



**By**

**The National Coal Council (NCC)**

**Study Chair**

Fred Palmer  
Peabody Energy

**Technical Work Group Chair**

Steve Jenkins  
CH2M HILL, Inc.

## **Key Components of the Secretary's Request of July 29, 2009**

- **Focus on the application of CCS to the existing fleet of coal-based generating plants**
- **Examine varying amounts of CO<sub>2</sub> capture and the advantages of initially capturing 50 – 60% of CO<sub>2</sub>**
- **Examine capturing CO<sub>2</sub> at 80 % and higher levels**
- **Study the costs associated with these technologies**
- **Assess value added opportunities such as enhanced oil recovery (EOR) and beneficial reuse applications**

# The Goals Have Been Delineated

- **Environmental**

**“I've put forward very substantial proposals to get 80 percent reductions in greenhouse gasses by 2050” (President Obama)**

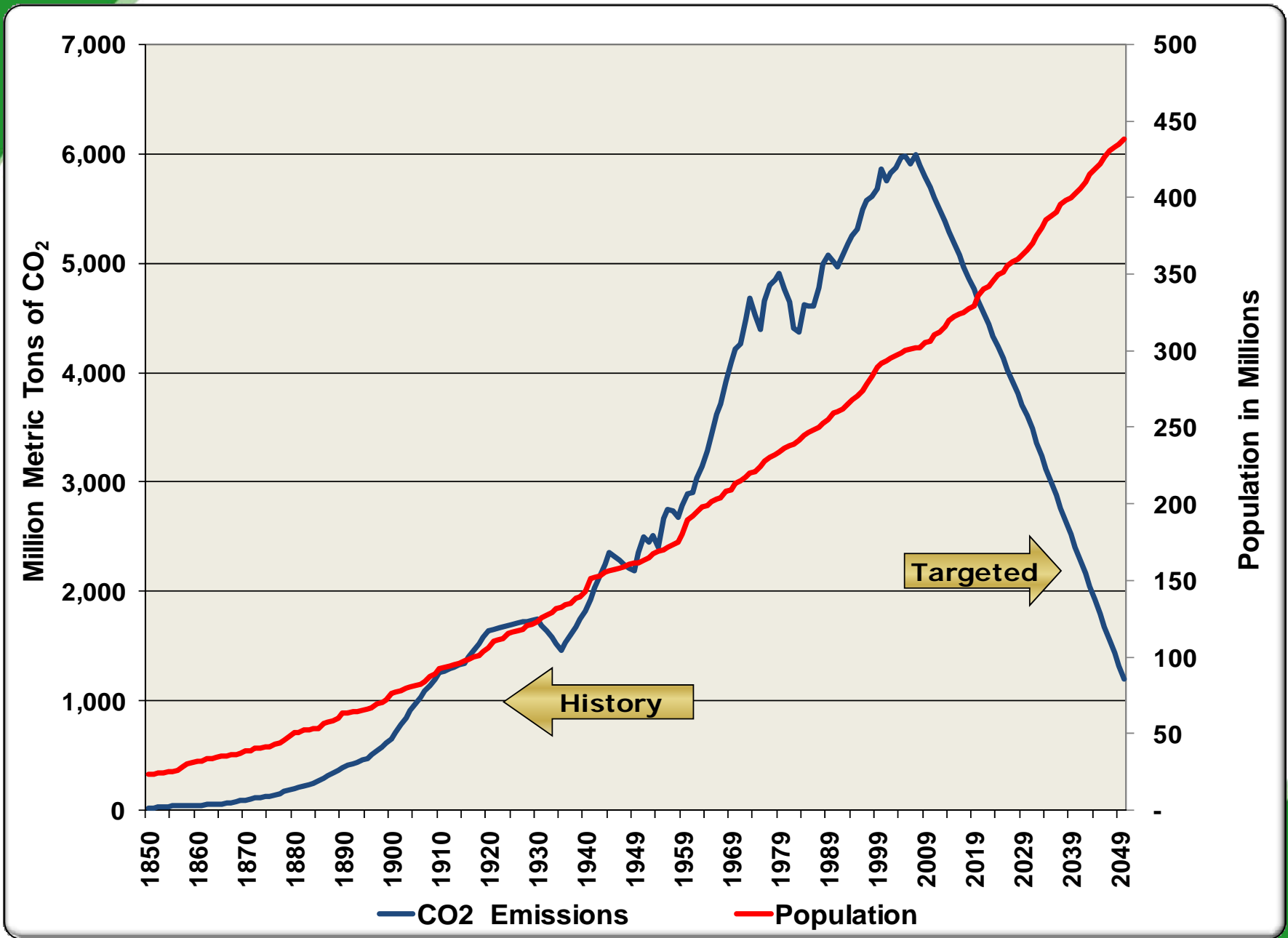
- **Economic-**

**“Each policy we pursue is driven by a larger vision of America’s future – a future where sustained economic growth creates good jobs and rising incomes” (President Obama)**

- **Technological**

**“I believe we must make it our goal to advance carbon capture and storage technology to the point where widespread, affordable deployment can begin in 8 to 10 years” (Steven Chu, Secretary of Energy)**

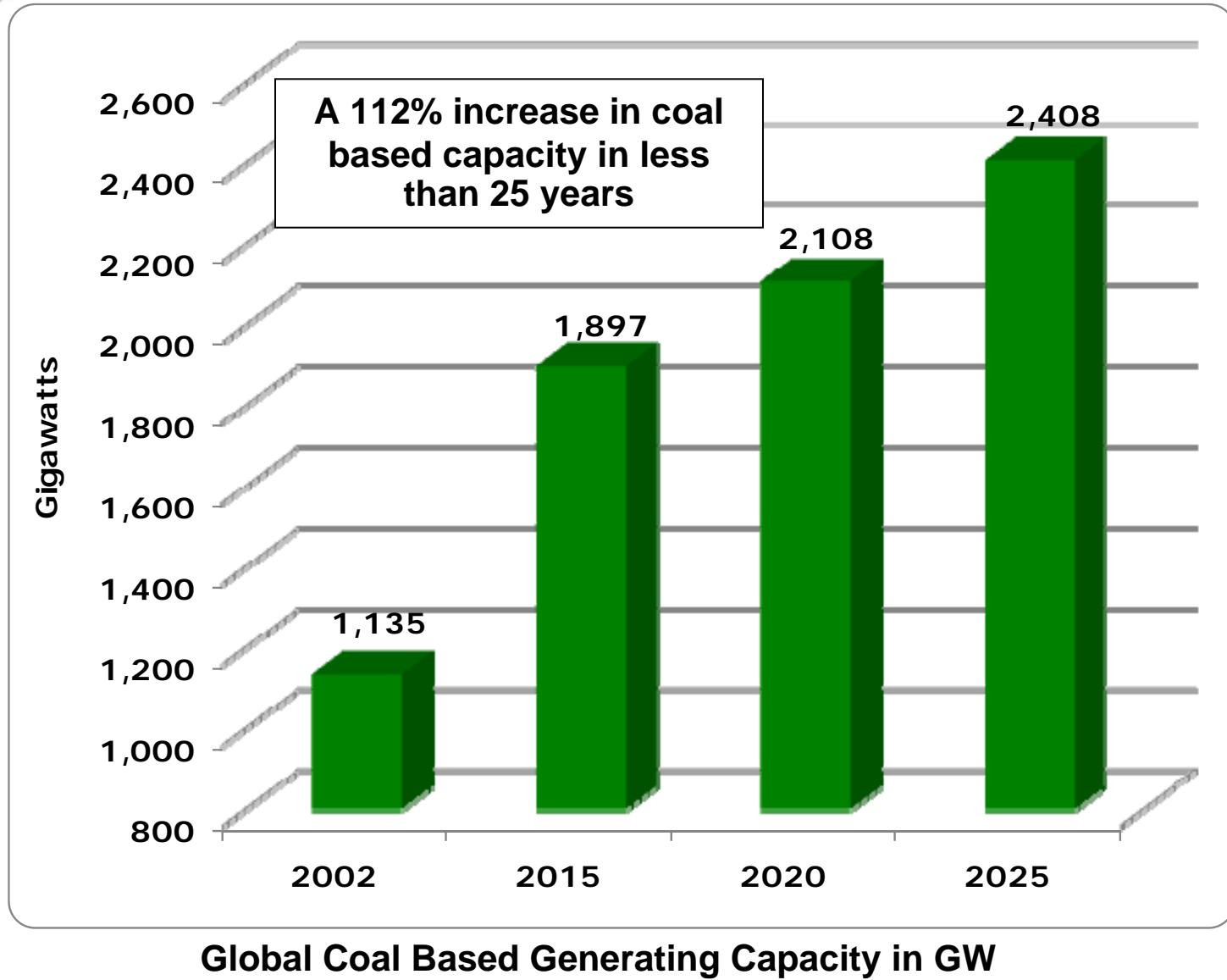
# The Scale of the Challenge



# NCC Reports Have Led the Way

- **2000 -- “It is imperative that CO<sub>2</sub> sequestration and generation efficiency become high priorities...”**
- **2003 -- “The Department should expedite research on a wide range of CO<sub>2</sub> capture options...”**
- **2006 -- “The U.S. must develop strategies to adopt CCS technologies...”**
- **2007 -- “... efforts (should) move forward quickly on a portfolio of technologies to reduce or capture and store carbon dioxide emissions.”**
- **2008 -- “CCS technologies must be developed and made commercially available.”**

# Why Retrofit with CCS is so Critical



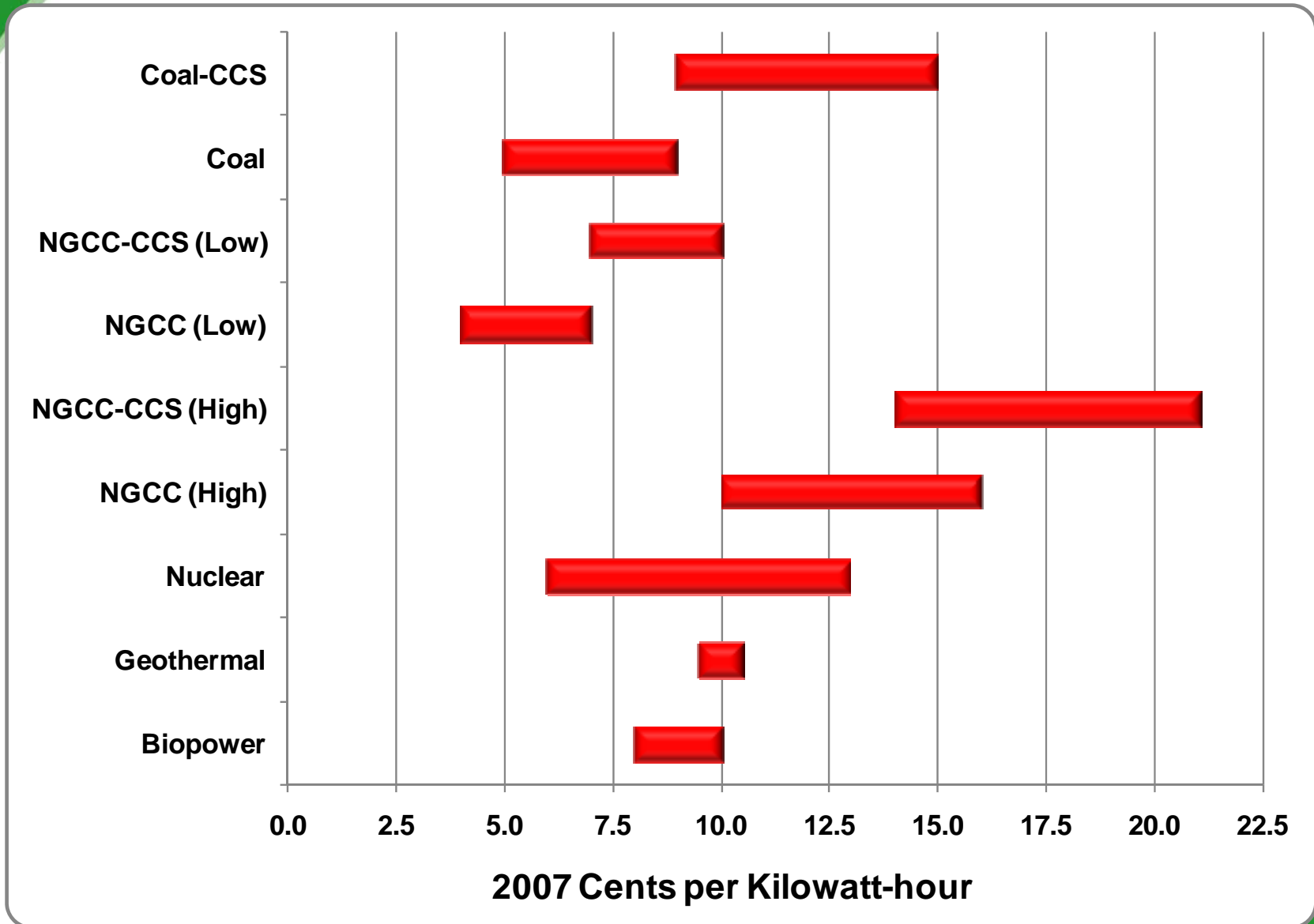
Source: IEA, 2009



## **The U.S. and China are Emerging as Global Leaders in CCS:**

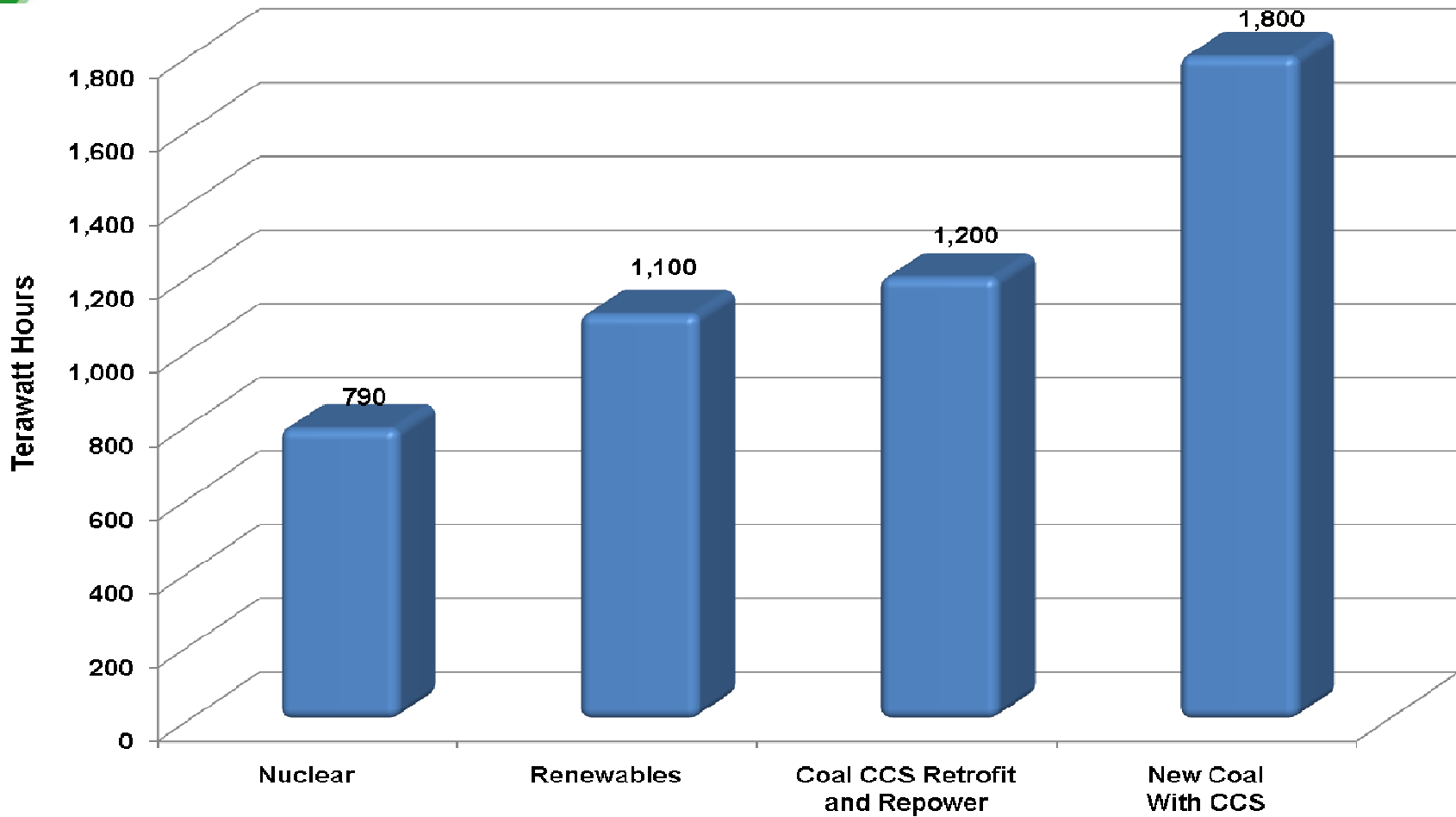
- **"The two sides strongly welcomed work in both countries to promote 21st century coal technologies... and to begin work immediately on the development, deployment, diffusion, and transfer of CCS technology. The two sides welcomed recent agreements between Chinese and U.S. companies, universities, and research institutions to cooperate on CCS and more efficient coal technologies" Joint Statement by President Obama and President Hu Jintao, November 2009**
  - **A key indicator of this cooperation is the recent agreement between companies in the U.S. and China regarding the construction of GreenGen-- a coal-based CCS facility in Tianjin.**
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## The NRC Identified Coal-based generation with CCS to be a low cost, low carbon alternative

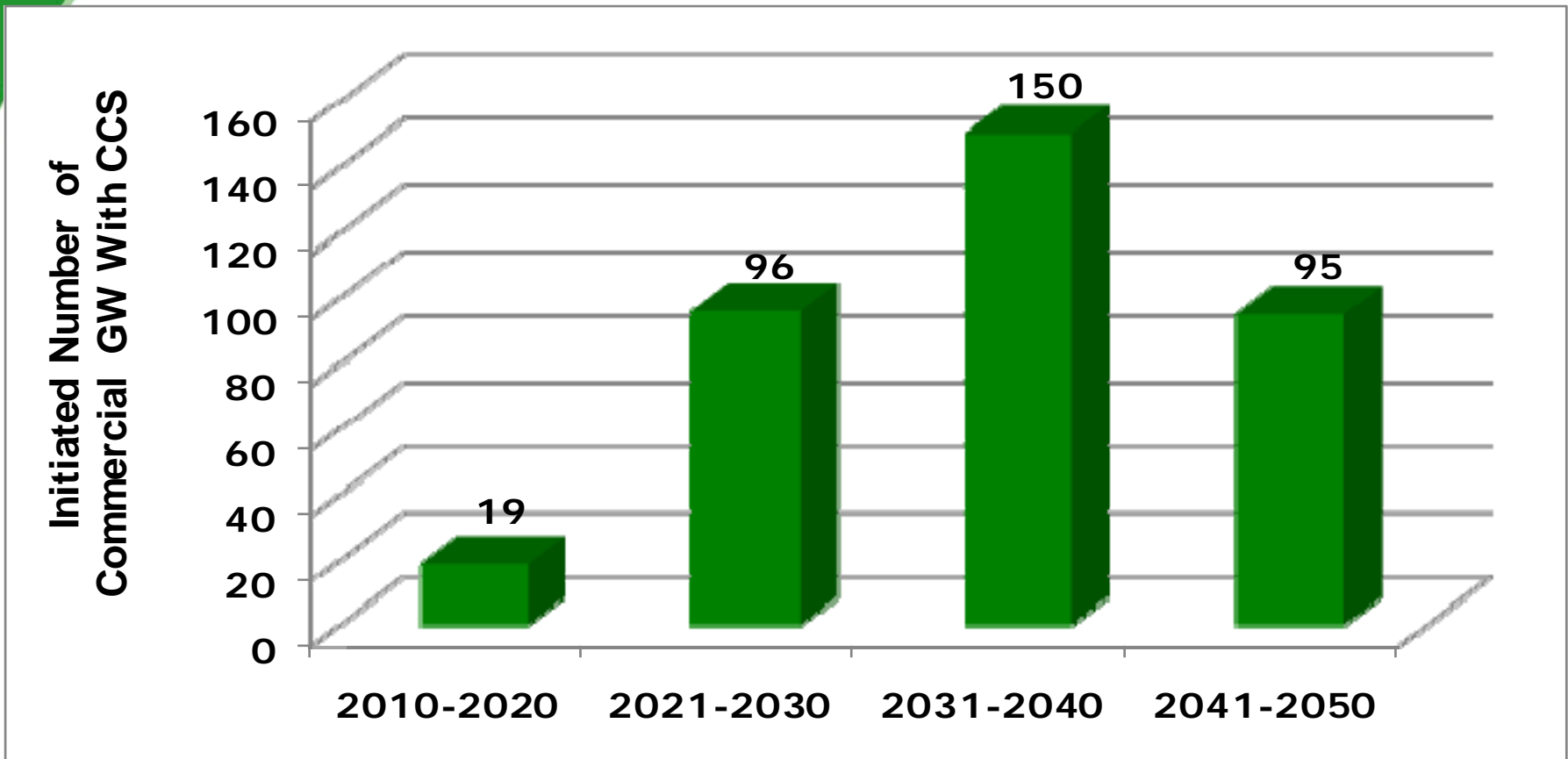




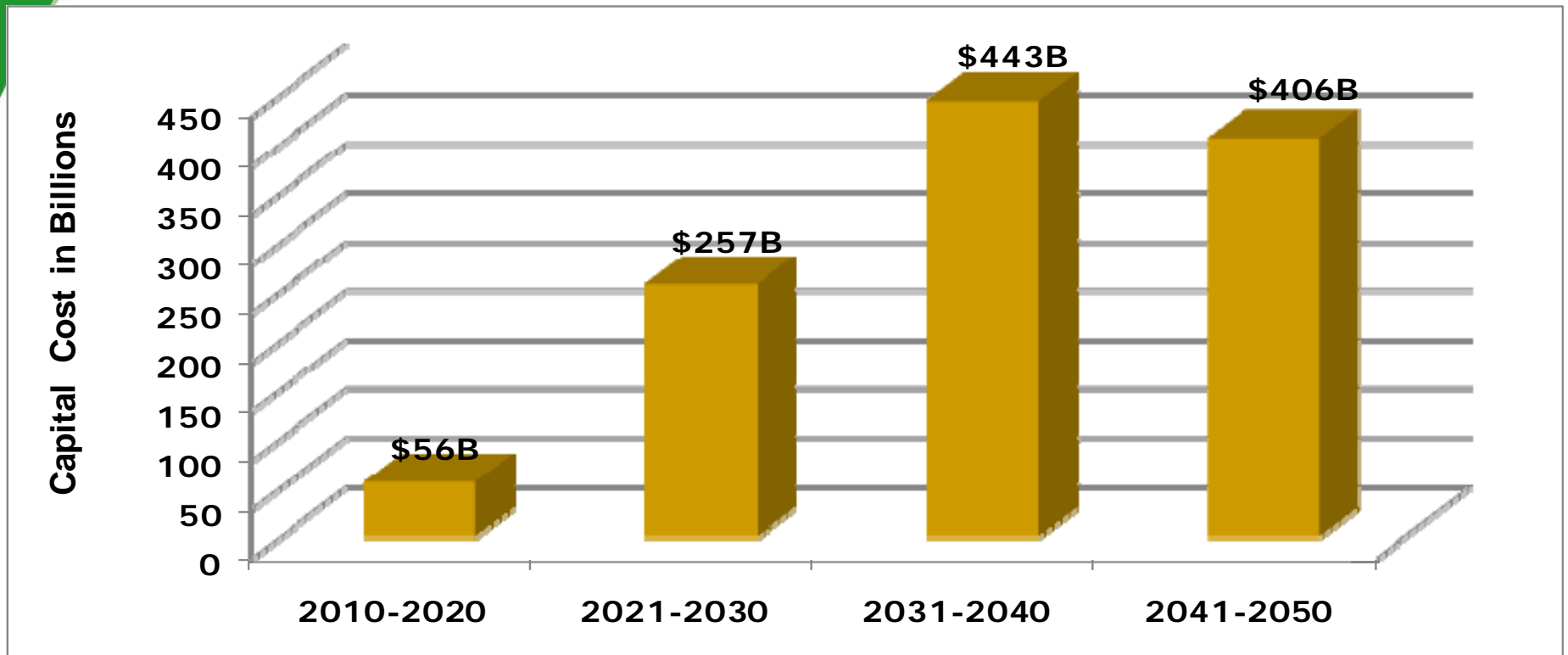
**"In combination, the entire existing coal power fleet could be replaced by CCS coal power" NRC, 2009**



## Based on the NRC Assessment , A Potential Deployment Pattern of 360 GW of Coal With CCS

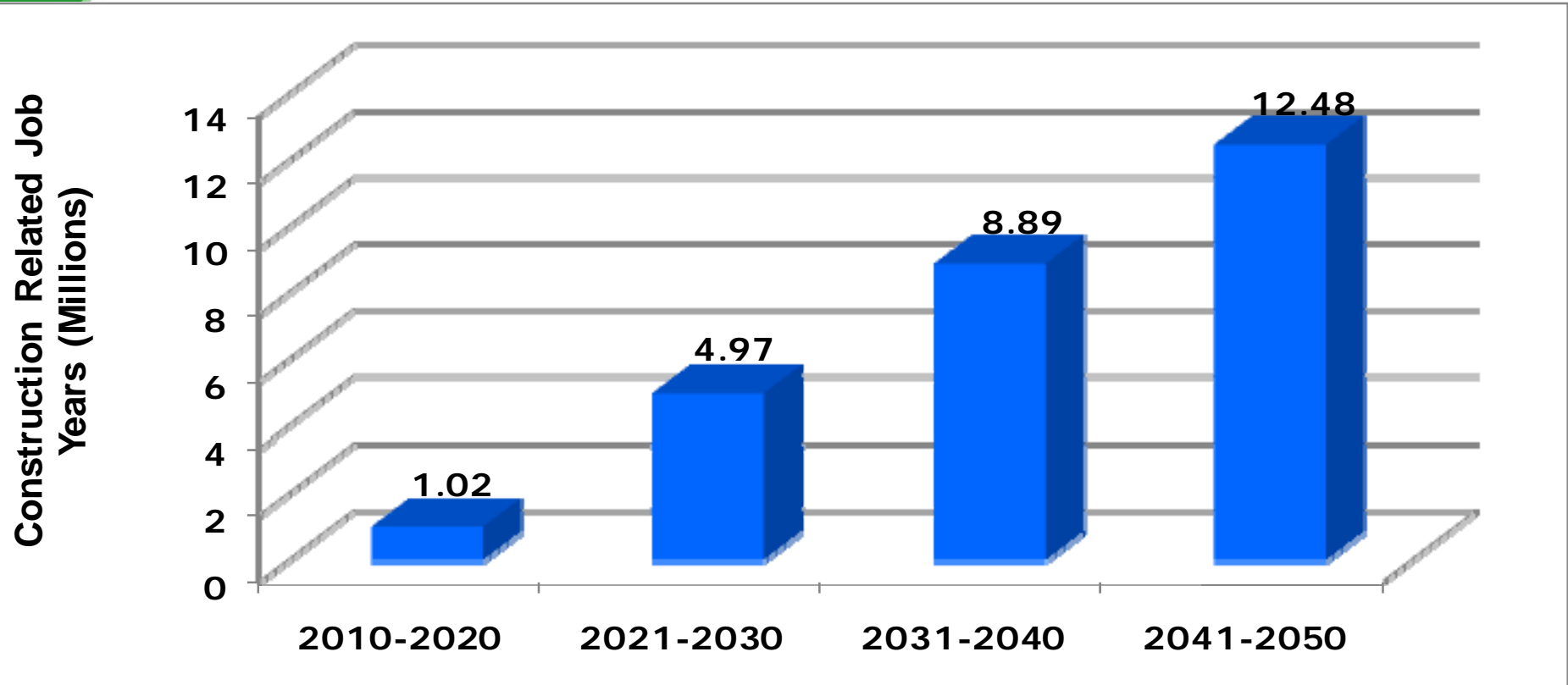


# Capital Expenditures by Decade for Coal-based Generation with CCS

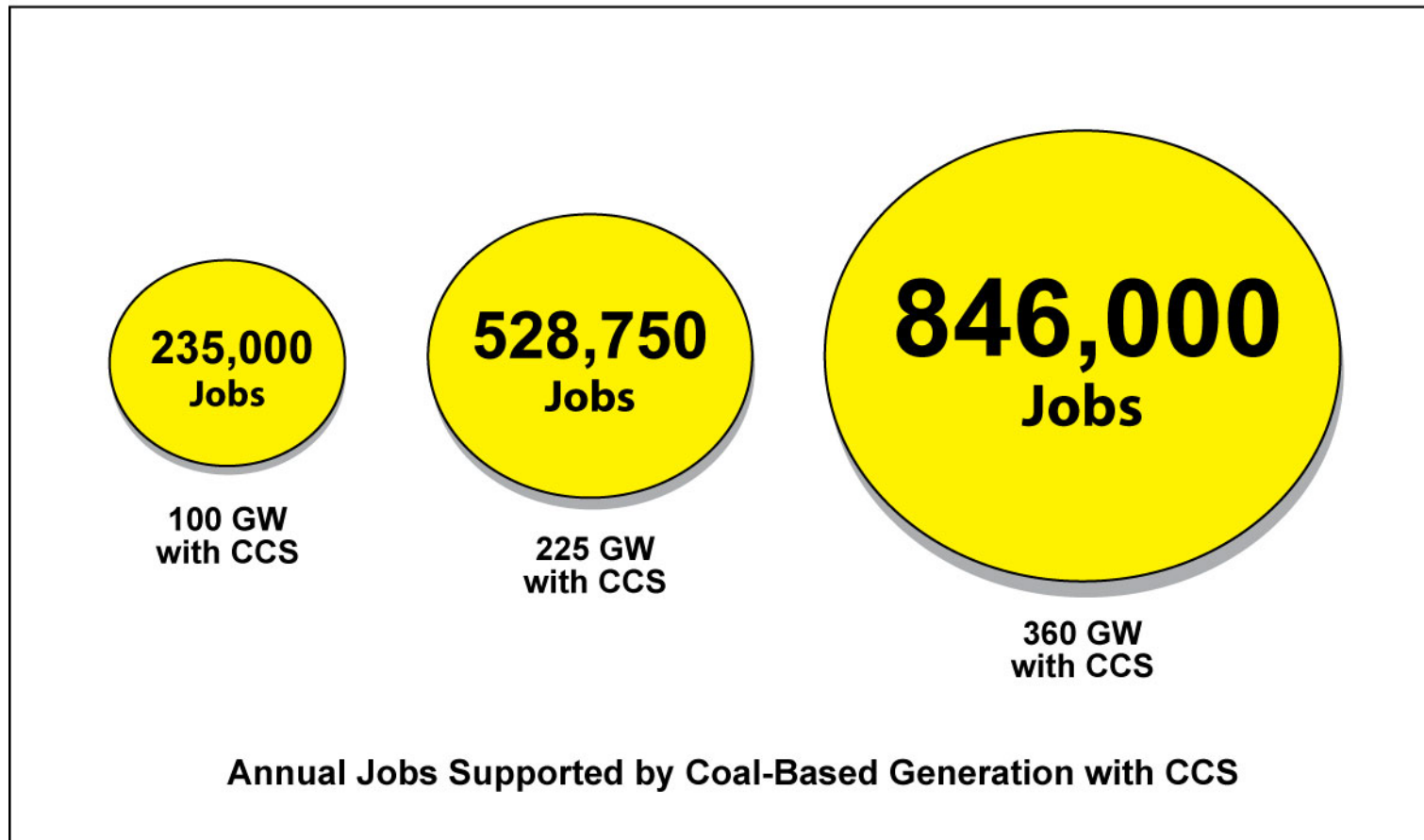


**Billion 2007 dollars**

# Construction Related Job Years by Decade for Projects with CCS

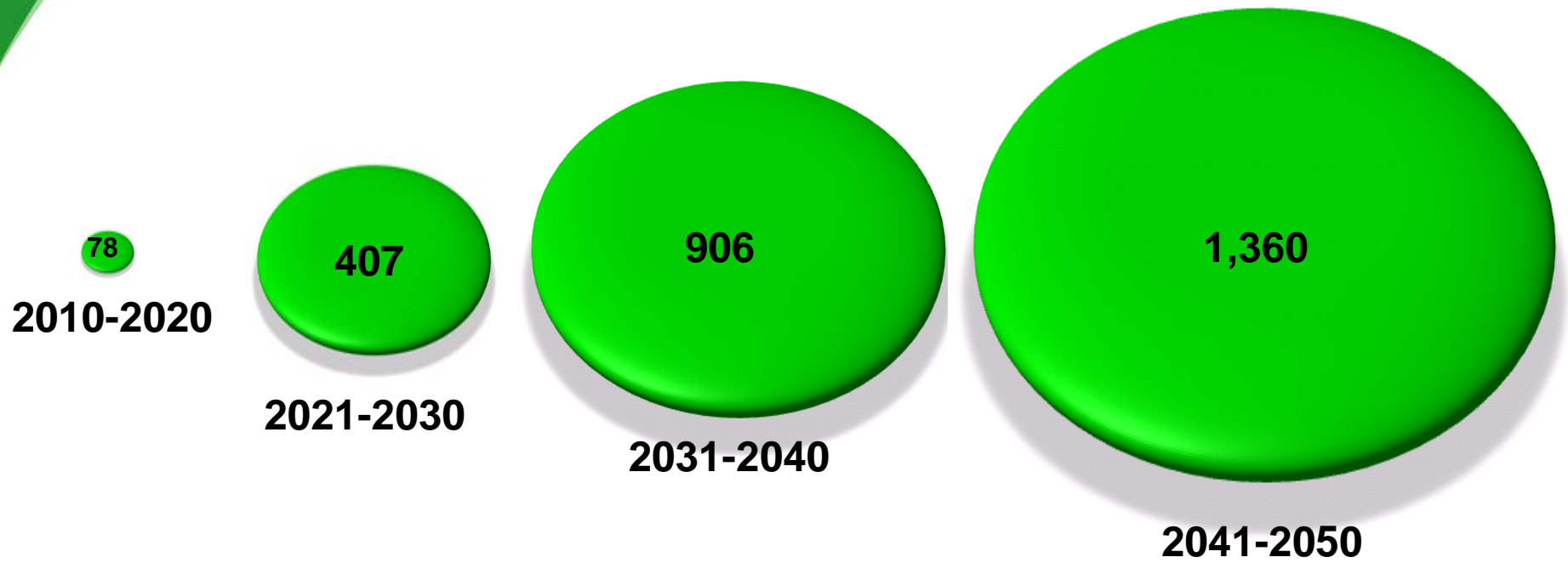


## Continuing Jobs for Generations of Americans



Source: BBC Research & Consulting

# GDP Increases Will Benefit America for Decades

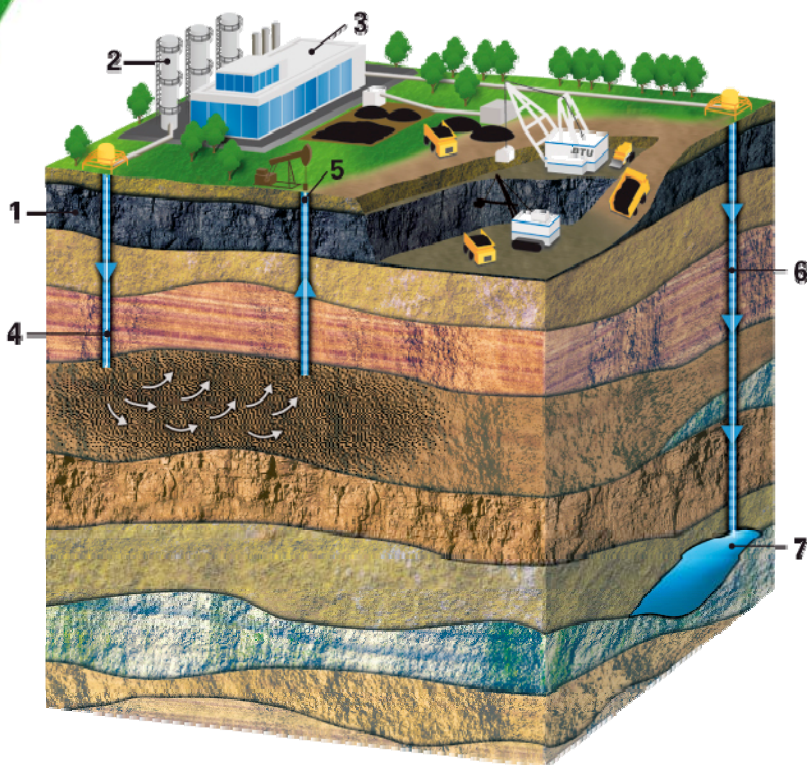


**Billion 2007 dollars**

# Enabling CO2-based EOR

## Coal's Carbon Content is a Competitive Advantage:

NETL found that “next generation” CO<sub>2</sub>-EOR technology will:



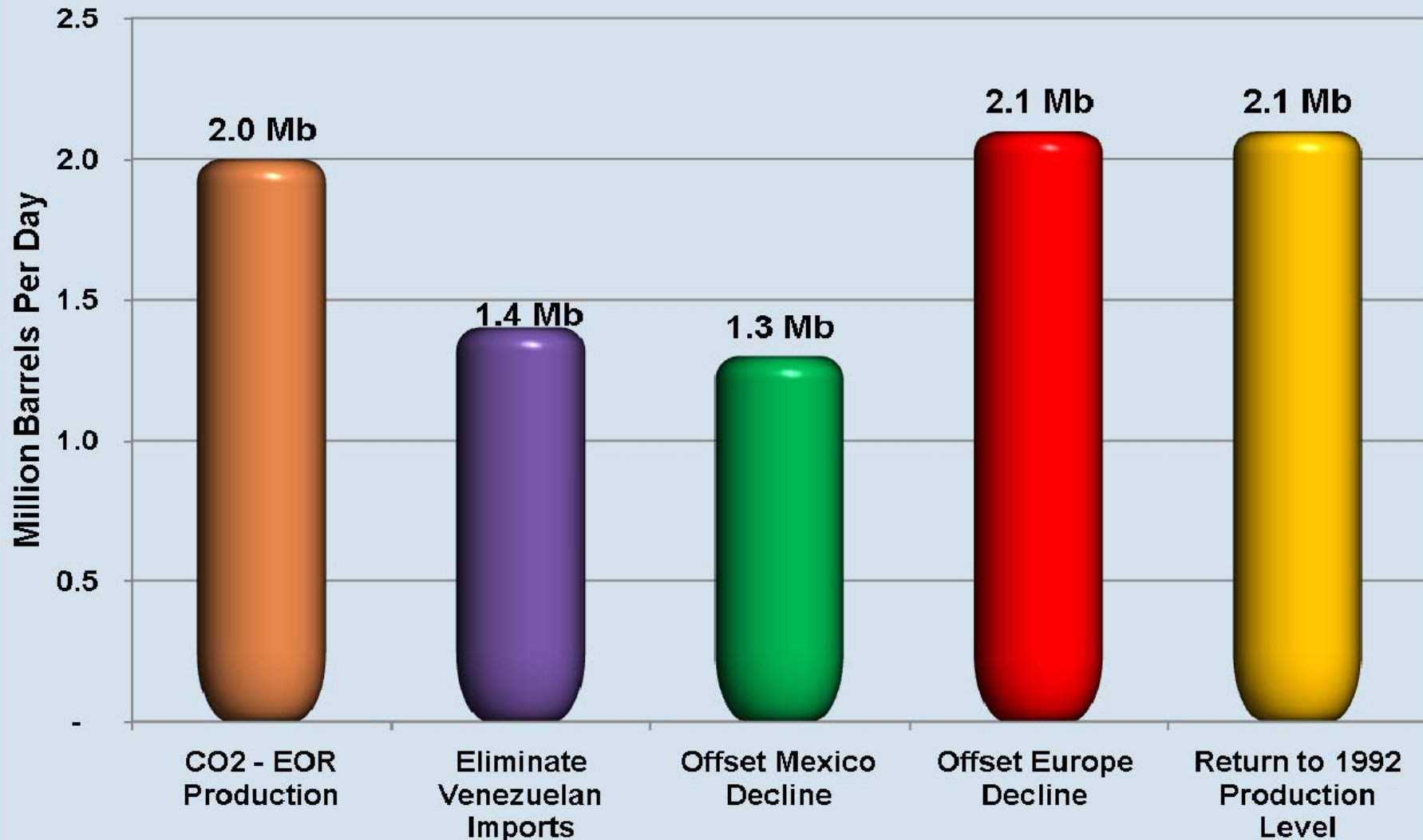
1. Clean Coal Fuel Supply  
2. Carbon Capture  
3. Electricity Production  
4. Carbon Dioxide Injection

5. Enhanced Oil Recovery  
6. Carbon Dioxide Injection  
7. Saline Aquifer Storage

- Provide access to 70 billion barrels of economically recoverable oil
- Create enough demand for CO<sub>2</sub> to offset the emissions of 70 GW of coal based generation for 30 years
- Yield oil that is 50-80% “carbon free”

Two million barrels of oil per day from EOR would require CO<sub>2</sub> from 360 million tpy of coal.

# What Two Million Barrels a Day from CO<sub>2</sub>- EOR Would Do







# Time is of the Essence

**“The next 10 years will be critical for CCS development ...If these demonstration projects do not materialize in the near future, it will be impossible for CCS to make a meaningful contribution to GHG mitigation efforts by 2030.” (International Energy Agency, 2009)**

**“The failure to successfully demonstrate the viability of these technologies during the next decade will greatly restrict options to reduce CO<sub>2</sub> emissions from the electricity sector... the urgency of getting started on these demonstrations to clarify future deployment options cannot be overstated” (National Research Council, 2009)**

