

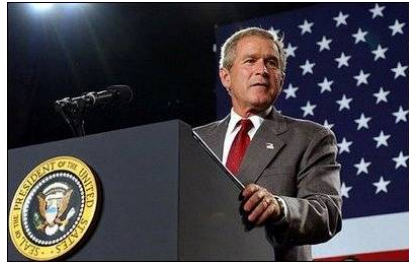


U.S. Climate Change Technology Program

**Stephen D. Eule
Director
Office of Climate Change Policy
U.S. Department of Energy**

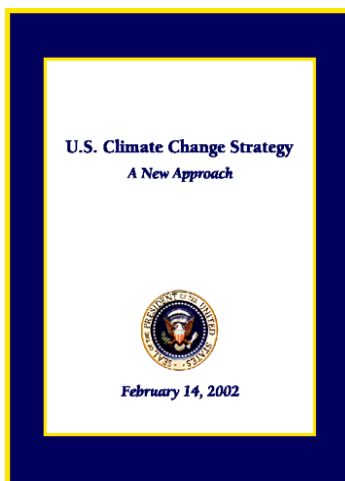
**UNFCCC
11th Conference of the Parties
Montréal, Canada
30 November 2005**

U.S. Approach



I reaffirm America's commitment to the United Nations Framework Convention and its central goal, to stabilize atmospheric greenhouse gas concentrations at a level that will prevent dangerous human interference with the climate.

President George W. Bush
February 14, 2002

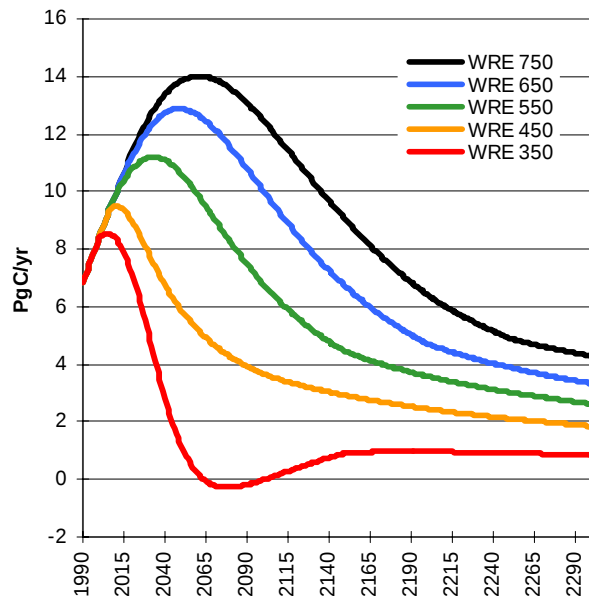


- U.S approach to climate change harnesses the power of markets and technological innovation, maintains economic growth, and encourages global participation.
- Four basic elements:
 - ❖ near-term policies & measures, including tax incentives;
 - ❖ improved climate science;
 - ❖ advanced technologies; and
 - ❖ international collaboration.

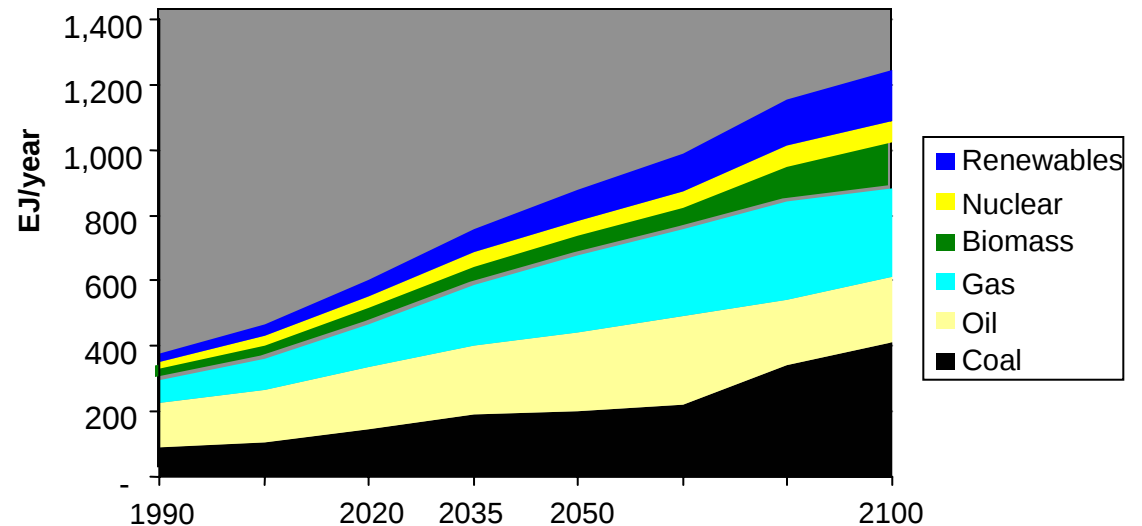
Climate Change Technology: Meeting the Long-Term Challenge

To provide the energy for continued economic growth and development while we reduce greenhouse gas emissions, we will have to develop cost-effective technologies that alter the way we produce and use energy.

Stabilization Curves

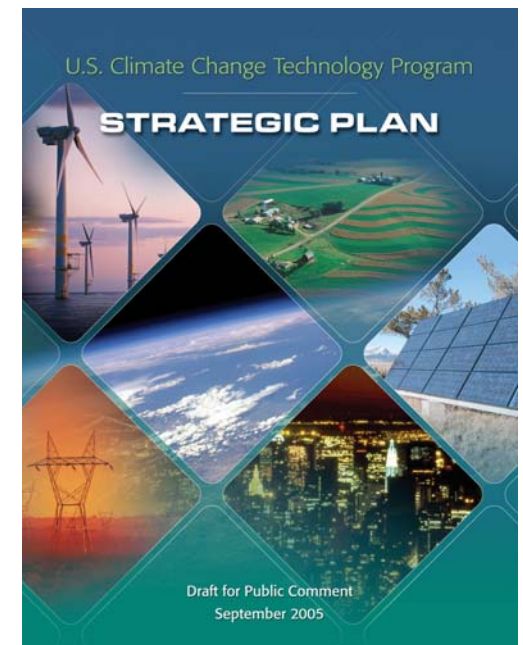


World Primary Energy Demand, 1990-2100: Reference Case



Technology: Seeking Better and More Cost-Effective Solutions

- U.S. Climate Change Technology Program
 - ❖ An ambitious program of RDD&D
 - ❖ \$3 billion/year
- Climate Technology Goals:
 1. Reduce Emissions From Energy End Use & Infrastructure
 2. Reduce Emissions From Energy Supply
 3. Capture & Sequester CO₂
 4. Reduce Emissions From Non-CO₂ Gases
 5. Improve Capabilities to Measure & Monitor GHG
 6. Bolster Basic Science
- CCTP authorized in *EPAAct2005*.



www.climatetechnology.gov

Roadmap for Climate Change Technology Development

CCTP Goals

Near-Term

Mid-Term

Long-Term

Goal 1: Energy End-Use & Infrastructure

- Hybrid & Clean Diesel Vehicles
- High-Efficiency Appliances
- High-Performance Buildings
- High-Efficiency Industrial Processes & Boilers
- Modernized Grids

- H₂ Fuel Cell Vehicles
- High-Efficiency Aviation
- Net-Zero Buildings
- Expanded Solid-State Lighting
- Transformational Technologies for Energy-Intensive Industries
- Advanced Energy Storage & Controls

- Low-Emission Intelligent Transport Systems
- Net-Zero Communities
- Low-Emission Industrial Production
- Closed-Cycle Products & Materials
- Low-Loss Energy Transmission & Distribution

Goal 2: Energy Supply

- Wind, Hydro, Solar & Geothermal
- Biomass, Biodiesel, Clean Fuels
- Distributed Electric Generation
- IGCC Coal Plants
- Stationary H₂ Fuel Cells
- Enhanced Nuclear Power

- Large-Scale Wind Power
- Community-Scale Solar
- Bio-Fuels, Bio-Refineries
- Advanced Bio-Refining of Cellulose & Biomass
- FutureGen Scale-Up
- Gen IV Nuclear Energy

- Widespread Renewable Energy
- Bio-Inspired Energy & Fuels
- Zero-Emission Fossil Energy
- H₂ & Electric Economy
- Widespread Safe Nuclear Energy
- Fusion Power Deployment

Goal 3: Capture, Storage & Sequestration

- CSLF & Regional Partnerships
- Oxy-Fuel Combustion
- Enhanced Oil Recovery
- Reforestation
- Soils Conservation

- Improved CO₂ Capture
- Safe Geologic Storage
- Environmental Guidelines
- Bio-Based & Recycled Products
- Soils Uptake & Land Use

- Large Global CO₂ Storage
- Large-Scale Sequestration
- CO₂ as Commodity Chemical
- Carbon-Based Products & Materials

Goal 4: Other Gases

- Methane to Markets
- Alternatives to High GWP Gases
- Bioreactor Landfill Technology

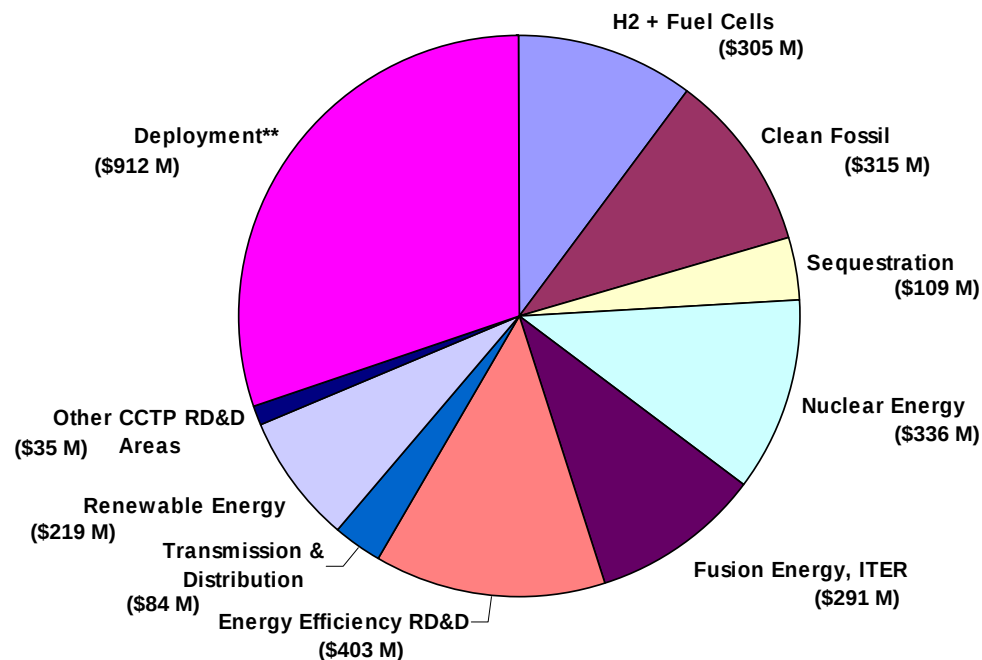
- Methane Emissions Reduction
- Precision Agriculture
- PFC Substitutes

- Low Emissions of Other GHGs
- Low-Emission Agriculture
- Genetically Designed Forages & Bacteria

CCTP Portfolio- FY-2006 R&D Investments

Percent of CCTP FY06 Budget Request*

Total Multi-Agency
FY06 Budget Request:
\$ 3,008 Million



* All CCTP Federal Agencies FY06 Budget Request
Includes: RD&D + Deployment

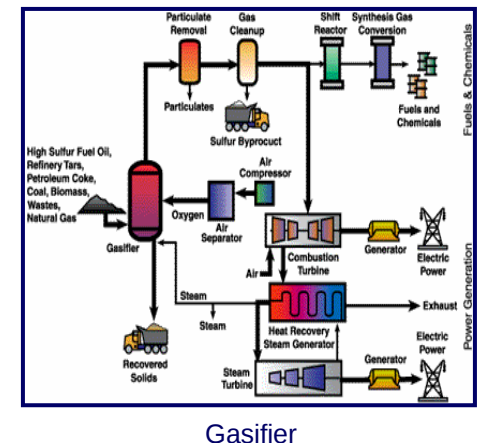
** Deployment is 81% Energy Efficiency

Deployment Provisions of *EPAct2005*

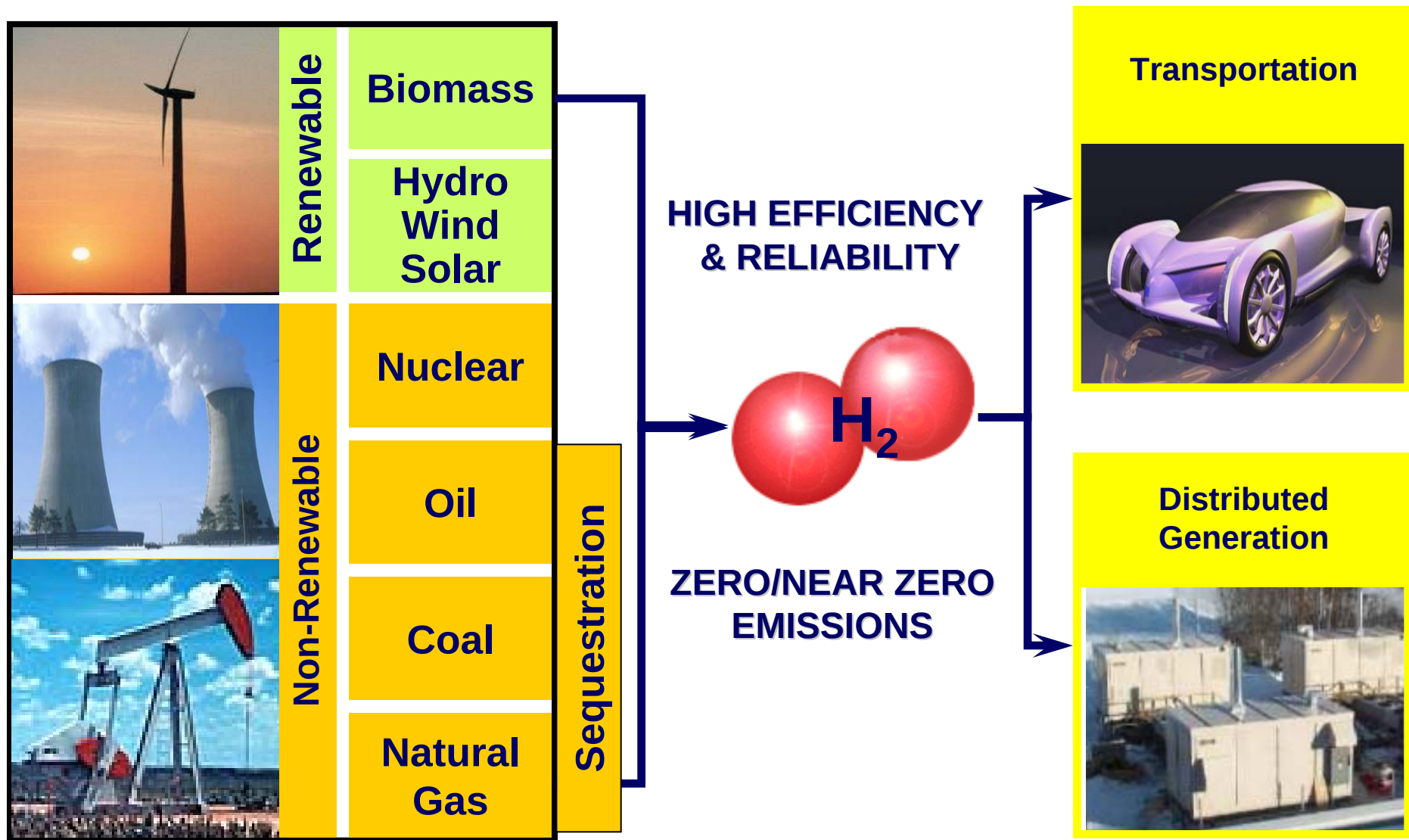
- *EPAct2005*: ≈\$11 billion in tax incentives over 10 years, including:
 - ✓ Production from advanced nuclear power;
 - ✓ Clean coal facilities;
 - ✓ IGCC;
 - ✓ Energy efficient commercial buildings;
 - ✓ Construction of energy efficient homes;
 - ✓ Energy efficient (i.e., Energy Star) appliances;
 - ✓ Residential energy efficient property;
 - ✓ Business installation of fuel cells and stationary microturbine power plants;
 - ✓ Business solar investment tax credit;
 - ✓ Alternative motor vehicle credit;
 - ✓ etc.

Incentives for Innovative Technologies

- **Title XVII** authorizes DOE to issue loan guarantees of up to 80% of project costs to accelerate commercial deployment of advanced energy technologies.
 - ❖ Eligible technologies must:
 - ✓ Avoid, reduce or sequester GHG or air pollutants
 - ✓ Employ new or significantly improved technology
 - ❖ Technology categories include:
 - ✓ Renewables
 - ✓ Coal gasification
 - ✓ Carbon capture & storage
 - ✓ Energy efficiency
 - ✓ Hydrogen fuel cells
 - ✓ Efficient generation and T&D
 - ✓ Advanced nuclear energy
 - ✓ Production facilities for fuel efficient vehicles
- **Title XV** increases the amount of the renewable content of gasoline from 4.0 billion gallons in 2006 to 7.5 billion gallons in 2012.
- **Title VI** provides standby support coverage for certain regulatory delays for up to 6 new nuclear plants.



Hydrogen Fuel Initiative

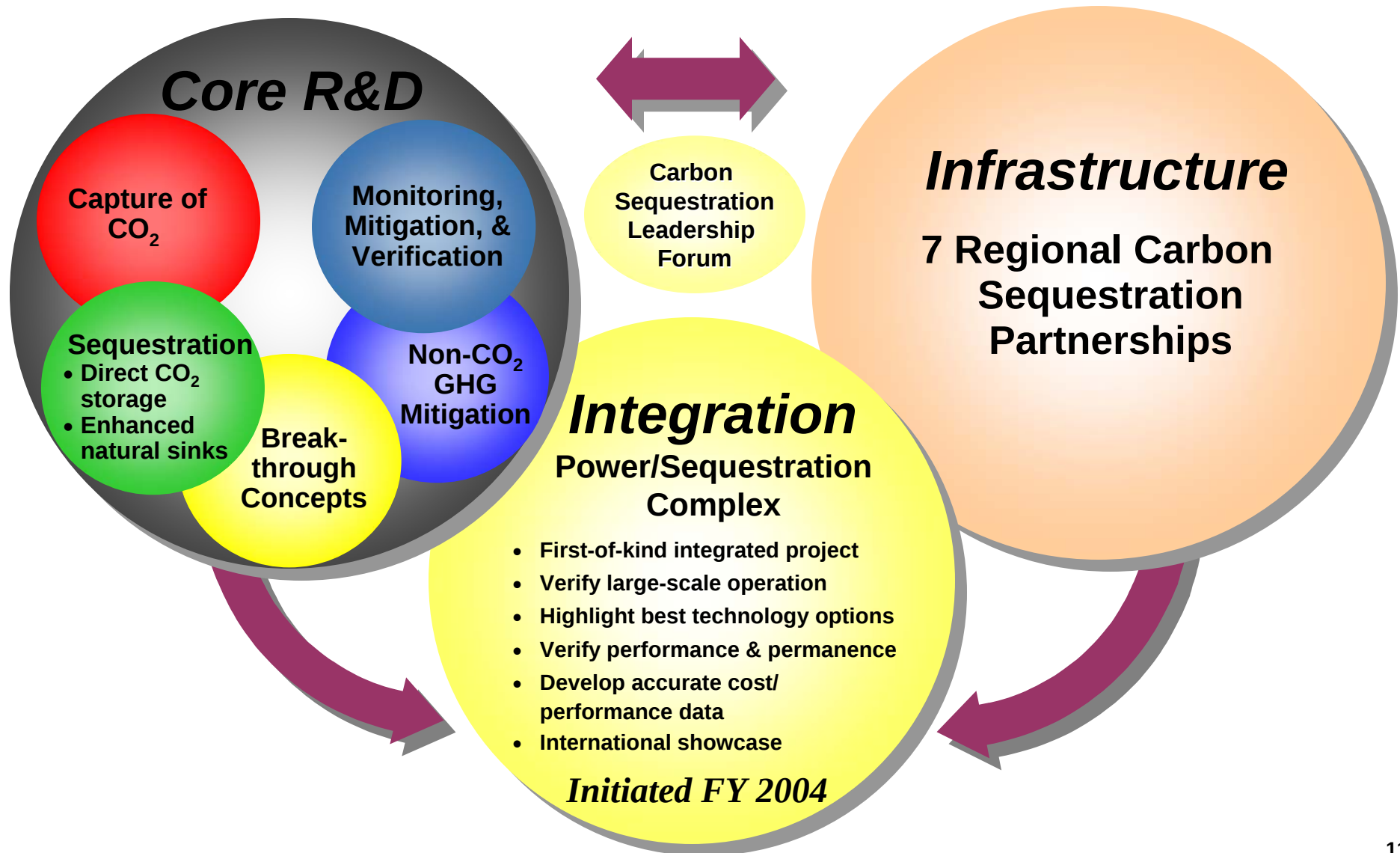


Hydrogen Fuel Initiative

- Hydrogen R&D activities: Focused hydrogen program.
- ❖ Will integrate technologies for:
 - ✓ **Hydrogen production** from fossil, nuclear, and renewable resources.
 - ✓ **Infrastructure development**, including delivery and storage.
 - ✓ **Fuel cells** for stationary and transportation applications.
- Technical milestones on the road to a hydrogen economy.



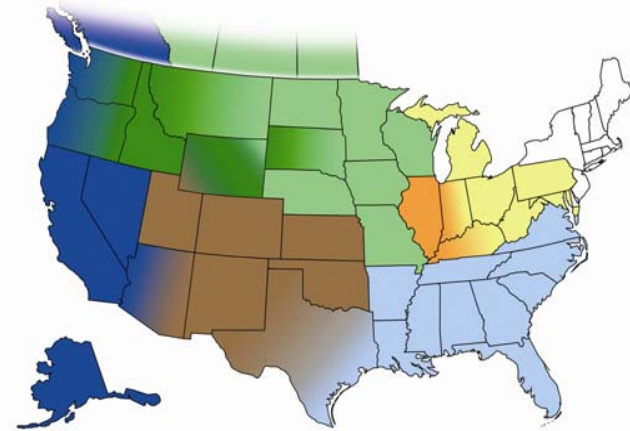
Carbon Sequestration



Regional Sequestration Partnerships: A Phased Approach

Phase I (Characterization)

- 7 Regional Partnerships (40 states & over 200 organizations)
- 24 months (2003-2005)



Regional Partnerships

Phase II (Field Validation Tests)

- 4 years (2005 - 2009)
- All seven Phase I partnerships continued
- \$100 million federal funds
- \$45 million in cost share



Phase III (MMV & Integration)

- 2009-2013
- Significance to FutureGen and public policy

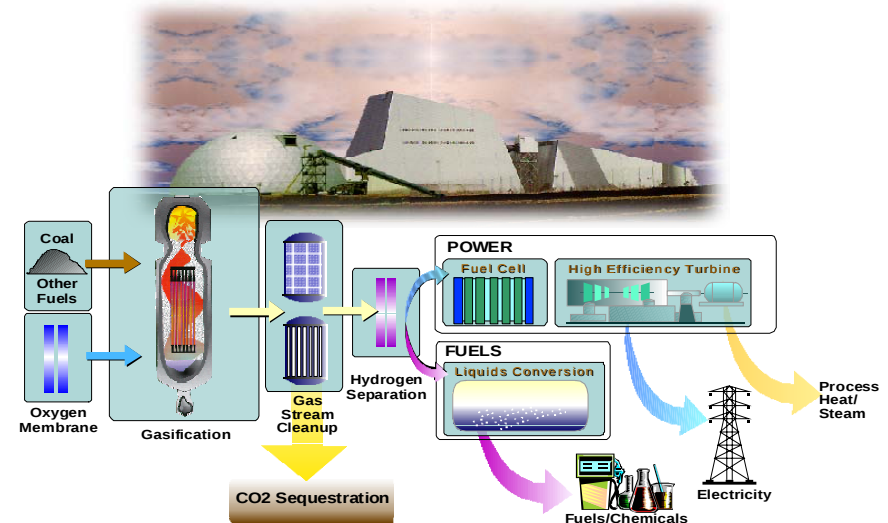
FutureGen

- A U.S.-led, 10-year, ≈\$1 billion effort to pioneer coal-to-hydrogen and carbon management technologies for coal.



- FutureGen will be the world's first zero-emission power plant and an international test facility that:

- ❖ Pioneers advanced hydrogen production from coal.
- ❖ Emits virtually no air pollutants.
- ❖ Captures and permanently sequesters carbon dioxide.



- DOE to share project costs with the private sector.
- CSLF members are eligible to participate in FutureGen.

Nuclear Power



Nuclear Power 2010: Goals are to:

- identify sites for new nuclear power plants;
- develop and bring to market advanced nuclear plant technologies;
- evaluate the business case for building new nuclear power plants; and
- demonstrate untested regulatory processes.

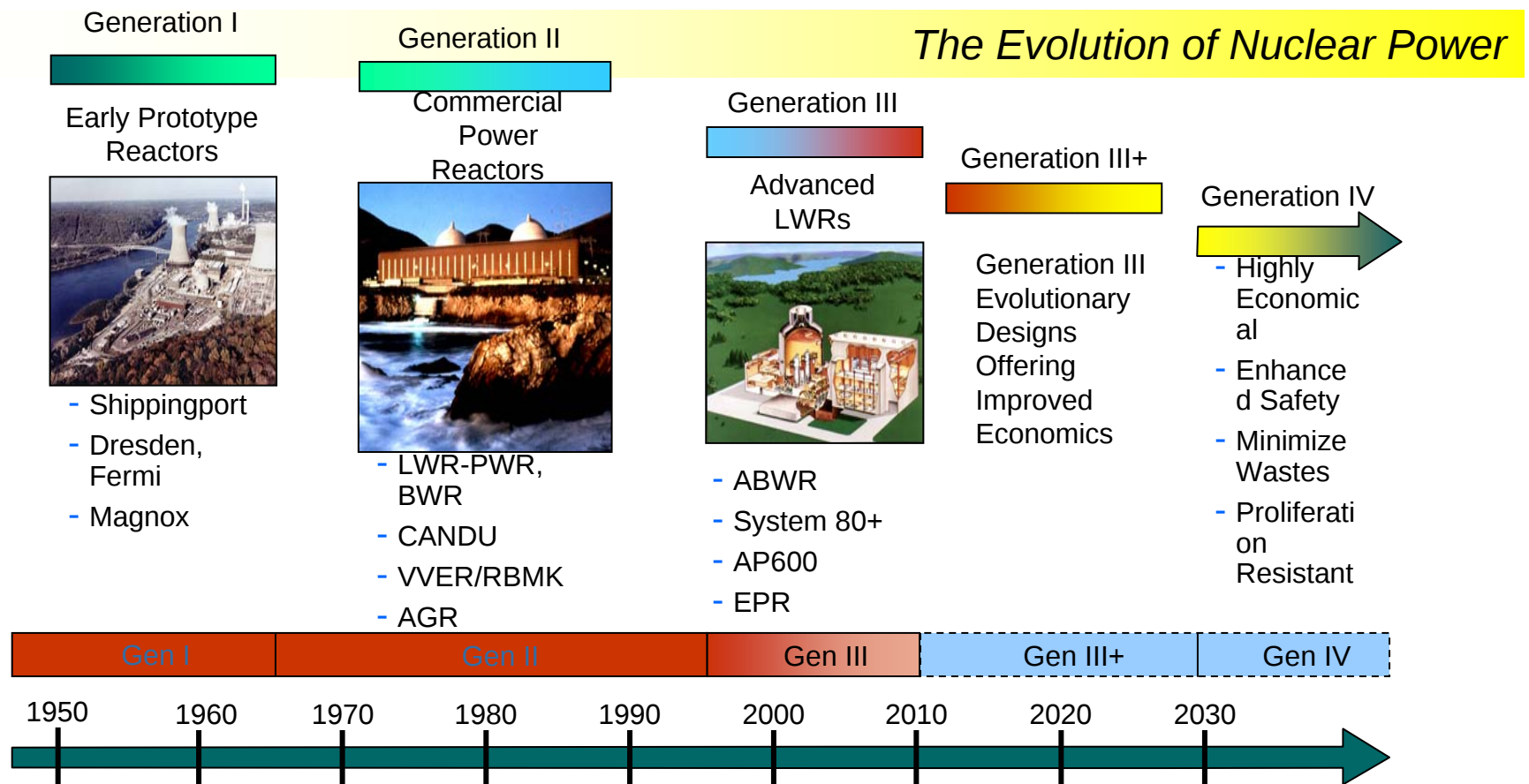
Advanced Fuel Cycle Initiative: Develop advanced, proliferation resistant nuclear fuel technologies that maximize the energy produced from nuclear fuel while minimizing wastes.

Generation IV Nuclear Energy Systems Initiative: R&D into the next generation of nuclear power plants that are safe, economical, secure, and proliferation resistant.

Nuclear Hydrogen Initiative: R&D into technologies that use nuclear reactors to produce hydrogen, including thermochemical water-splitting cycles, high-temperature electrolysis, and alternative technologies.

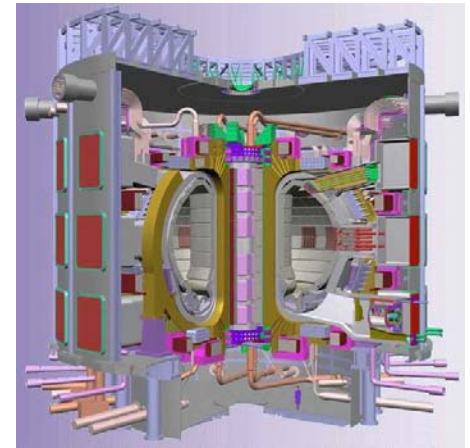
Generation IV Nuclear Power

Goal: Gen IV nuclear energy systems deployable no later than 2030 for generation of electricity and other energy products.



ITER Fusion Energy Project

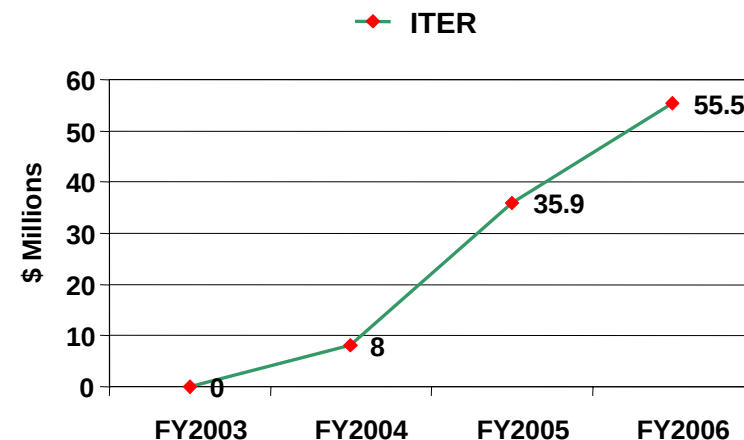
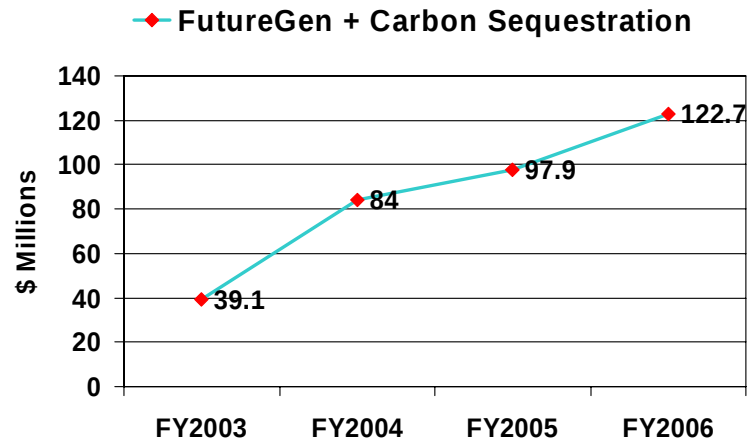
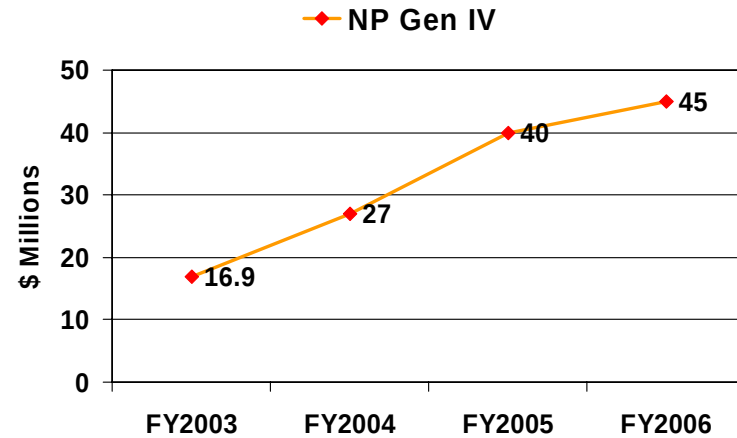
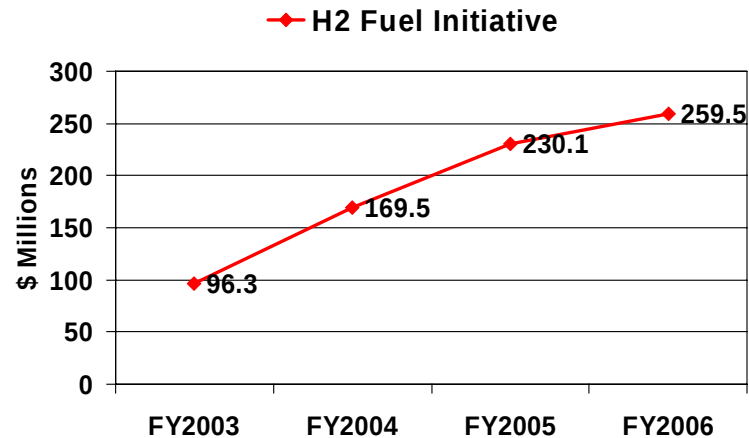
- A proposed multilateral collaborative project between the U.S., China, E.U., Japan, Russia, and Republic of Korea to design and demonstrate a fusion energy production system.
- ITER site has now been chosen: Cadarache, France, EU.
- Director General nominee from Japan has been chosen.
- India is applying to join as possible 7th Party.
- Considerable progress has been made toward an international agreement to build and operate ITER:
 - ❖ In-principle solutions have been found to virtually all issues.
 - ❖ Next negotiating meetings: December 1-7, 2005.
 - ❖ Plan to complete agreement negotiations by early 2006.



ITER

<http://www.iter.org>

Fiscal Year 2006 Budget: Key Initiatives



Innovative International Partnerships



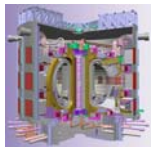
- **Carbon Sequestration Leadership Forum:** 22 members; focused on CO₂ capture & storage.



- **International Partnership for the Hydrogen Economy:** 17 members; organizes, coordinates, and leverages hydrogen RD&D programs.



- **Generation IV International Forum:** 10 members; devoted to R&D on next generation of nuclear systems.



- **ITER:** 6 members; project to develop fusion as a commercial energy source.



- **Methane to Markets:** 17 members; recovery and use of methane from landfills, mines, oil & gas systems, and agriculture.

Technology Scenarios Explore the Future

Technology Scenario #1: “Closing the Loop on Carbon”

Advanced Coal, Gasification, Carbon Capture, Sequestration, and Hydrogen Technologies Augment the Standard Suite of Technologies

Technology Scenario #2: “A New Energy Backbone”

Technological Advances in Renewable Energy and Nuclear Power Give Rise New Competitive Realities, Reducing Dominant Role of Fossil Fuels

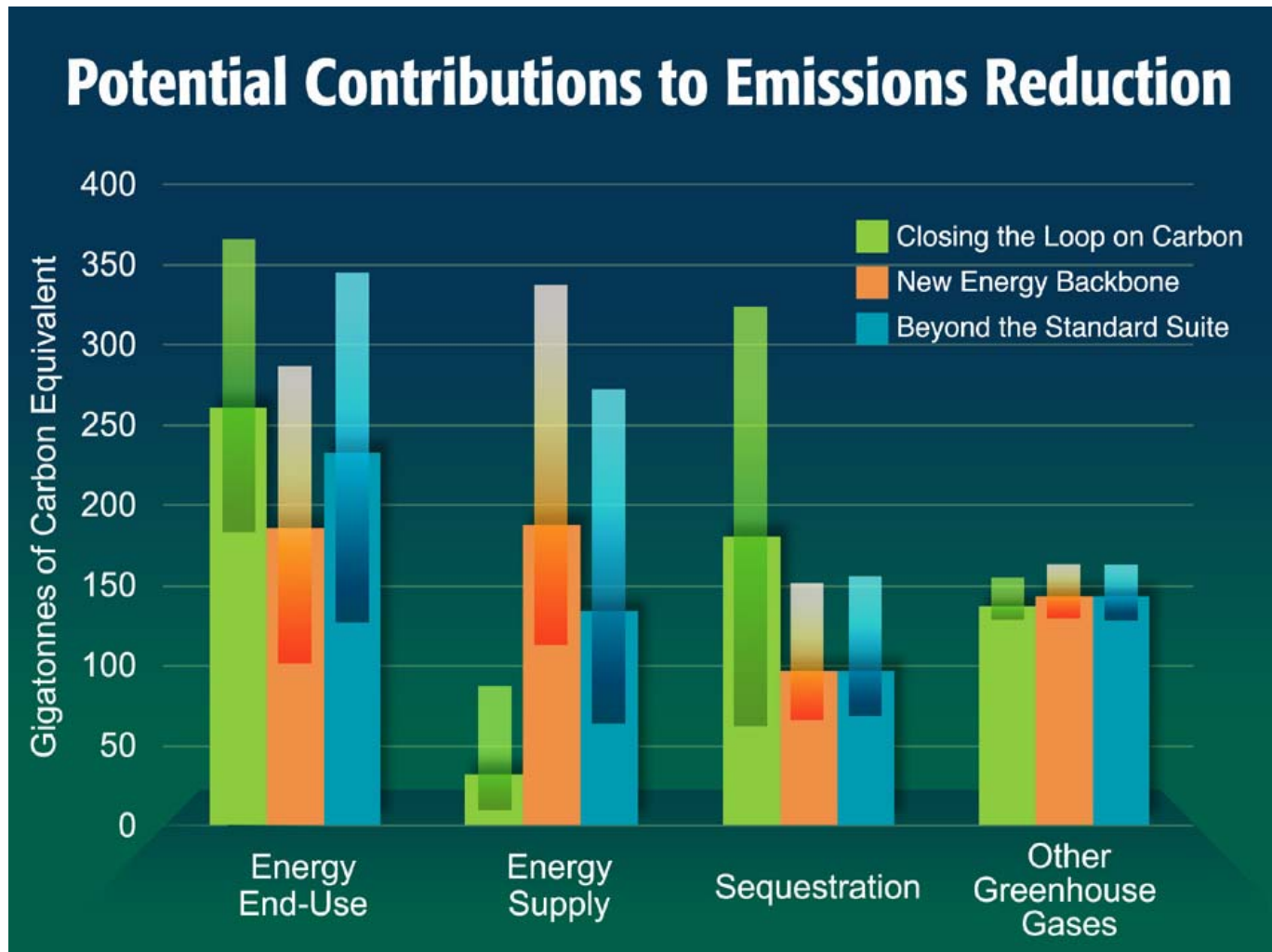
Technology Scenario #3: “Beyond the Standard Suite”

Novel and Advanced Technologies (e.g., Fusion, Large Scale Solar, and Bio-X) Emerge to Play Major Roles, Complementing the Standard Suite.

Common Characteristics Across Scenarios:

- ✓ *Hydrogen and Liquid Biofuels Become Significant Energy Carriers*
- ✓ *The Full Potential of Conventional Oil & Gas is Realized*
- ✓ *Dramatic Gains in Energy Efficiency Occur*
- ✓ *Successful Management of other GHGs*
- ✓ *Early Market Penetration of Low-Cost Terrestrial Sequestration*

Integrated Results



Source: Placet M; Humphreys, KK; Mahasenan, NM. *Climate Change Technology Scenarios: Energy, Emissions and Economic Implications*. Pacific Northwest National Laboratory, PNL-14800, August 2004. Available at: <http://www.pnl.gov/energy/climate/technology.stm>

A Path Forward Involves ...

- Near-term actions – through partnerships, voluntary action, and financial incentives.
- Progress in climate change science – to reduce uncertainty.
- Progress in climate change technology will:
 - ❖ create new, better, and cheaper solutions
 - ❖ facilitate means for change and a smooth transition
- Expanded opportunities for cooperation among:
 - ❖ business, industry, States and NGOs
 - ❖ research institutions and academia
 - ❖ multilateral collaboration