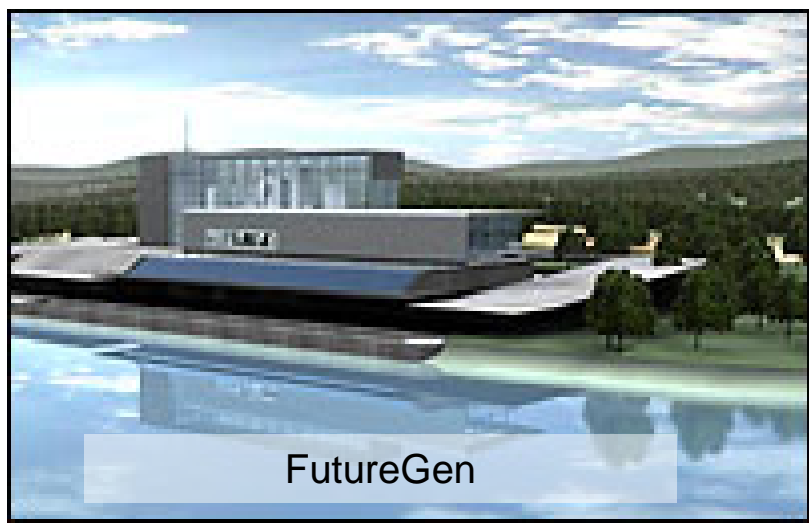
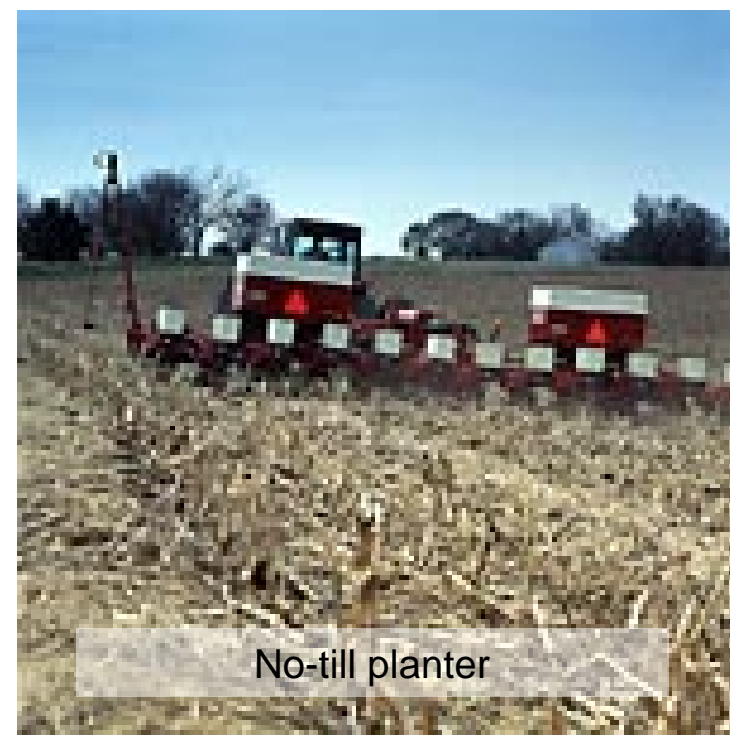


Role of Sequestration and Technology in Reducing Greenhouse Gas Emissions



FutureGen



No-till planter

March 2005

About Unions for Jobs and the Environment

UJAE is a partnership of:

The Brotherhood of Locomotive Engineers
International Brotherhood of Boilermakers,
Iron Ship Builders, Blacksmiths, Forgers and Helpers
International Brotherhood of Electrical Workers
International Brotherhood of Teamsters
Marine Engineers Beneficial Association
Sheet Metal Workers International Association
Transportation - Communications International Union
United Food and Commercial Workers
United Mine Workers of America
United Transportation Union
Utility Workers Union of America

UJAE was formed to provide a voice for union and worker concerns regarding the climate policy debate. UJAE is also a forum for discussion of air quality and energy issues. For more information please see our website at www.ujae.org, a site dedicated to the distribution of information on ways to provide a healthier environment balanced with the need to ensure growth in jobs and incomes.

Failure of the Kyoto Protocol

- Based primarily on mandatory CO2 emission rollbacks from fossil fuels.
- Would drive up energy prices.
- Would cause one million job loss in the US according to Clinton Administration study.
- Job loss of 2-3 million according to other studies.
- No significant impact on greenhouse gas concentrations in the atmosphere.

Alternative to mandatory CO2 emission rollbacks

- Rapid development of new technologies
 - Wind, solar and other renewables
 - Hydrogen economy
- Terrestrial sequestration – storing carbon by managing forests, croplands and grazing lands.

Hydrogen economy

- Program began in the Clinton Administration, continued under Bush as FutureGen. Coal appears to be the lowest cost source of hydrogen.*
- Goals
 - Build a 275 megawatt power plant that produces its hydrogen fuel from coal.
 - Sequester 90% of CO₂ emissions and produce zero emissions of pollutants including SO₂, NO_x, and mercury.
 - Produce electricity with at 10% greater cost than non-sequestered systems.
 - Produce hydrogen at equivalent to 48 cents per gallon of gasoline that can be used in transportation.

*Natural gas is a source of hydrogen, but natural gas is already in high demand.

Source: Department of Energy

Removal of carbon before the fuel is burned

Coal Gasification

CO2 Capture

Hydrogen Production

Electricity Generation



Hydrogen / Fuel Cell Powered Vehicles

Technology issues

- Hydrogen technology and is a decade away.
- It will take more time for new hydrogen technologies to displace older technologies once they are developed.
- Solar and wind technologies are promising but slowed by cost and siting.



A sequestration bridge is needed to get to a greenhouse gas stabilization path

What is Sequestration?

- The capture of CO₂ before or after fossil fuels are burned.
- Kinds of sequestration
 - **Terrestrial sequestration** – capturing CO₂ in trees, plants and the soil. Managing crop lands, pasture lands and forests.
 - **geologic sequestration** – piping CO₂ into geologic formations as the fuel is burned. The possibility of piping CO₂ into the oceans has also been raised.

Advantages of Sequestration

- Sequestration allows continued use of fossil fuels, particularly coal.
- Technology can be transferred to developing countries for more effective worldwide emission reductions.
- Sequestration creates jobs.
- Emission limitations can create very high prices and shift away from coal to more scarce natural gas and imported oil.

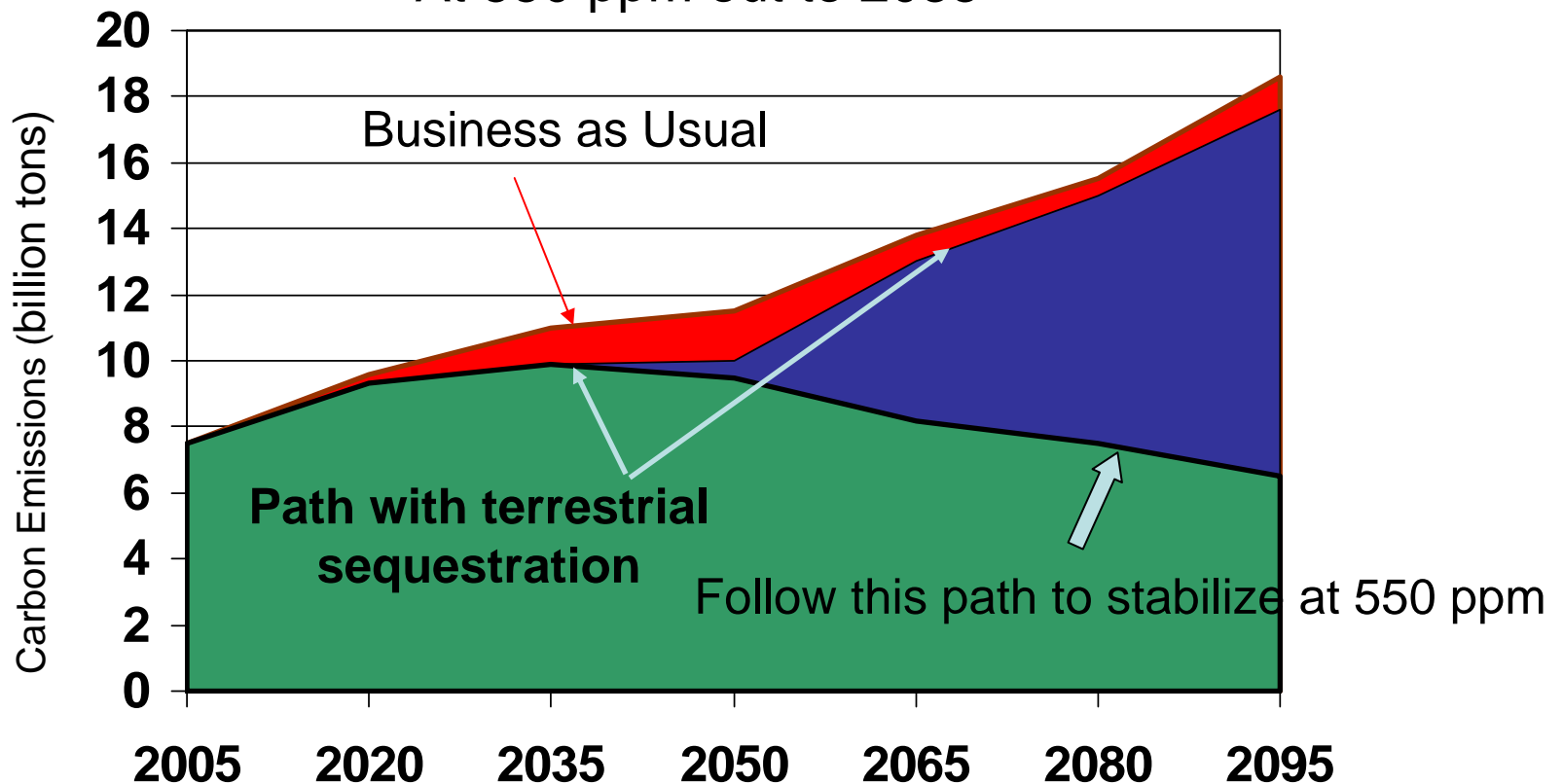
Terrestrial Sequestration

- Terrestrial sequestration alone can put globe on a path to maintain 550 ppm target until 2035, allowing time for advanced energy technologies to mature.
- Terrestrial sequestration technology is already available at relatively low cost. *

* geologic sequestration requires more R&D

Note: Improvements in conservation and energy efficiency (not shown on next chart) can take you further into the future than terrestrial sequestration alone.

Policy of Terrestrial Sequestration ***by itself*** can put the **US**
And world on an aggressive path to stabilize greenhouse gases
At 550 ppm out to 2035



Source: Top line IPCC (1990); Bottom line Wigley-Richels-Edmonds scenario (Wigley et al., 1996);
terrestrial sequestration path, Wigley, Richels, and Edmonds 1996, Economic and environmental choices in
the stabilization of atmospheric CO₂ concentrations. Nature 379.

Conclusion

- Begin rapid development of technologies for fuels that do not produce greenhouse gases.
- Research and develop technologies for geologic storage of carbon.
- Immediately begin terrestrial sequestration programs
 - Create incentives for an aggressive terrestrial sequestration program in the U.S.
 - Create incentives for developing nations to use terrestrial sequestration.
- Continue to develop voluntary programs for the reduction of greenhouse gases.