



“Pathways to Greenhouse Gas Stabilization”

Carbon Sequestration Program



**US DOE PROGRAMMES
SUMMARY
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Energy for the New Millennium

Carbon Sequestration Program Structure

Core R&D

Separation and Capture of CO₂

Sequestration

- Direct CO₂ storage
- Enhanced natural sinks

Break-through Concepts

Measurement Monitoring & Verification

Non-CO₂ GHG Control



Infrastructure

4-10 Regional Partnerships

- Engage regional, state, local government entities
- Determine benefits of sequestration to region
- Baseline region for sources and sinks
- Establish monitoring and verification protocols
- Address regulatory, environmental, outreach issues
- Test sequestration technology at small scale

Demonstration

Integrated Power/ Sequestration Demo(s)

- First-of-kind integrated project
- Verify large-scale operation
- Highlight best technology options
- Verify performance & permanence
- Develop accurate cost/ performance data
- International showcase



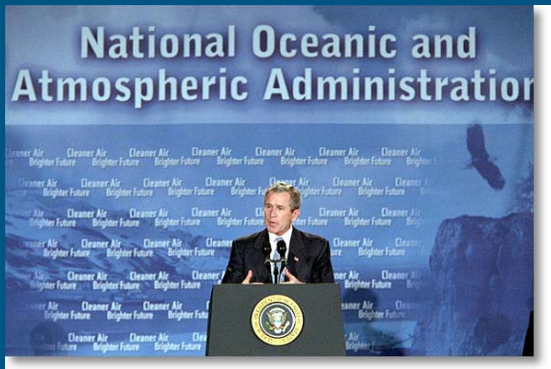
NEP and GCCI Drive Carbon Sequestration Program

National Energy Policy

- “Development of new technologies”
- “Identify market mechanisms and incentives “
- “Cooperate with allies”... international collaboration

Global Climate Change Initiative

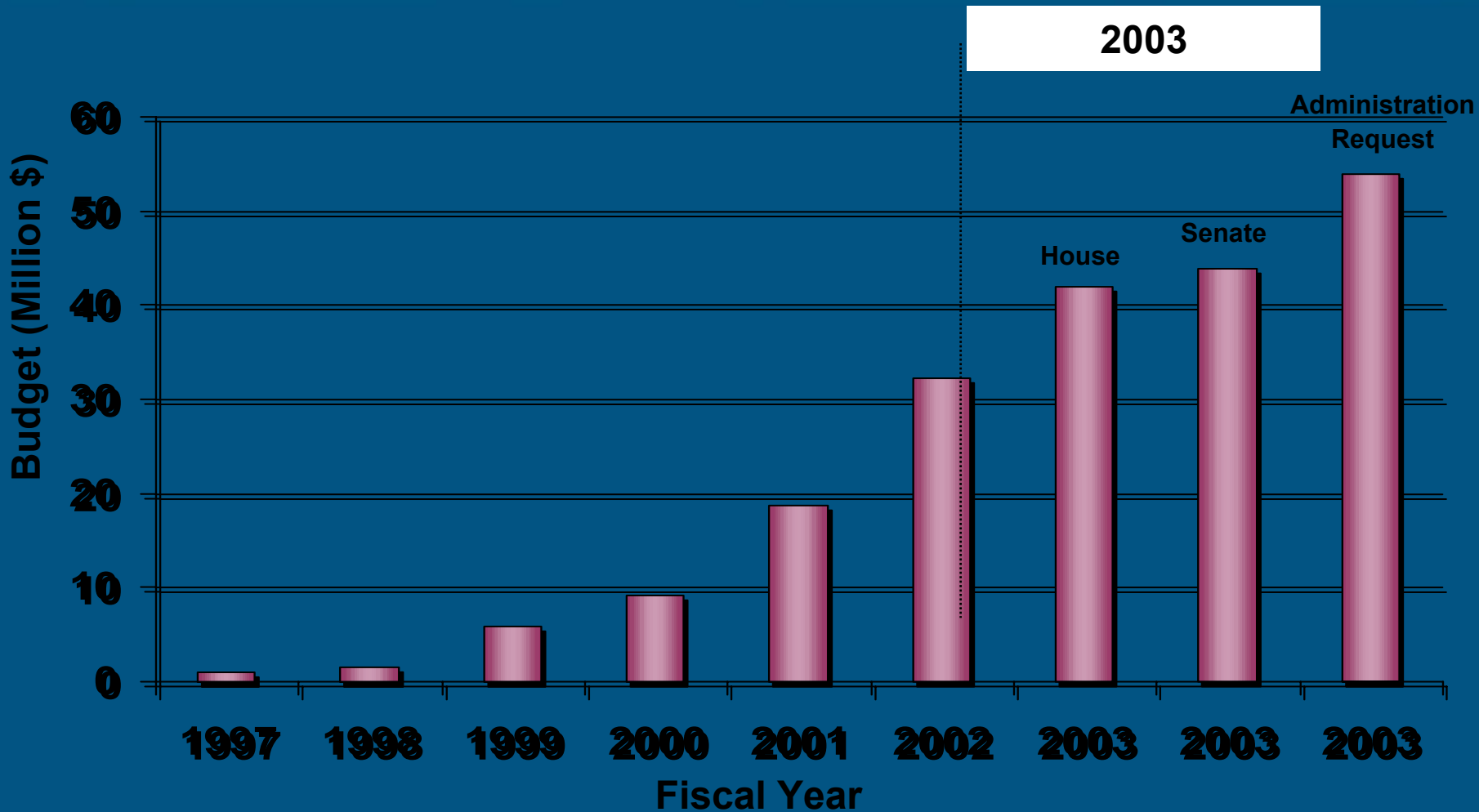
- “Sustain economic growth”
- “Reduce GGI by 18% in the next ten years”
- “Set a path to slow GHG emissions, and as science justifies - stop and then reverse that growth”



**President Bush
February 14, 2002**

White House photo: Paul Morse

Carbon Sequestration Budget



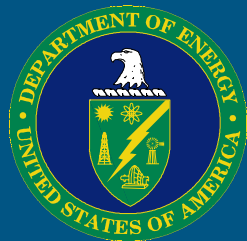
U.S. Department of Energy Clean Coal Programs



Vision 21

The Zero Emissions Power Plant of the Future

November 2002



Vision 21



- ◆ Virtually pollution free
 - ◆ Sulfur/nitrogen pollutants converted to chemicals, fertilizers, etc.
- ◆ Double power efficiencies
 - ◆ 60%+ (compared to 33% today), Reduces CO₂ emissions by 40%
- ◆ Multiple products
 - ◆ Combined heat and power, plus liquid fuels/chemicals boosts overall efficiencies to 80%+

Today

2005

2010

2015

**Adv. Pulverized &
Fluidized Combustors**

**Gasification
Combined Cycle**

Gas Turbines

Emission Controls

Fuel Preparation

Liquid Synthesis

**Ultra-Super Critical
Steam Systems**

**High Performance
Heat Exchangers**

**Membrane/Other
Gas Separation**

**Fuel Flexible Gasifiers and
Gas Turbine/Fuel Cells**

Carbon Sequestration R&D

**Hybrid Gasifier/Combustor, Fuel
Cell/Turbine Systems**

Advanced Emission Controls

Liquids/Heat Coproduction

CO₂ Capture

Carbon Sequestration



Vision 21 *Public Benefits*

- ☰ **Increases electricity supply and reduces costs**
 - Resolves environmental issues and mitigates plant siting concerns
 - Enables continued use of low-cost, secure domestic coal
- ☰ **Eases transition to carbon-constrained environment with minimal economic disruption**
 - Vision 21 plants designed to allow for affordable CO₂ separation and capture
- ☰ **Provides near-term spin-off technologies**
 - Advances in computer simulation and other technologies promote development of improved components for energy & other systems