

Carbon Sequestration



*Media Background Briefing
June 16, 2003*

*Scott Klara
Carbon Sequestration
Product Manager*

National Energy Technology Laboratory



Office of Fossil Energy



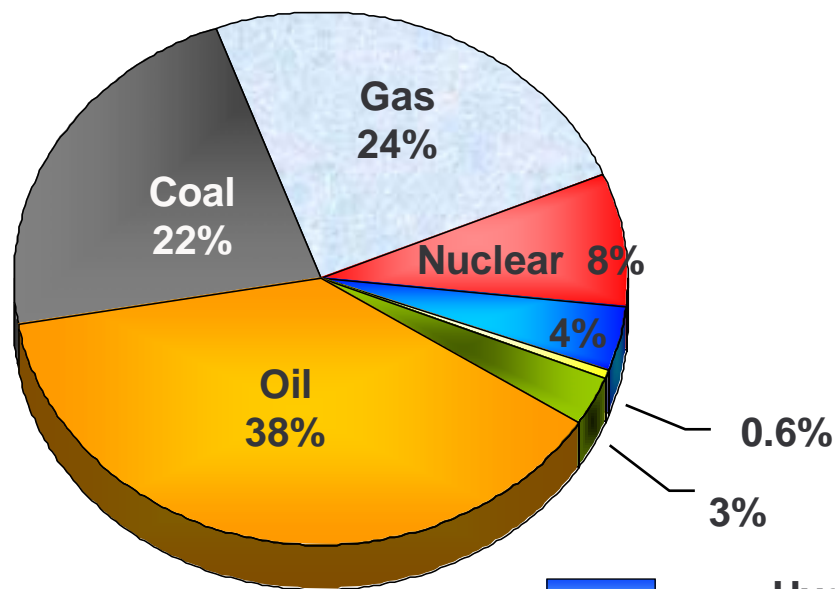
The Fossil Energy Situation



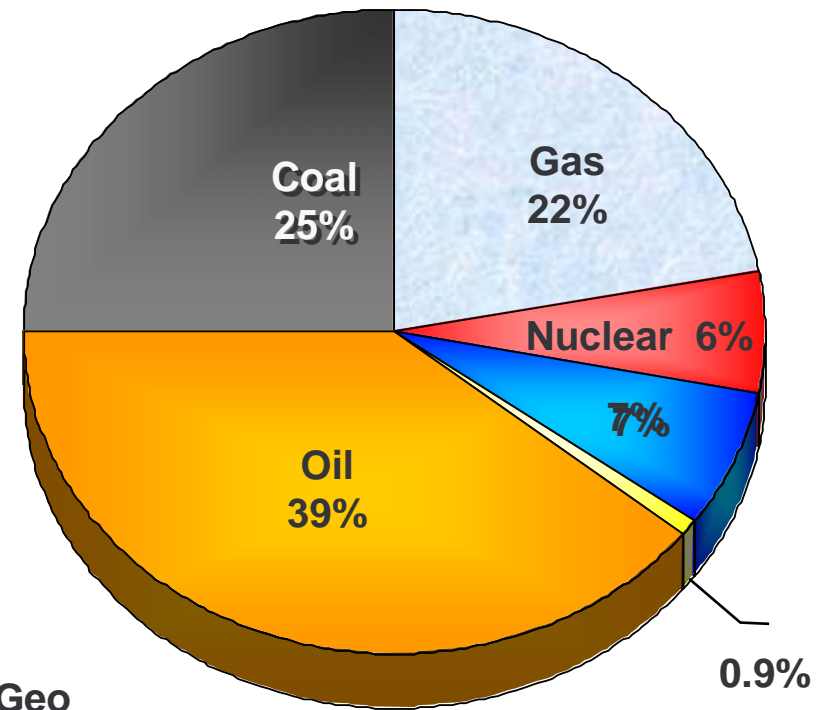
Fossil Fuels

World's Dominant Energy Source

United States
99 Qbtu/yr; 85% Fossil Energy



World
382 Quads/yr; 86% Fossil Energy



■ Hydro
■ Solar, Wind, Geo
■ Biomass

World Data from EIA96. Does not include non-grid-connected biomass.
U.S. Data from Table 2 of EIA REA 97 & AEO 2002 Table A2

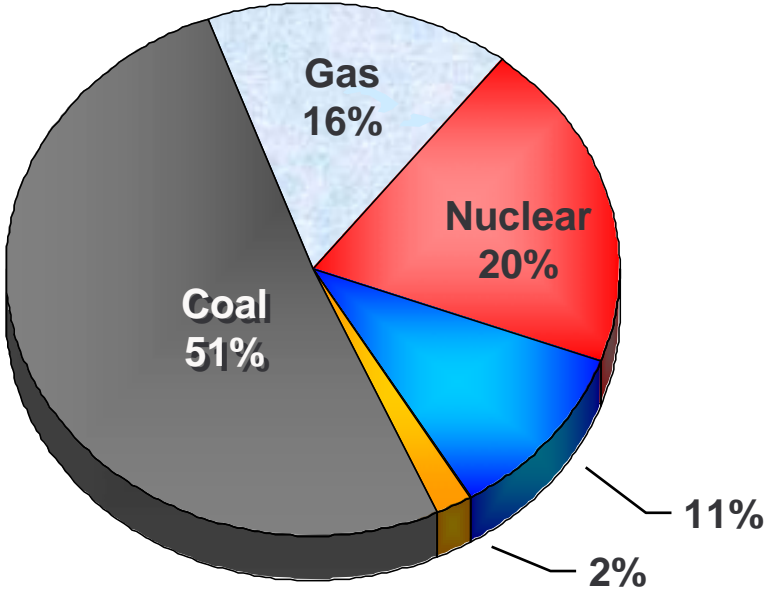


Fossil Fuels

World's Dominant Electricity Source

United States - 1999

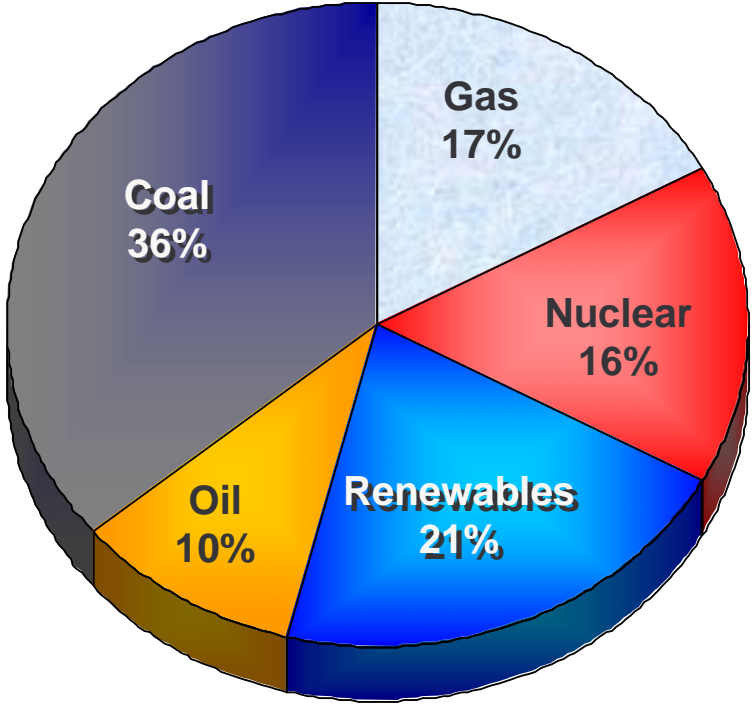
3.2 Trillion kWh - 69% Fossil Energy



Renewables
Oil

World - 1999

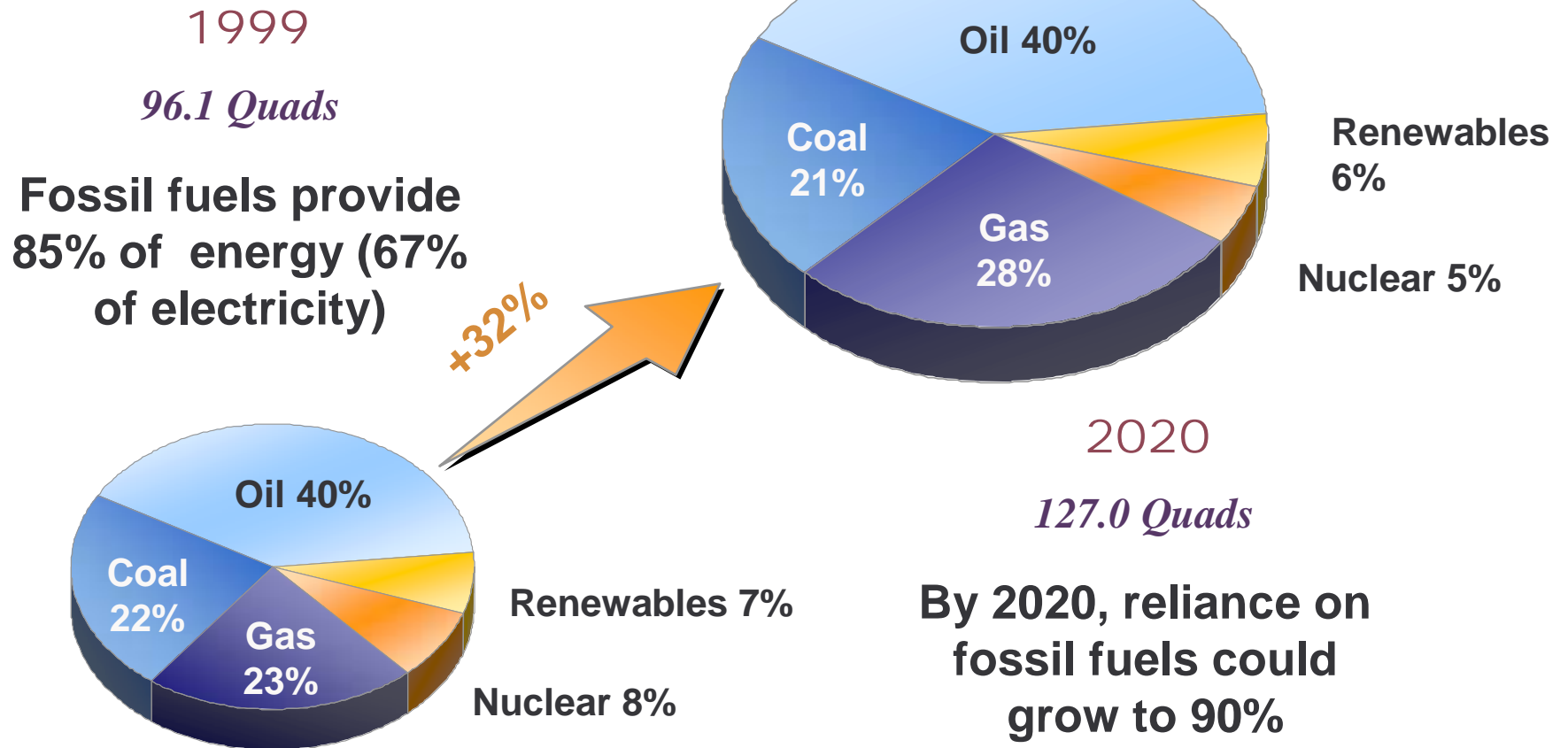
12.8 Trillion kWh - 63% Fossil Energy



Source: EIA International Energy Outlook 2001
Edison Electric Institute 2001



Fossil Energy - America's Energy Foundation

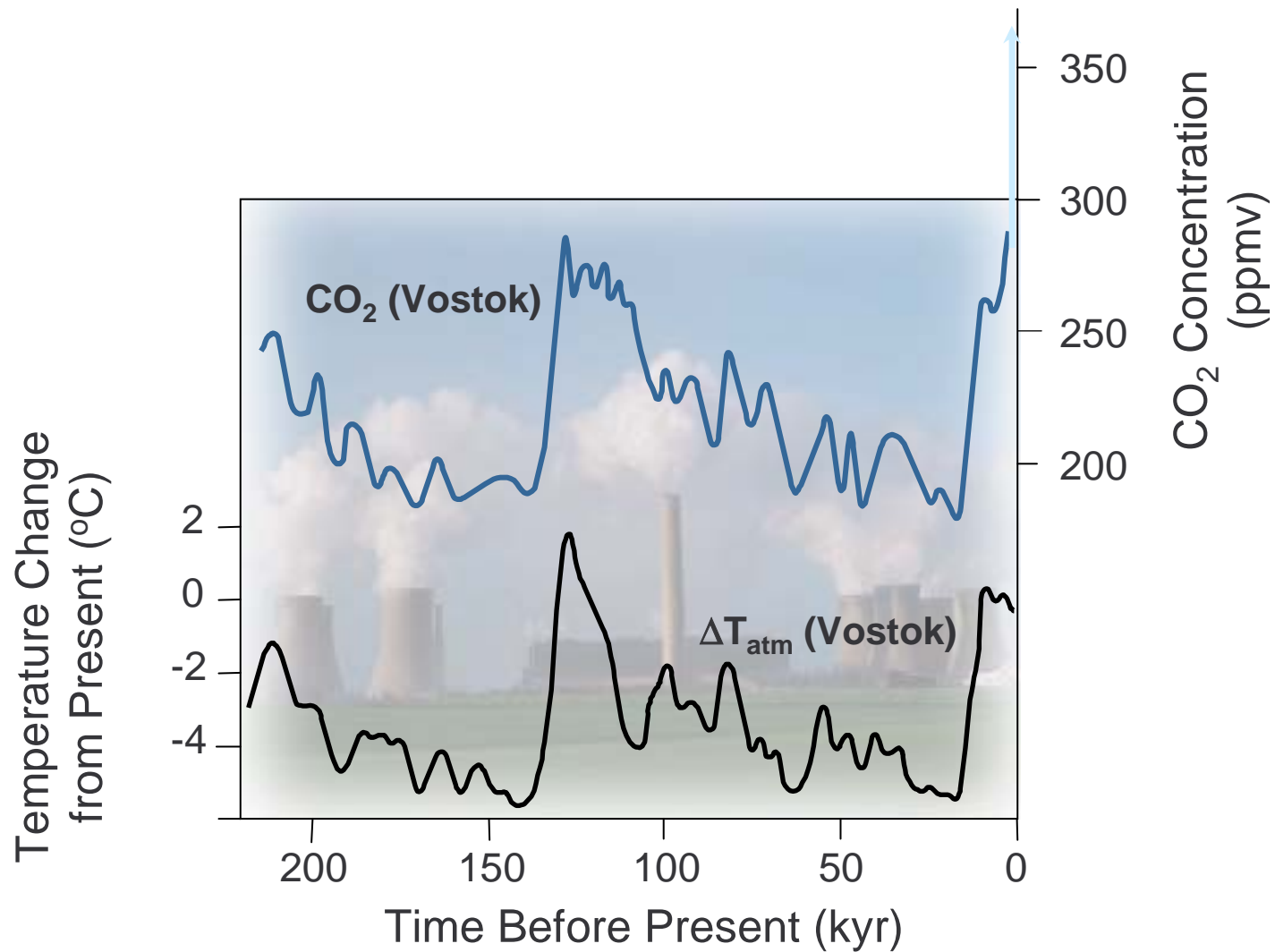


Greenhouse Gas Implications



CO₂ Concentrations On The Rise

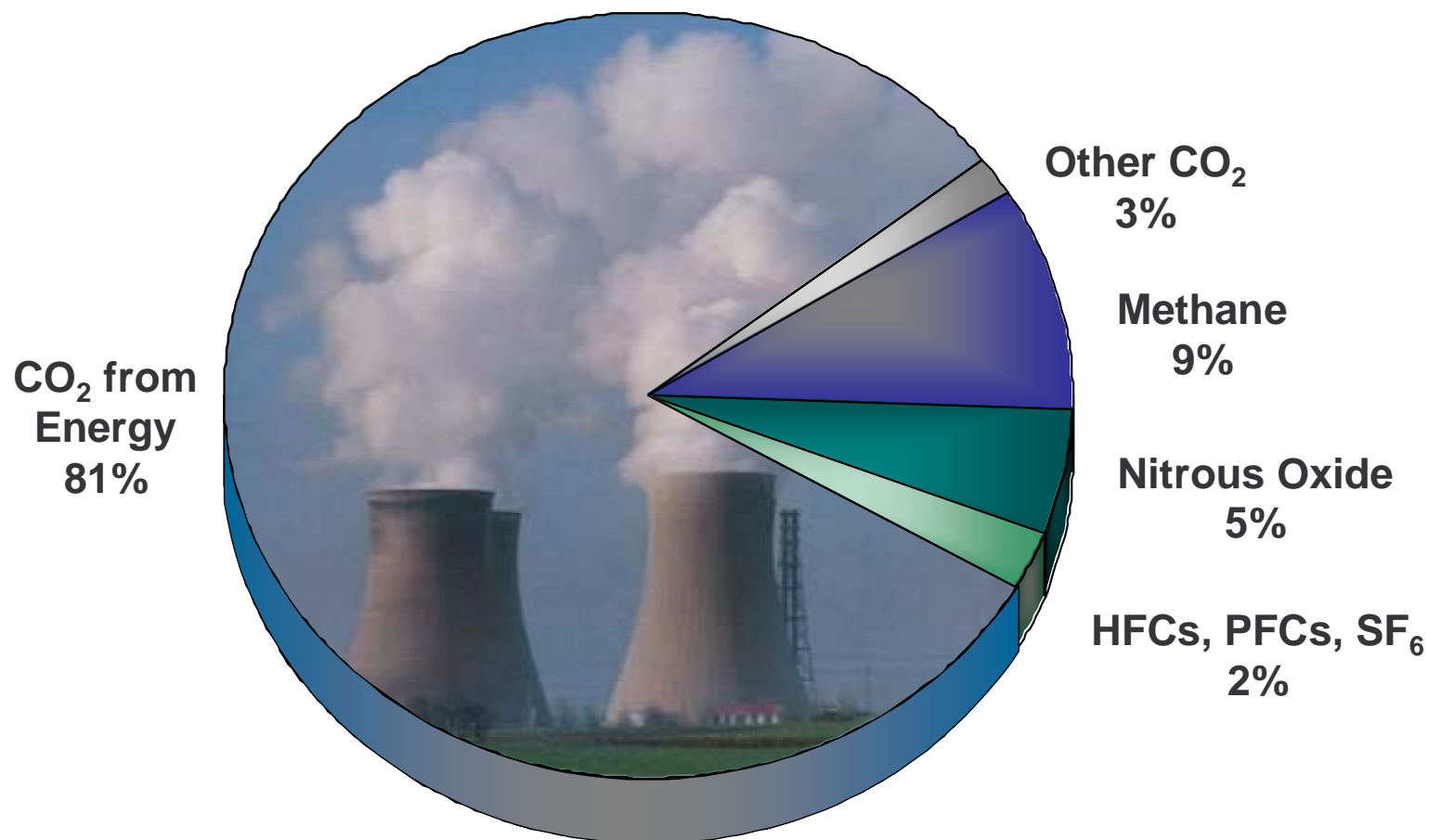
(~280 ppm to 370 ppm over last 100 years)



CO₂ & CH₄ - The Primary GHG Contributors

United States Greenhouse Gas Emissions

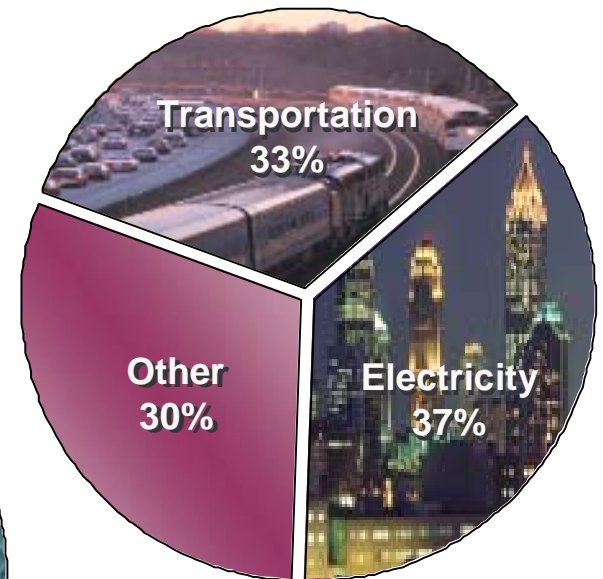
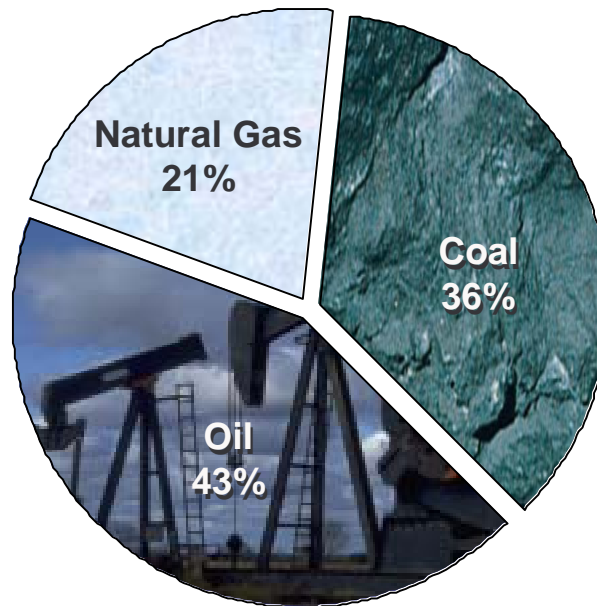
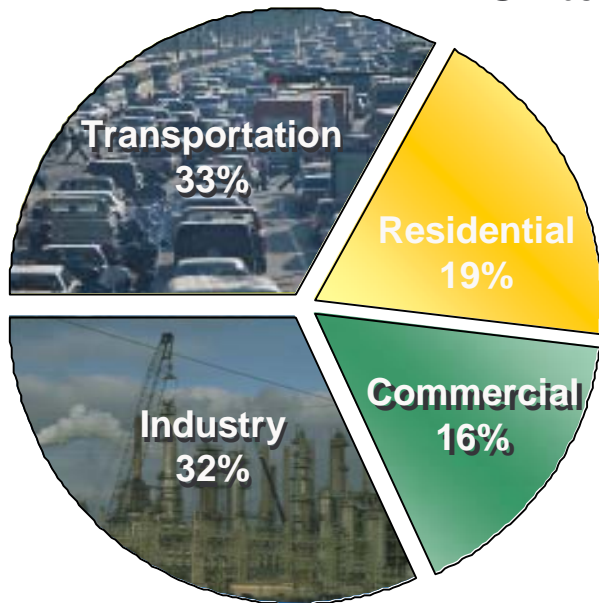
(Equivalent Global Warming Basis)



"EIA Emissions of Greenhouse Gases in the U.S.: 2000"

All Fossil Fuels & Energy Sectors Contribute CO₂ Emissions

United States Carbon Dioxide Emissions
(By Source & Sector)



Carbon Management & Carbon Sequestration

“Pathways to Greenhouse Gas Stabilization”



Technological Carbon Management Options

Reduce Carbon Intensity

- Renewables
- Nuclear
- Fuel Switching

Improve Efficiency

- Demand Side
- Supply Side

Sequester Carbon

- Capture & Store
- Enhance Natural Sinks

All options needed to:

- Affordably meet energy demand
- Address environmental objectives



Presidential Direction

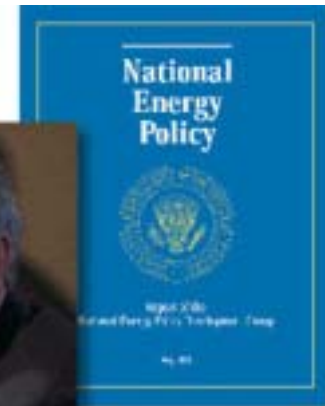
Current Drivers for Carbon Sequestration

NCCTI
June 11, 2001

- Third option for global climate change
- Enables continued use of domestic energy resources and infrastructure
- Geologic formations have potential for essentially unlimited storage capacity
- Demonstrated industry interest, participation, and cost-sharing in public/private partnerships
- “We all believe technology offer great promise to significantly reduce emissions -- especially carbon capture, storage and sequestration technologies.”

GCCI
February 14, 2002

- Sustain economic growth
- Reduce GHG intensity by 18% in next 10 years
- Reevaluate science & path in 2012



White House photo: Paul Morse

What is Carbon Sequestration?

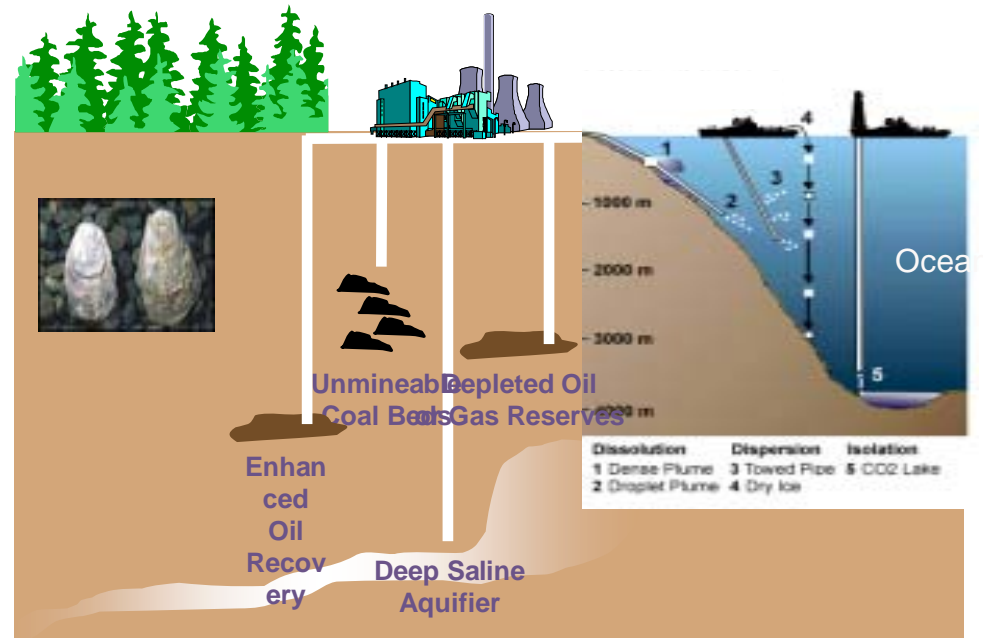
Capture and storage of CO₂ and other Greenhouse Gases that would otherwise be emitted to the atmosphere

Capture can occur:

- at the point of emission
- when absorbed from air

Storage locations include:

- underground reservoirs
- dissolved in deep oceans
- converted to solid materials
- trees, grasses, soils, or algae



Approaches to Sequester Carbon

Capture and Storage



Unmineable
Coal Seams



Ocean Uptake



Depleted Oil /
Gas Wells,
Saline Reservoirs



Mineral
Carbonation



Iron or Nitrogen
Fertilization of
Ocean

Enhance Natural Processes



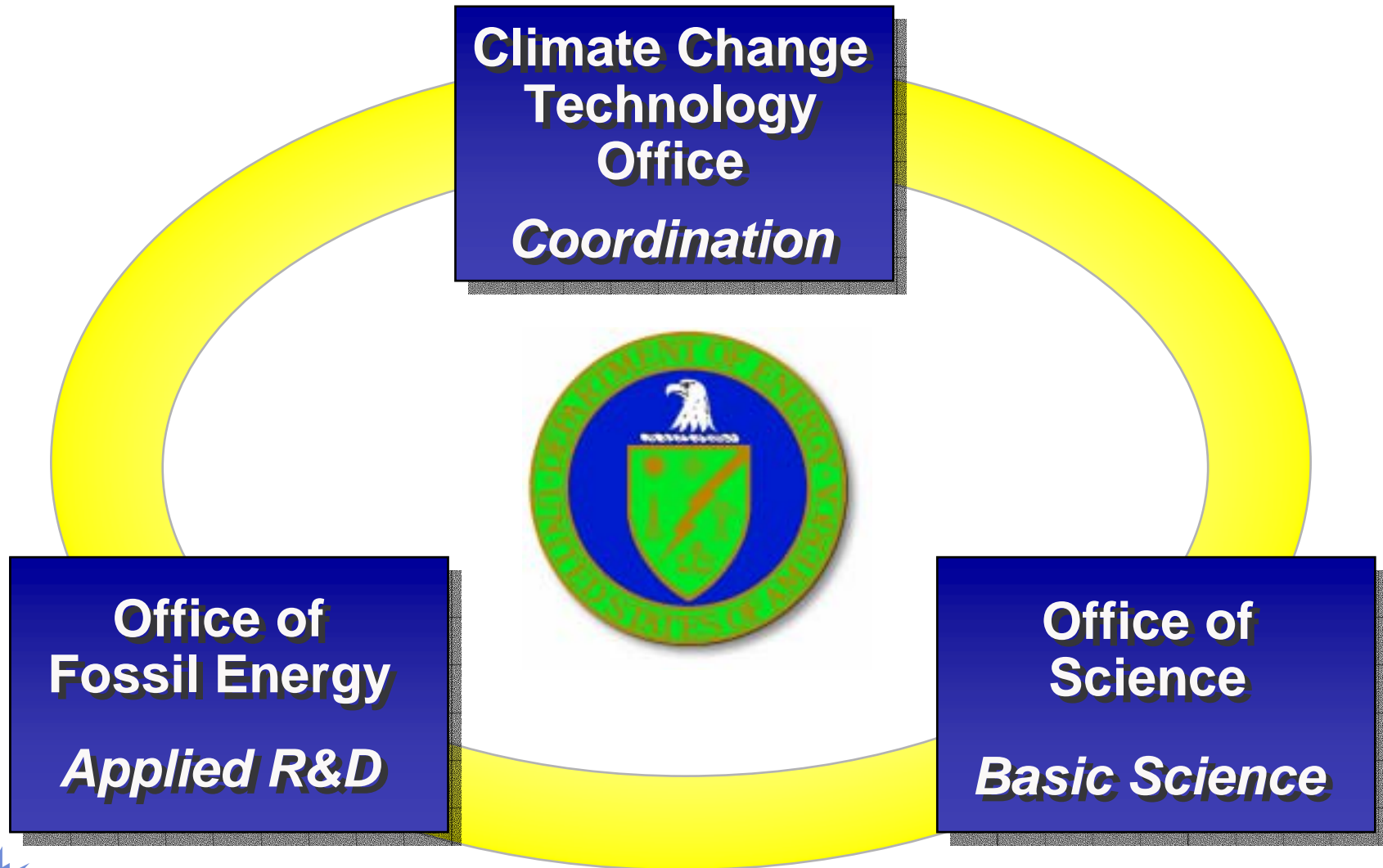
Forestation



Enhanced
Photosynthesis



Sequestration at DOE



Agencies Conducting Sequestration-Related Research

USGS

Geologic sequestration research

NASA

Space-based studies of earth as integrated system

EPA

Inventory of greenhouse gases

OSM

Carbon sequestration on abandoned mine sites



USAID

Tropical reforestation in developing countries

NOAA

Atmospheric and oceanic global observations

NSF

Science of CO₂ and N₂ cycles in oceans

USDA

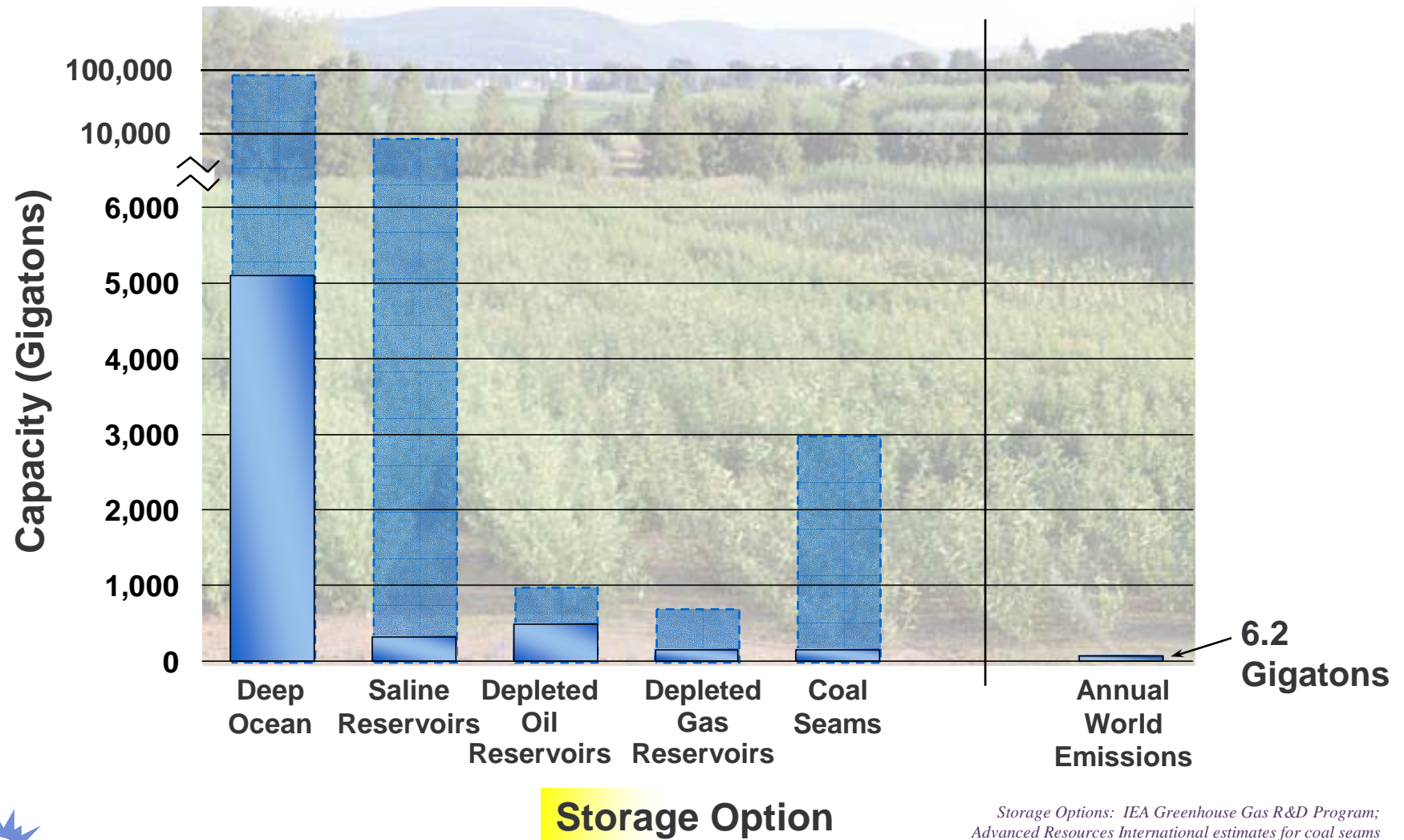
Terrestrial sequestration, soil carbon database, sequestration models

U.S. Dept. of State

Facilitate International collaboration and activities



Large Potential Worldwide Storage Capacity



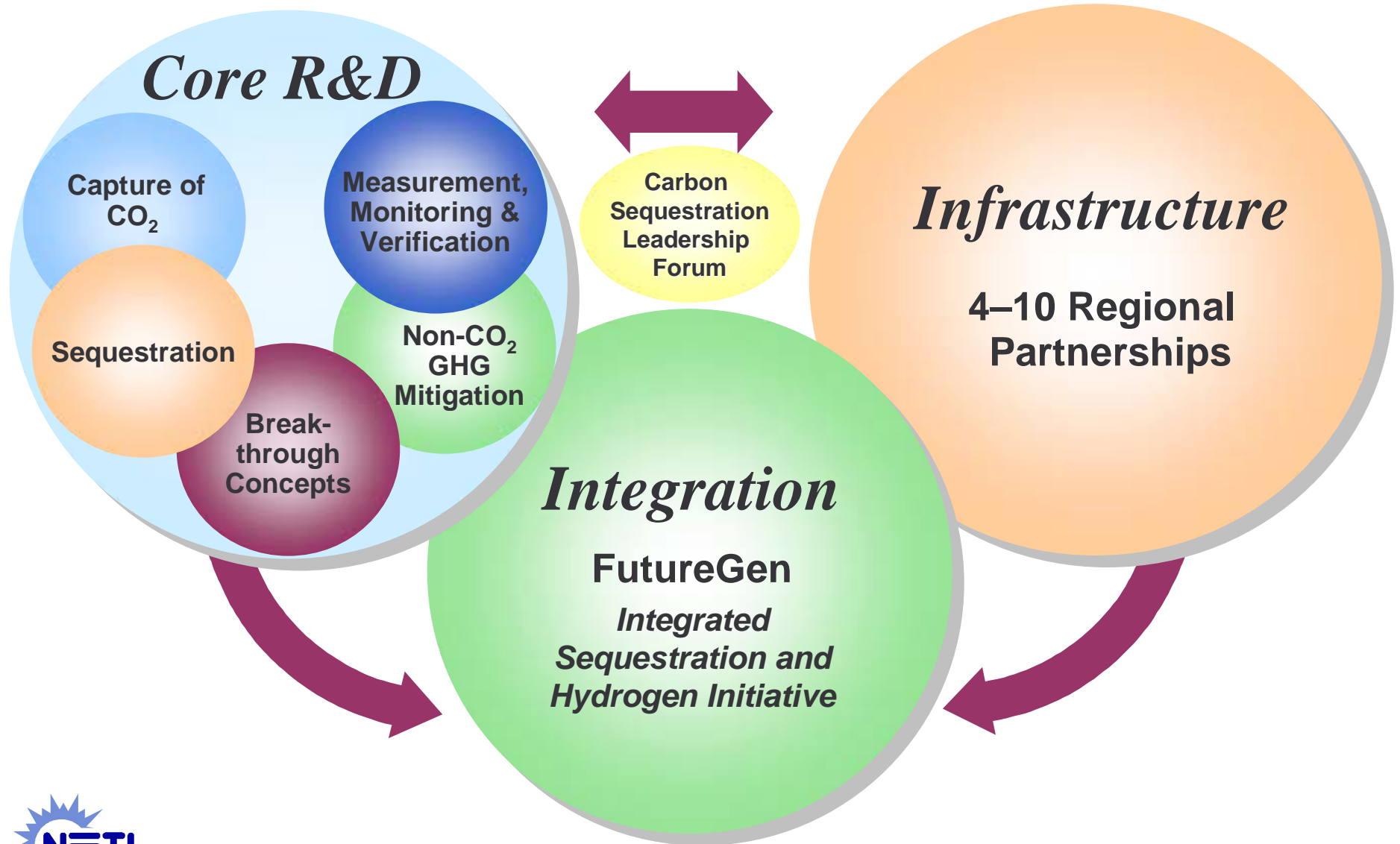
*Storage Options: IEA Greenhouse Gas R&D Program;
Advanced Resources International estimates for coal seams
World Emissions: International Energy Outlook 2000, Table A10*

Requirements for Sequestration

- **Environmentally acceptable**
 - No legacy for future generations
 - Respect existing ecosystems
- **Safe**
 - No sudden large-scale CO₂ discharges
- **Verifiable**
 - Ability to verify amount of CO₂ sequestered
- **Economically viable**

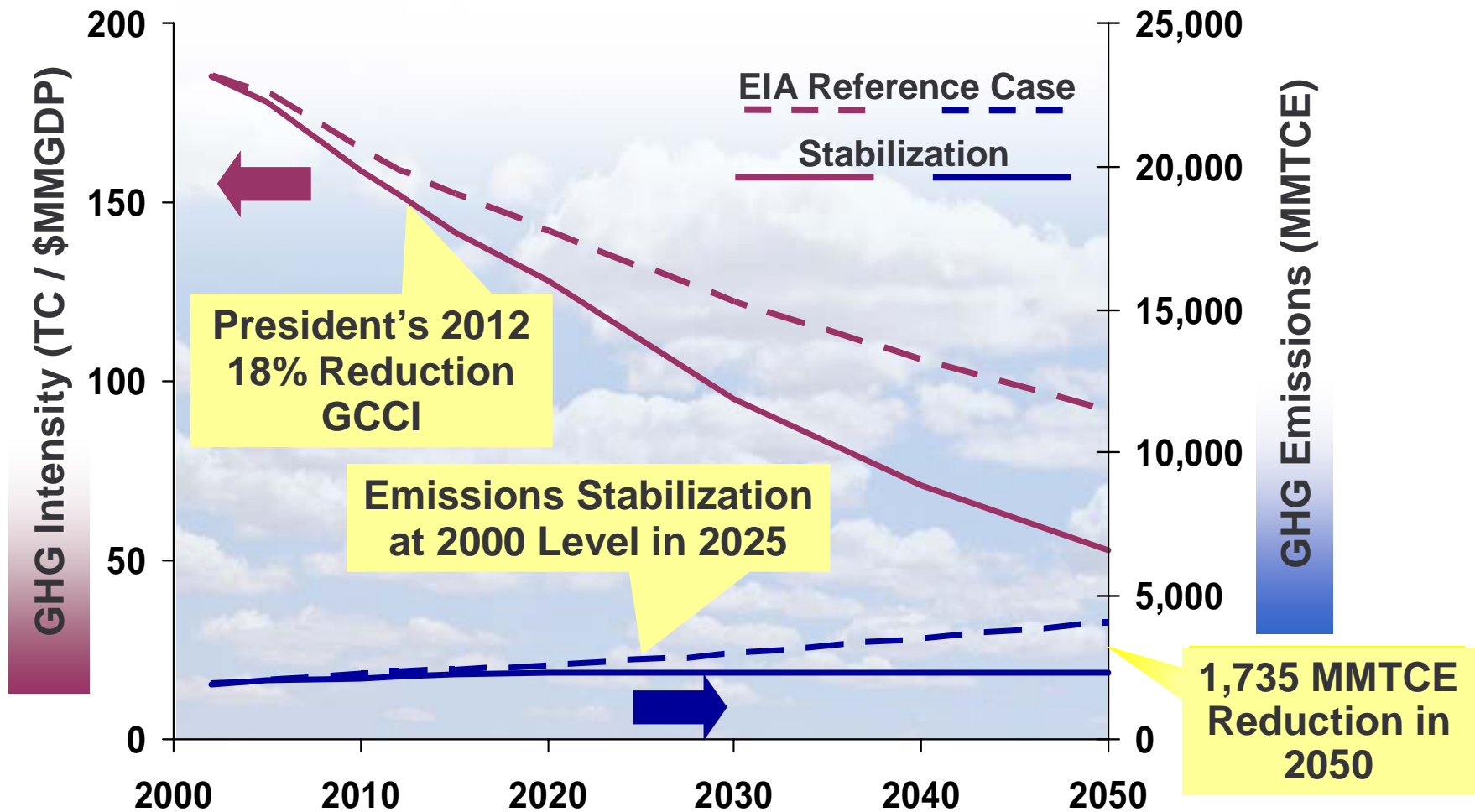


Fossil Energy Sequestration Program Structure



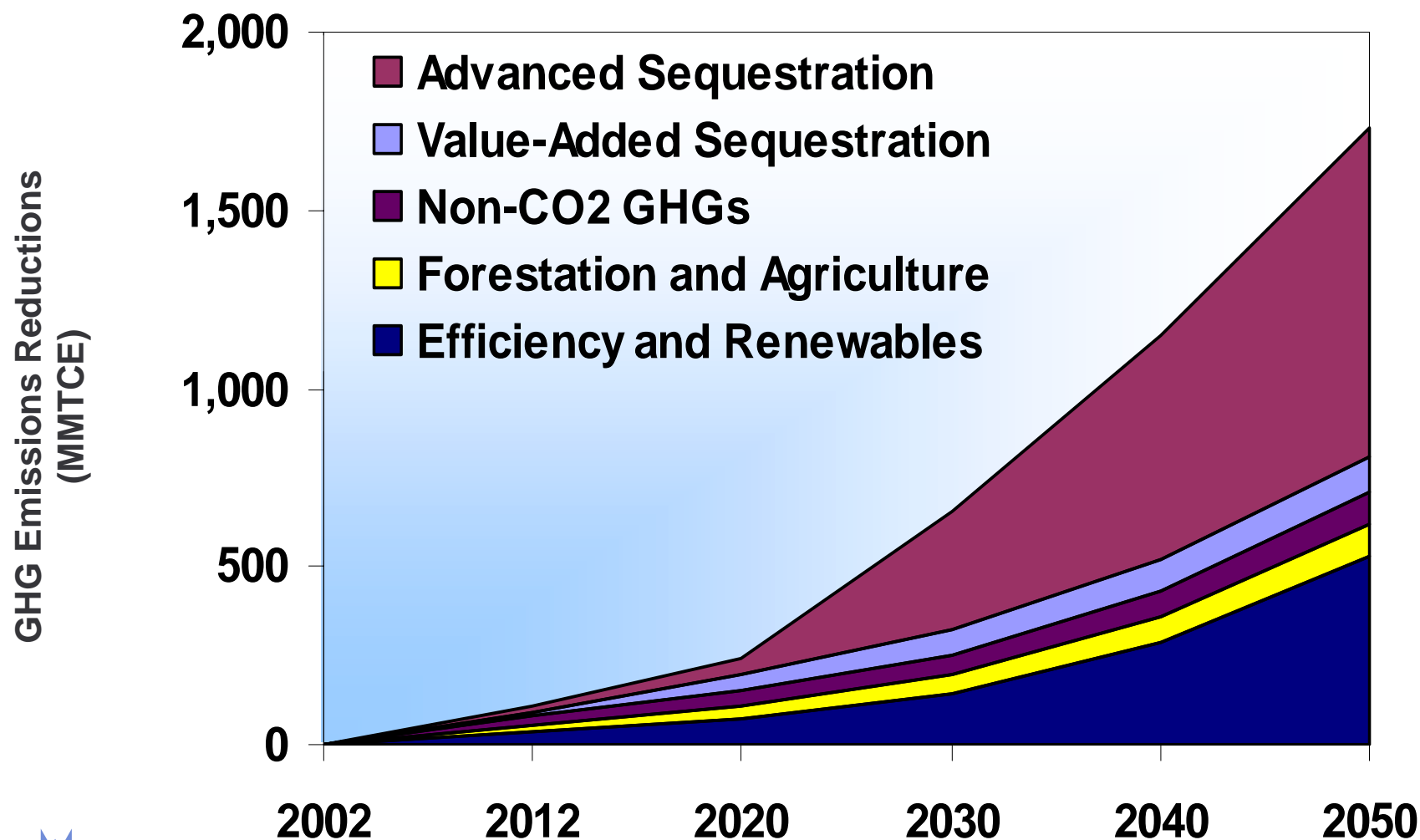
Possible Pathway to Emissions Stabilization

A Significant Undertaking



Sequestration = Stabilization

Plausible Scenario to Stop GHG Emissions Growth



*EIA Annual Energy Outlook 2002; EPA special studies;
DOE/FE/NETL Sequestration Benefits Model*



Visit the NETL Sequestration Website

www.netl.doe.gov/coalpower/sequestration/

NATIONAL ENERGY TECHNOLOGY LABORATORY
CARBON SEQUESTRATION WEBSITE

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January 13, 2003

Carbon Sequestration

*Pathways to Sustainable Use of Fossil Fuels--
enabling the removal and permanent storage
of carbon dioxide from fossil-energy systems*

Welcome to NETL's **Carbon Sequestration Product** webpage. We seek to define carbon sequestration's role in stabilizing atmospheric carbon dioxide levels by developing a scientific understanding and environmentally acceptable technologies. Our research areas include capture & storage, geologic, ocean, and terrestrial sequestration, advanced CO₂ conversion & reuse, and modeling & analysis.

Our site is designed to answer your questions about carbon sequestration—

- Regional Partnerships
- Capture & Storage
- Geologic Sequestration
- Ocean Sequestration
- Terrestrial Sequestration
- Adv. CO₂ Conversion & Reuse
- Modeling & Analysis

What's New
Events
Overview
Capture
Geologic
Ocean
Terrestrial
Conversion
Modeling
In-House R&D
Ref. Shelf
Kids Only!
Links
Contacts
GHG Facts



Carbon Sequestration E-mail Newsletter

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Each month, NETL publishes a short newsletter describing significant events related to carbon sequestration that have taken place over the past month. This newsletter is posted here on our website's [Reference Shelf](#) and distributed by e-mail. If you'd like to join the e-mail distribution list, please refer to the [Subscription Directions](#) page for more information as to "Subscribing" and "Unsubscribing" to our mailing list.



The Carbon Sequestration Newsletter

TABLE OF CONTENTS OCTOBER 2001

- Sequestration in the News
- Events/ Announcements from NETL's Carbon Sequestration Program
- Publications
- Legislative Activity

www.netl.doe.gov/products/sequestration/refshelf.html

Sequestration in the News

Congress Shifts Focus Due to the terrorist attacks of September 11, the agenda in congress has been radically simplified to focus on national

A Greener Greenhouse NASA Satellites show plant growth in northern regions has been more vigorous over the past two decades. The

