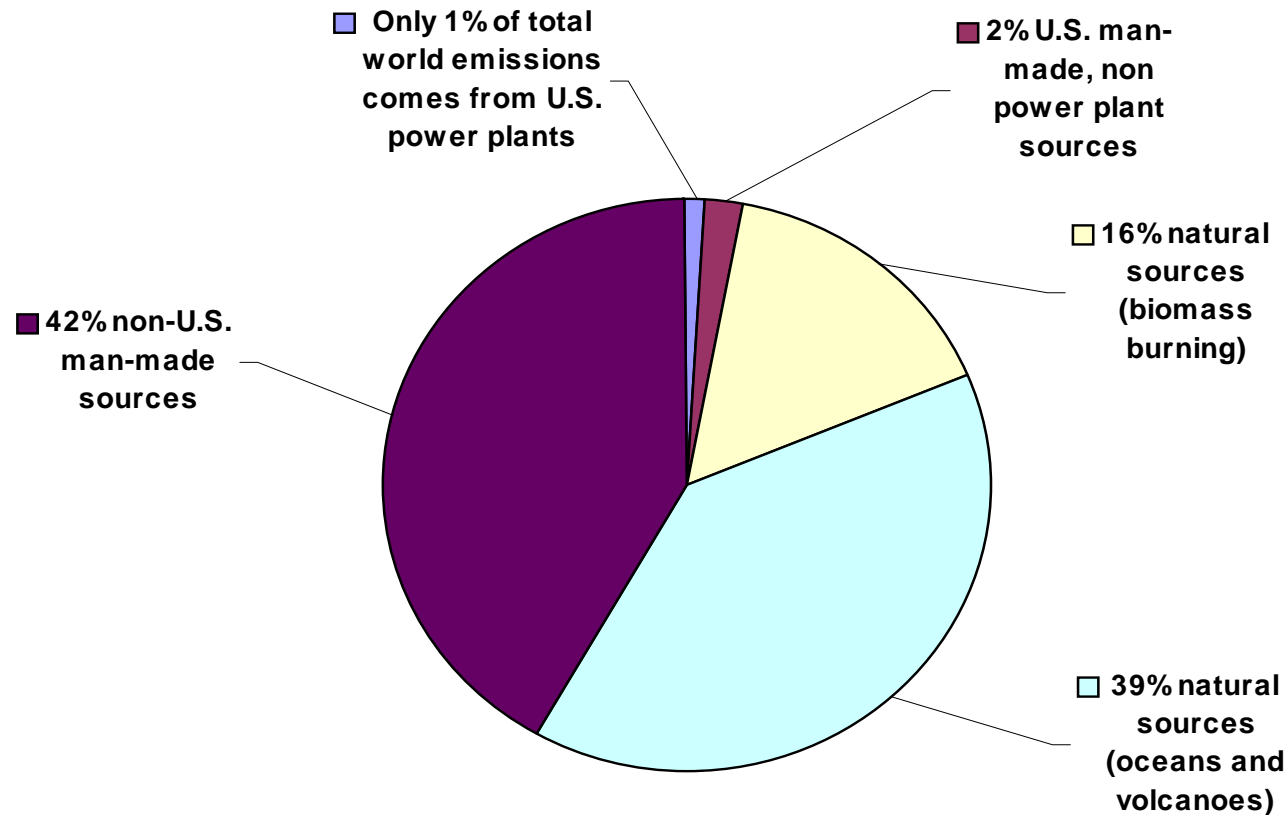
- MACT - Up to 90% reduction by 2008
  - Facility specific control
- Cap & Trade - 70% reduction by 2018
  - Market-based approach
  - Reduce from current 48 tons to 15 tons
  - Estimated to save consumers \$8 Billion - 2020

# Foreign Contribution

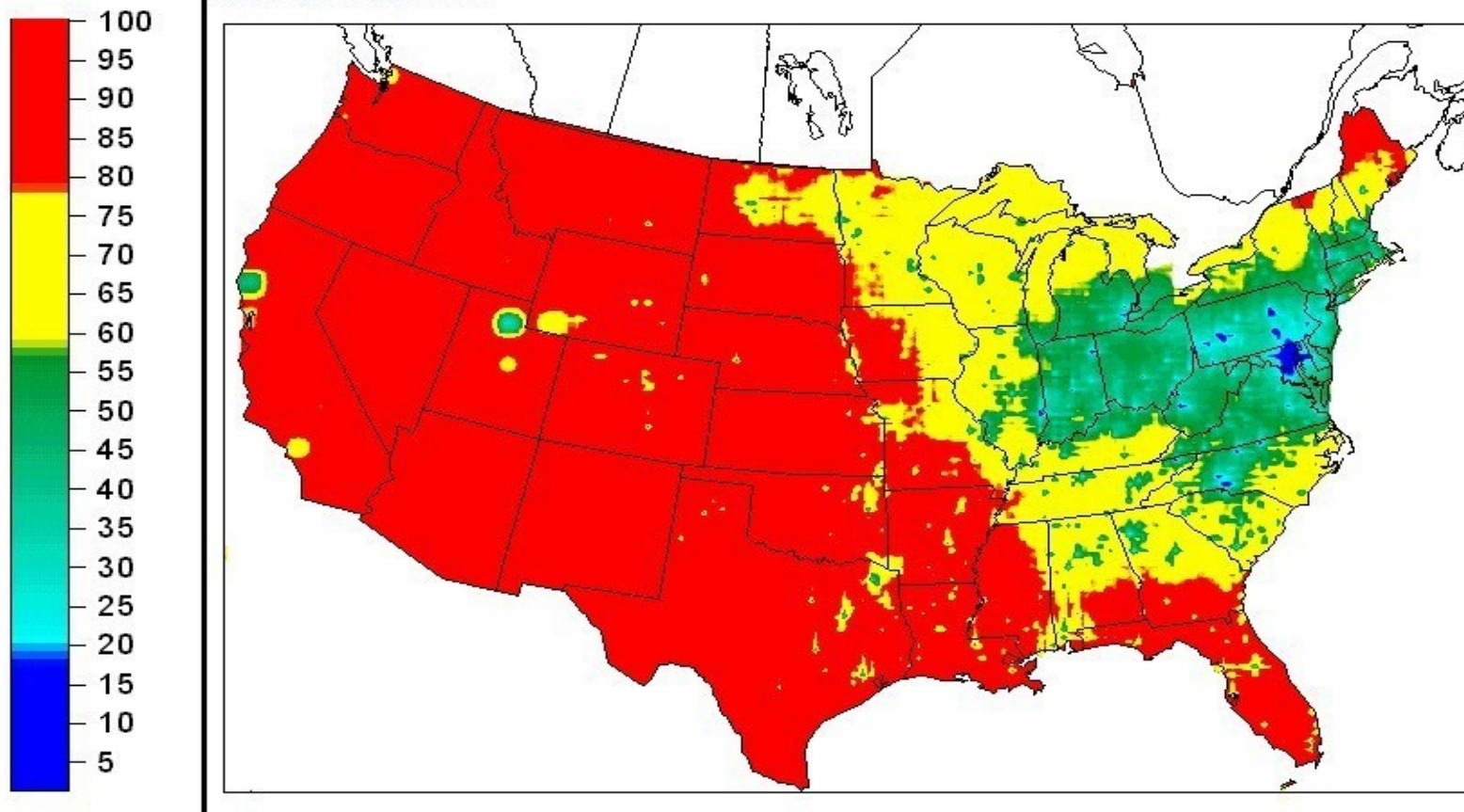
- **Fact:** Wildfires, prescribed burns, and crop burning alone emit some 800 tons of mercury each year globally – National Center for Atmospheric Research
- **Fact:** 50% of the mercury found in the U.S. is from foreign sources – U.S. EPA
- **Fact:** The world's oceans contains millions of tons of mercury which impacts the mercury in the atmosphere – National Center for Atmospheric Research

# Sources of Mercury

**Emissions of mercury from U.S. coal-fired power plants are small compared to global emissions sources**



# Global Mercury Deposition in the U.S.



Percent of mercury deposition that originates outside of the U.S.

Source: EPRI



# Mercury Facts – local deposition

- “Given the current scientific understanding of the environmental fate and transport of this element, it is not possible to quantify how much of the methylmercury in fish consumed by the U.S. population is contributed by U.S. emissions relative to other sources of Hg (such as natural sources and reemissions from the global pool).” – EPA proposed rule

# Local Deposition

- **Facts:** Only 4 – 7% of mercury is deposited locally, according to research by the Brookhaven National Laboratory
- *“Only a small percentage of the mercury would be deposited nearby as particles fall to earth, while the vast majority drifts to greater distances in the atmosphere.”* Hans Friedli, National Center for Atmospheric Research

# Louisiana's Mercury Emissions

- **Fact:** Coal-based power plants in Louisiana emit less than half a ton of mercury – U.S. EPA
- **Fact:** This equates to less than 0.01 of 1% of the total global mercury emissions – U.S. EPA
- **Fact:** Louisiana coal-fueled power plants emit 265 lbs. of oxidized mercury, with the remaining 740 lbs. in an elemental form – U.S. EPA

# Health Concerns

- **Fact:** The national Health and Nutrition Survey, which measured actual mercury levels in women and children did not find anyone approaching the lowest level that would have been associated with any measurable health effect due to mercury – U.S. Center for Disease Control
- *“ People consume far higher levels of PCBs and other persistent environmental chemicals in other foods, including beef, poultry, and dairy products.” - National Academy of Science*

# Benefits of Fish

The American Heart Association predicts about 250,000 people die from sudden heart attacks each year. If 40 percent of these people ate more fish, which contains the beneficial omega fatty acids, 100,000 people would increase their odds of avoiding sudden death. Scaring the public away from eating fish can in itself be a health concern.

# Capturing Mercury is Difficult

## *Hypothetical Example*

- Houston Astrodome filled with 30 billion ping-pong balls
- 30 green “mercury” balls
- Find and remove 27 green balls for 90% Hg capture

EPA has said “So, is technology capable of getting a 90-percent reduction of mercury from coal-fired power plants in the near future?”

**EPA's answer is NO!**

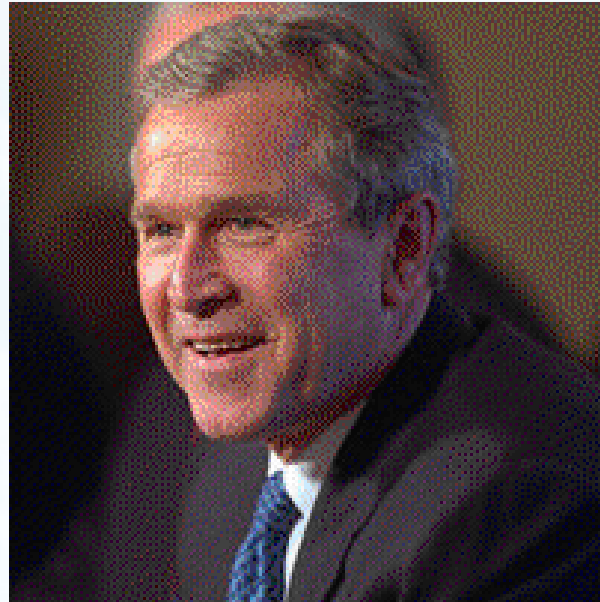


*Houston Astrodome*

# Cost to Control

- **Fact:** The estimated cost of removing mercury from a power plant is \$70,000 per pound – U.S. EPA
- **Fact:** A Tennessee Valley Authority study compared the cost of removing mercury versus other emissions:
  - Sulfur Dioxide \$200 a ton
  - Nitrogen Oxide \$2,000 a ton
  - Mercury \$200,000,000 a ton

# FutureGen – Energy Renaissance



**One billion dollar, 10-year demonstration project to create world's first coal-based, zero-emission electricity and hydrogen plant**

President Bush, February 27, 2003



# IGCC Technology in Early Commercialization

## *U.S. Plants in CCT Program*

### ■ Wabash River

- 1996 Powerplant of Year Award\*
- Achieved 95% availability

### ■ Tampa Electric

- 1997 Powerplant of Year Award
- First-dispatch power generator

**Nation's First Commercial-Scale IGCC Plants, Each Achieving**

**> 95% Sulfur Removal**

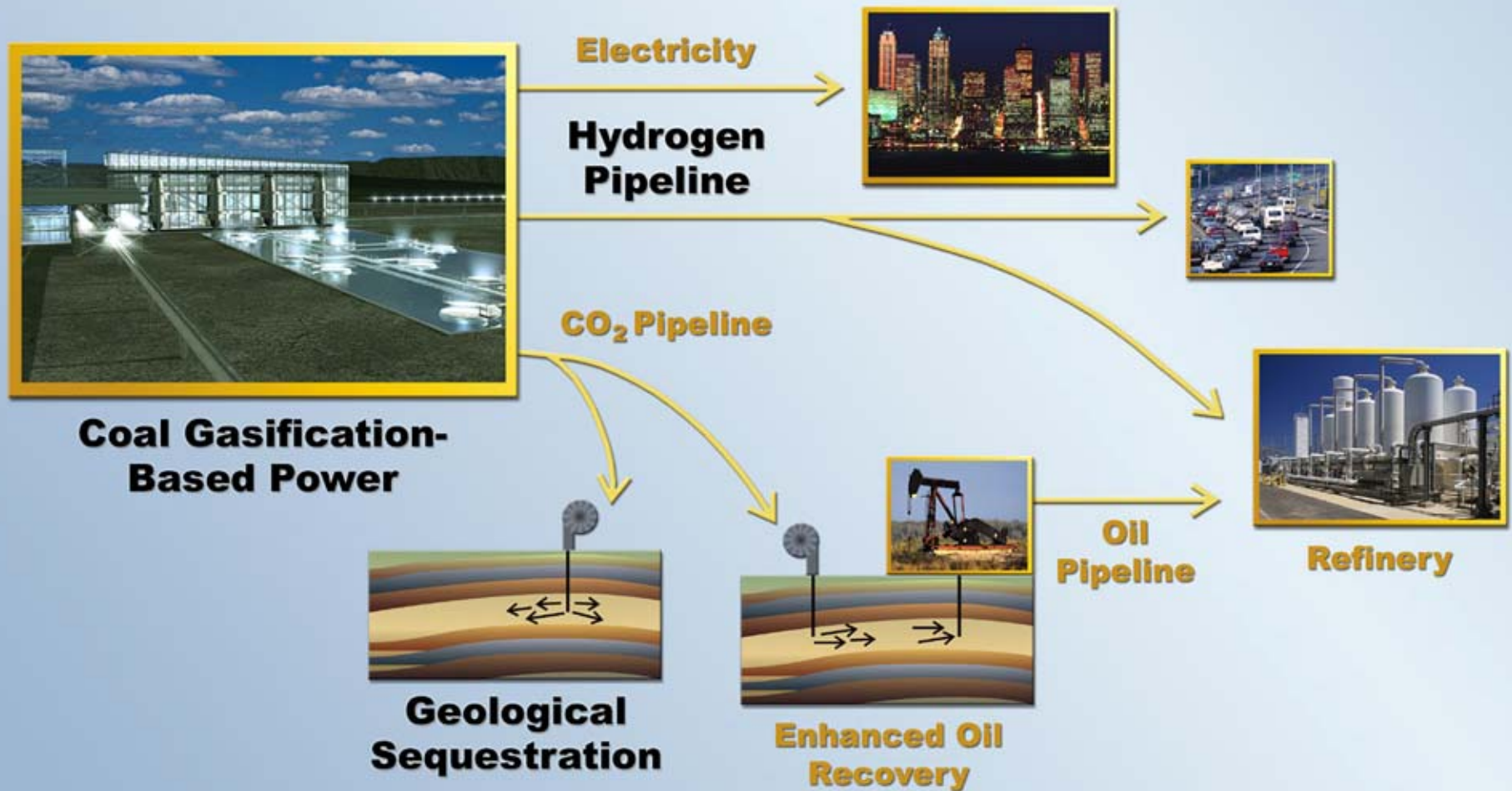
**≥ 90% NO<sub>x</sub> Reductions**



**CEED**

\*Power Magazine  
Center for Energy and  
Economic Development

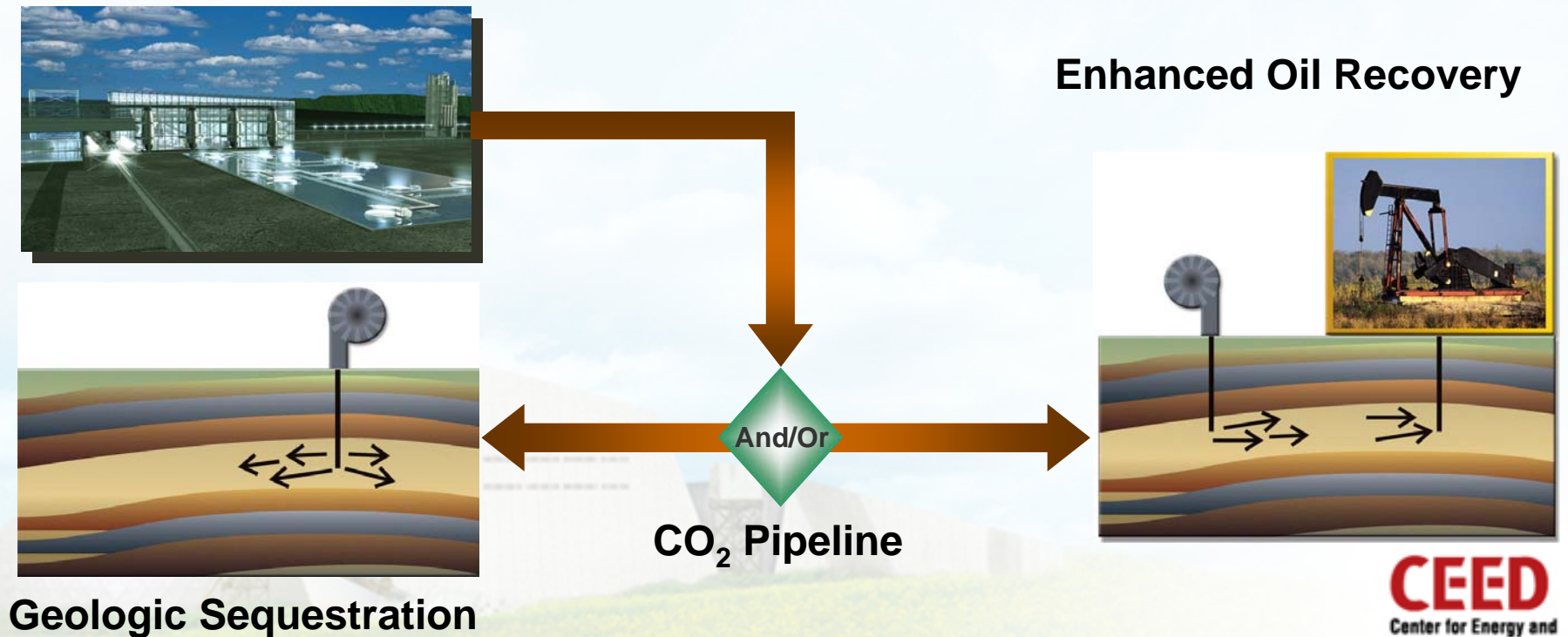
# FutureGen Project Concept



# Sequestration: A Key Objective

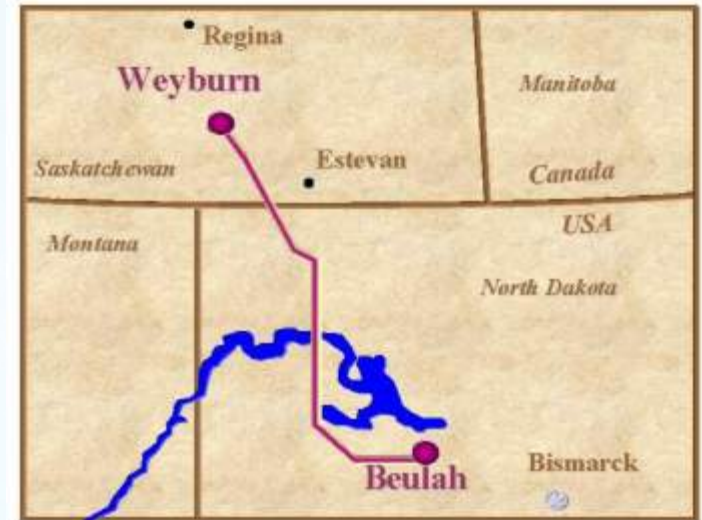
*FutureGen will:*

- Test new technologies to capture CO<sub>2</sub> at power plant
- Inject CO<sub>2</sub> into geologic formations
- Measure and monitor to verify permanence of storage



# Example: Weyburn CO<sub>2</sub> EOR Project

- Approximately 650 production and water injection wells on a 70-square mile oil field operated by EnCana Resources.
- A 20-year enhanced oil recovery (EOR) project begun in 2000 using CO<sub>2</sub> from a 200-mile CO<sub>2</sub> pipeline from Dakota Gasification Plant — \$20.5 million cooperative agreement with Canadian Federal and Saskatchewan Provincial Governments. Provides for 130 million barrels of oil and storage of about 20 million metric tons of CO<sub>2</sub> over 20-year lifetime.
- U.S. (DOE), EU, Japan, Alberta Government, private companies (e.g., BP, Chevron-Texaco, etc.) have joined, providing another \$20 million. IEA CO<sub>2</sub> Monitoring and Storage Project coordinated by 20 research organizations in the U.S., UK, Canada, France, and Italy.



# FutureGen . . .

- Produce electricity and hydrogen from coal using advanced technology
- Emit virtually no air pollutants
- Capture and permanently sequester CO<sub>2</sub>

## Addresses three Presidential initiatives:

- Hydrogen
- Clear Skies
- Climate Change



# The Future is Bright

Randy Eminger

Vice President – South Region

Center for Energy and Economic Development

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