

There is no Silver Bullet: Regionalization and Market Fragmentation in Greenhouse Gas Mitigation Strategies

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DEER 2004
San Diego
August 31, 2004

Battelle

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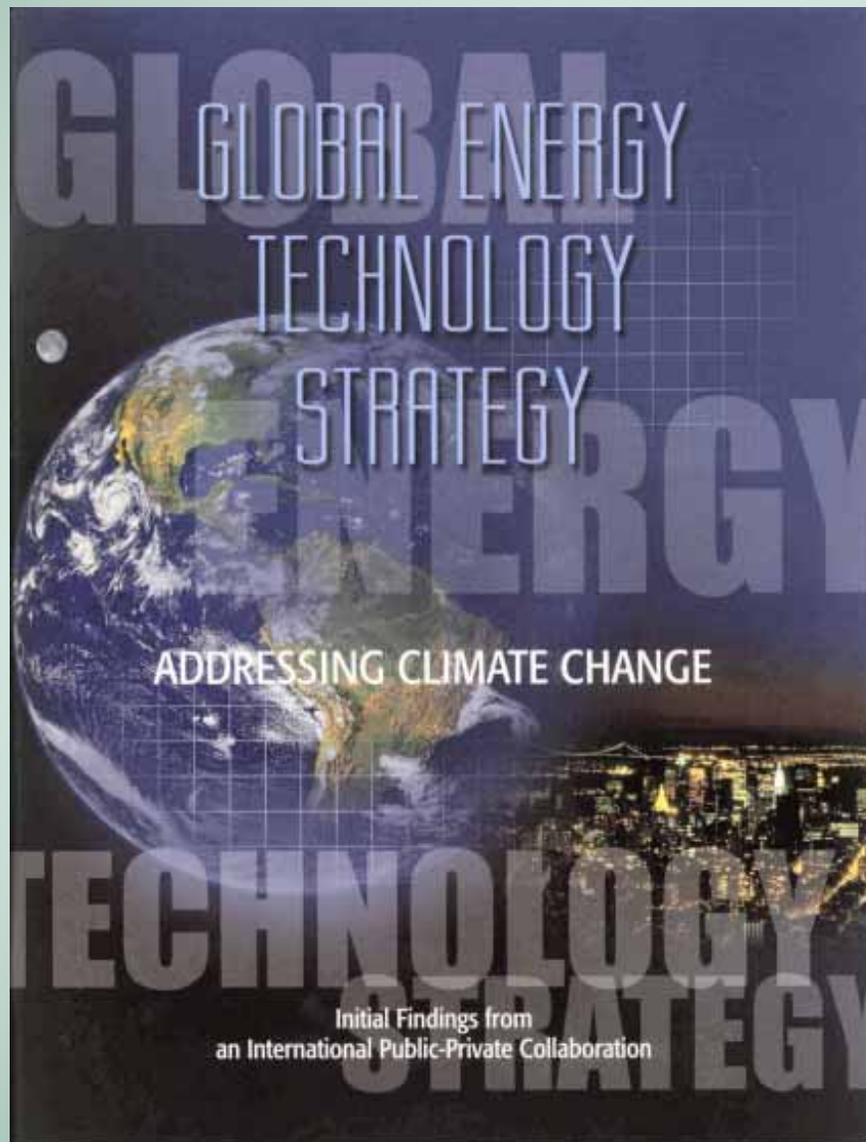


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At COP-6 we rolled out several ideas about technology ...

- We challenged the view that we had 'enough' technology to stabilize concentrations
- And indicated that a portfolio of technology options was required and there was unlikely to be a "silver bullet" technology
- Since then everyone has been polishing their ammo

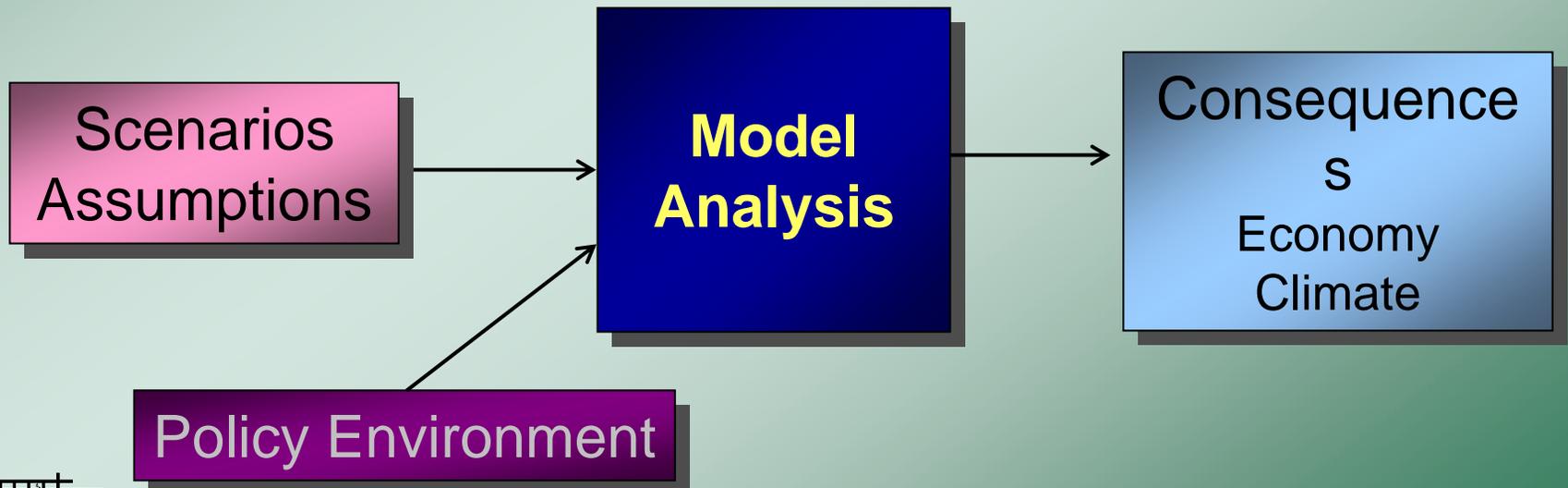


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An Integrated Assessment EIS

- Unlike climate models which attempt to project the future of the climate system, Integrated Assessment models do not.
- Rather they take projections of the future and examine the relative impact of different policy options.
- The results today are meant to be illustrative of the key issues and insights of this kind of analysis, not predictions.

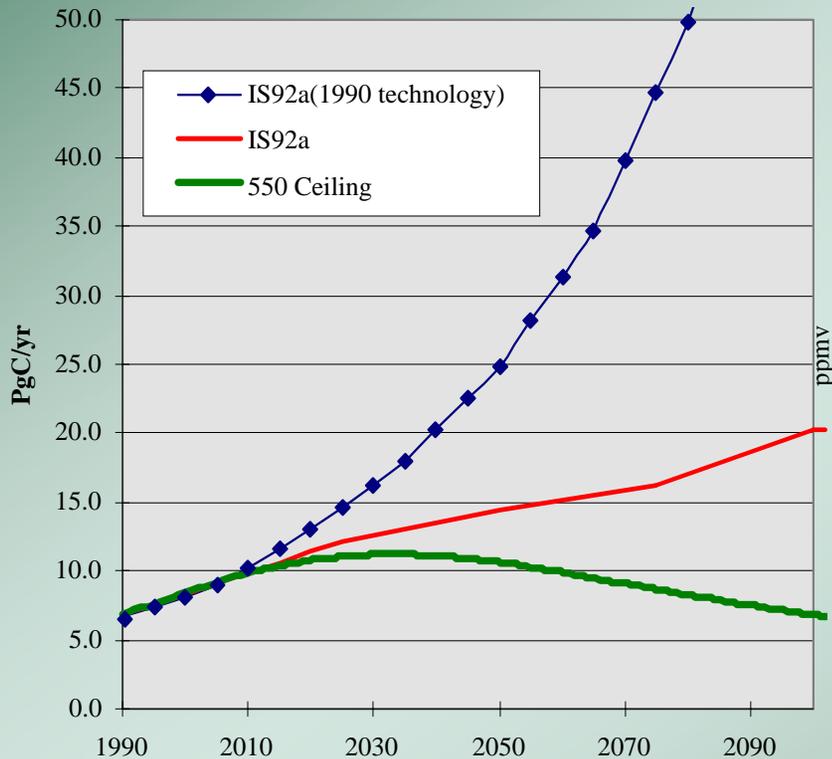


Point 1: For carbon dioxide, stabilizing climate impact is more than stabilizing emissions.

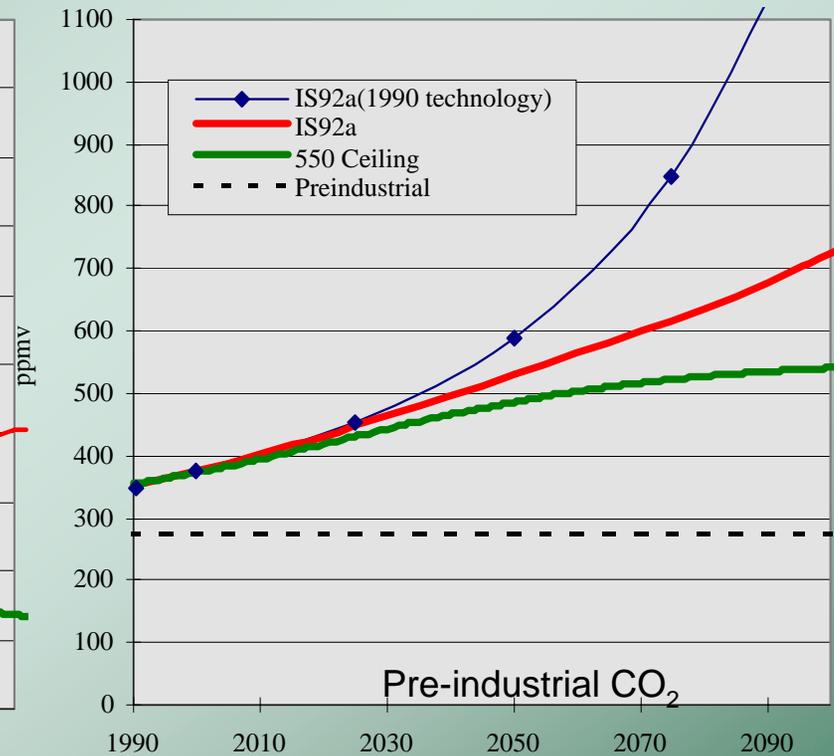


To stabilize concentrations, emissions of CO₂ must peak then decline - essentially to zero.

Emissions



Concentration



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Point 2: Reducing carbon dioxide emissions can either help solve the climate problem, or keep it from getting worse.

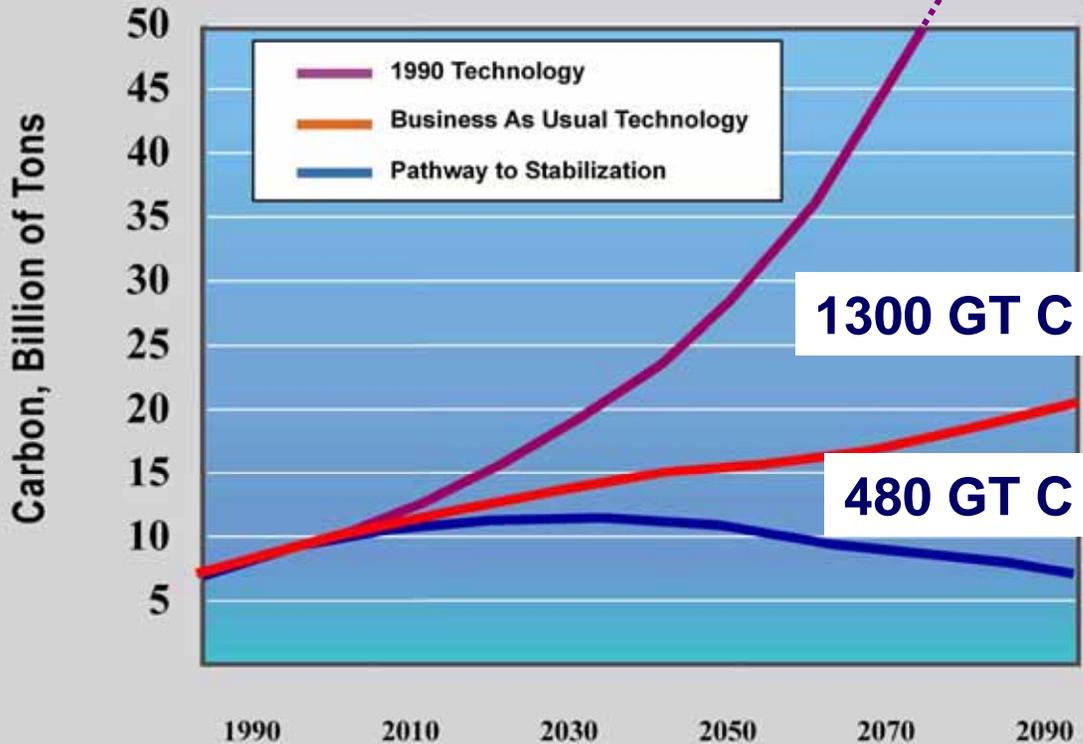


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Commitment to Stabilization Requires Closing TWO "Technology Gaps"

Carbon Emissions



**"Business-As-Usual"
Technology Gap**

**"Stabilization"
Technology Gap**



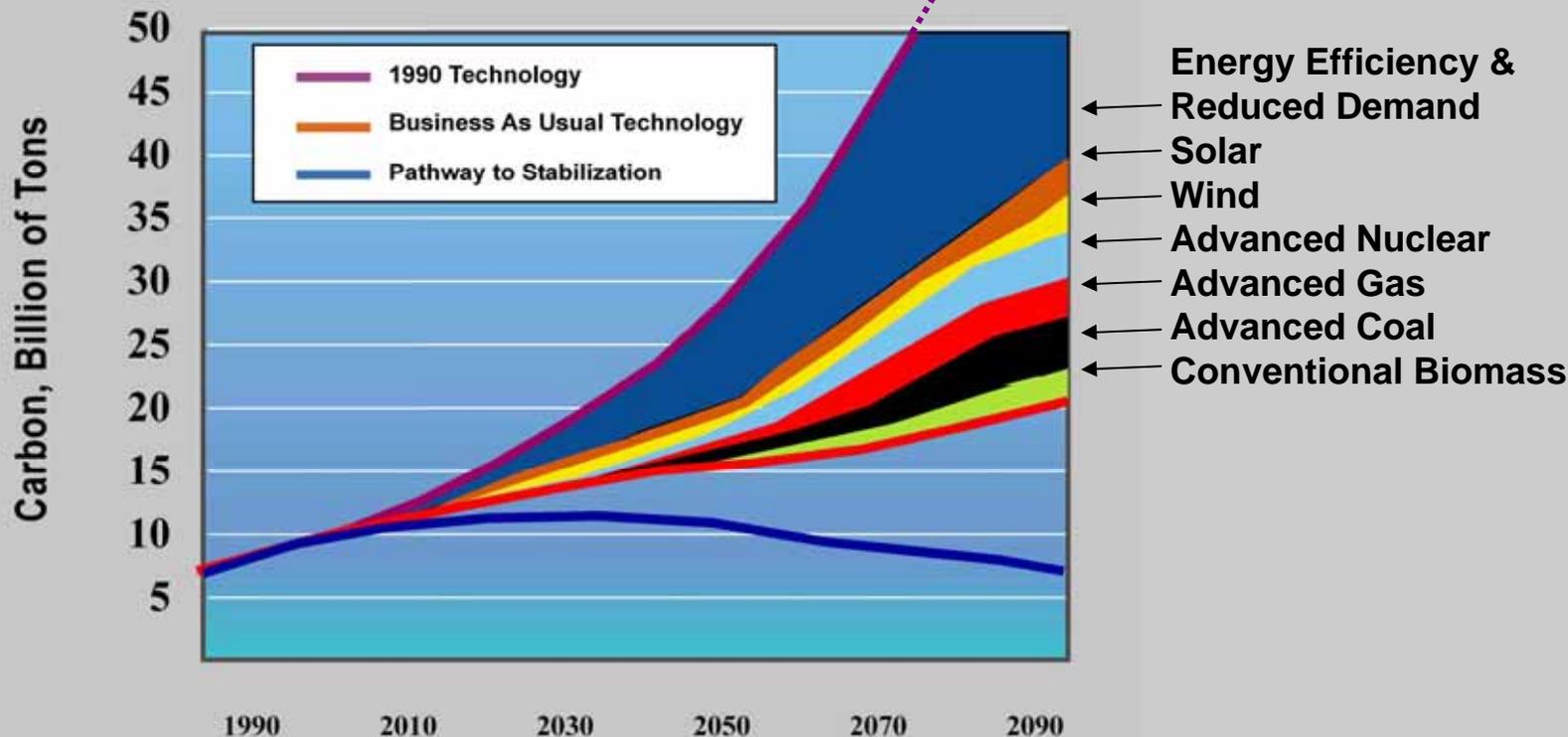
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Business-As-Usual Gap

Extraordinary Improvement is Built in to BAU

Carbon Emissions



**“Business-As-Usual
Technology Gap**



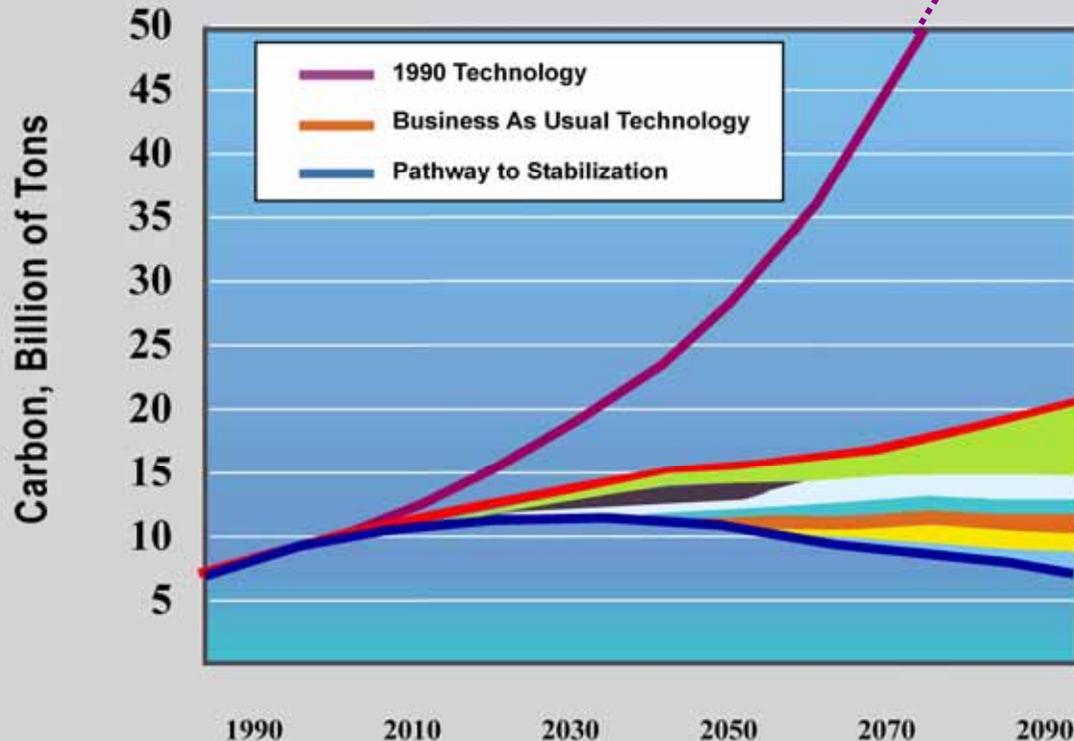
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Stabilization Gap

Tremendous Additional Technological Advance Required

Carbon Emissions



- Advanced Biomass
- Soil Sequestration
- H2 w/Sequestration
- Fossil Power w/Sequestration
- Add'l Solar/Wind
- Add'l Nuclear
- Add'l Efficiency & Reduced Demand

**“Stabilization”
Technology Gap**



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Point 3: Solving the climate problem requires placing a value on carbon:

- placing limits on emission,**
- increase price,**
- prescribe a technology path.**

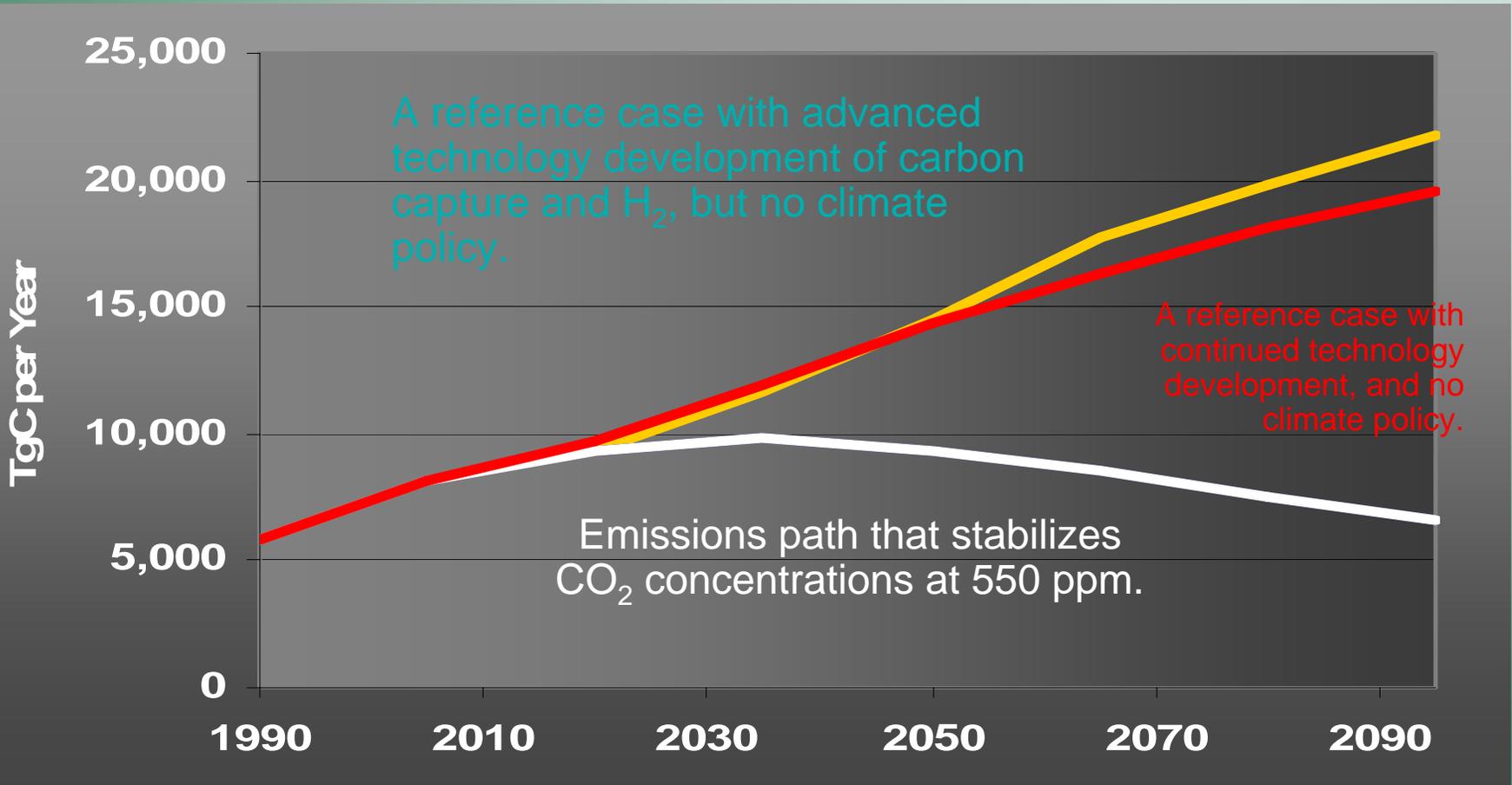


Point 4: Not all climate solutions work everywhere. Some have advantages over others in different parts of the world and the country.



Technology Alone Won't NECESSARILY Stabilize CO₂ Concentrations

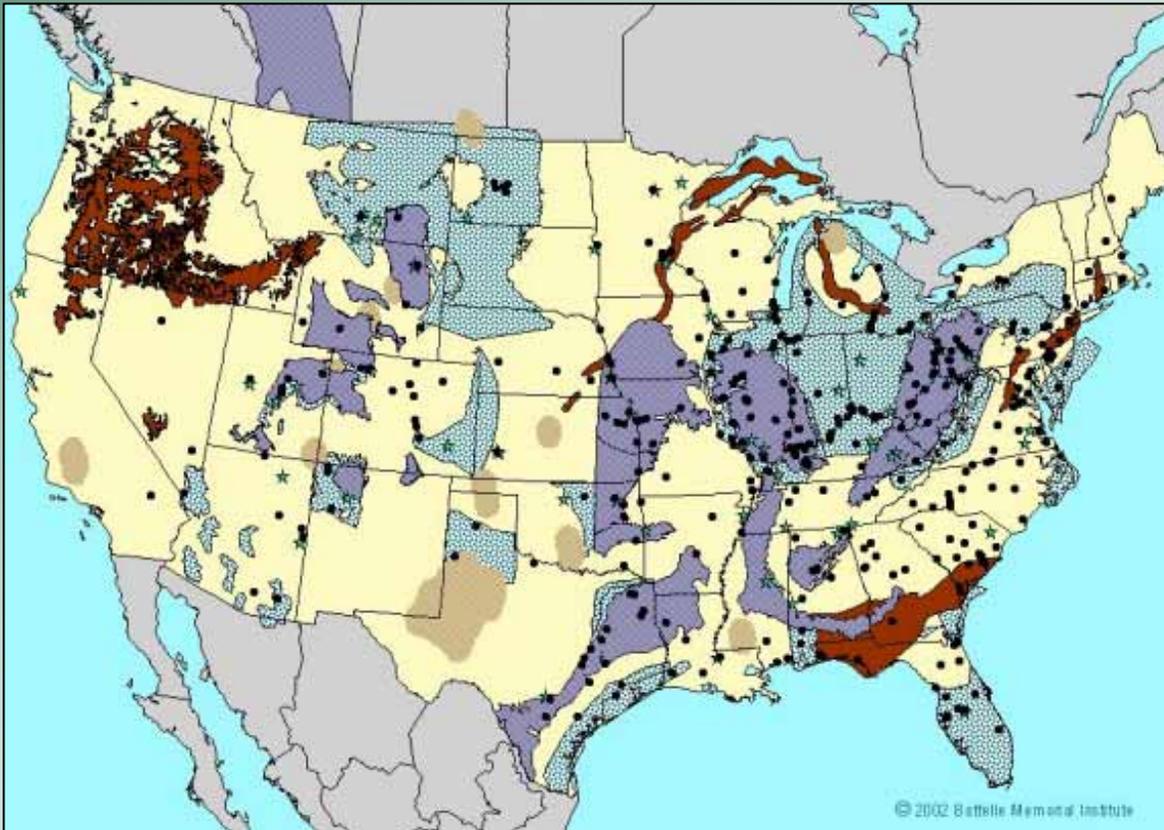
Energy Related Carbon Emissions



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Hydrogen economy in the U.S. will likely be tied to sequestration ... where will we put the carbon?



- There is some mismatch between capture and storage and existing power plants
- Even more so for motor vehicles.

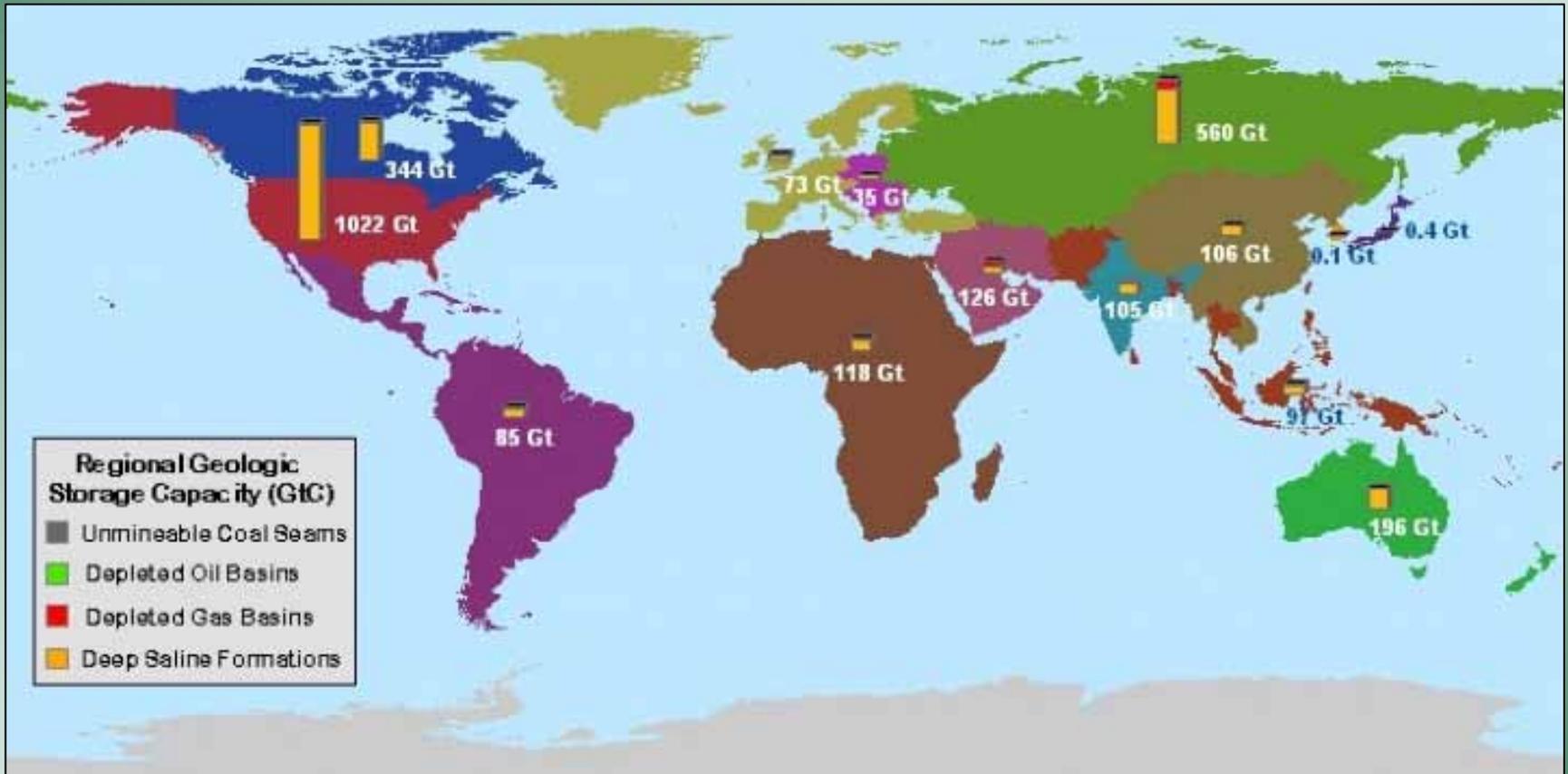


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Global CO2 Storage Capacity: A Very Heterogeneous Natural Resource

Gigatons of Carbon



Based on current understanding of reservoirs
Courtesy Jim Dooley



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Point 4A: Factors like local pollution control and energy security can add to regionally preferred approaches.



Point 5: There is no reason to believe that the current fragmentation of fuel markets will decrease soon.



Market fragmentation is already a fact of life for transportation fuels.

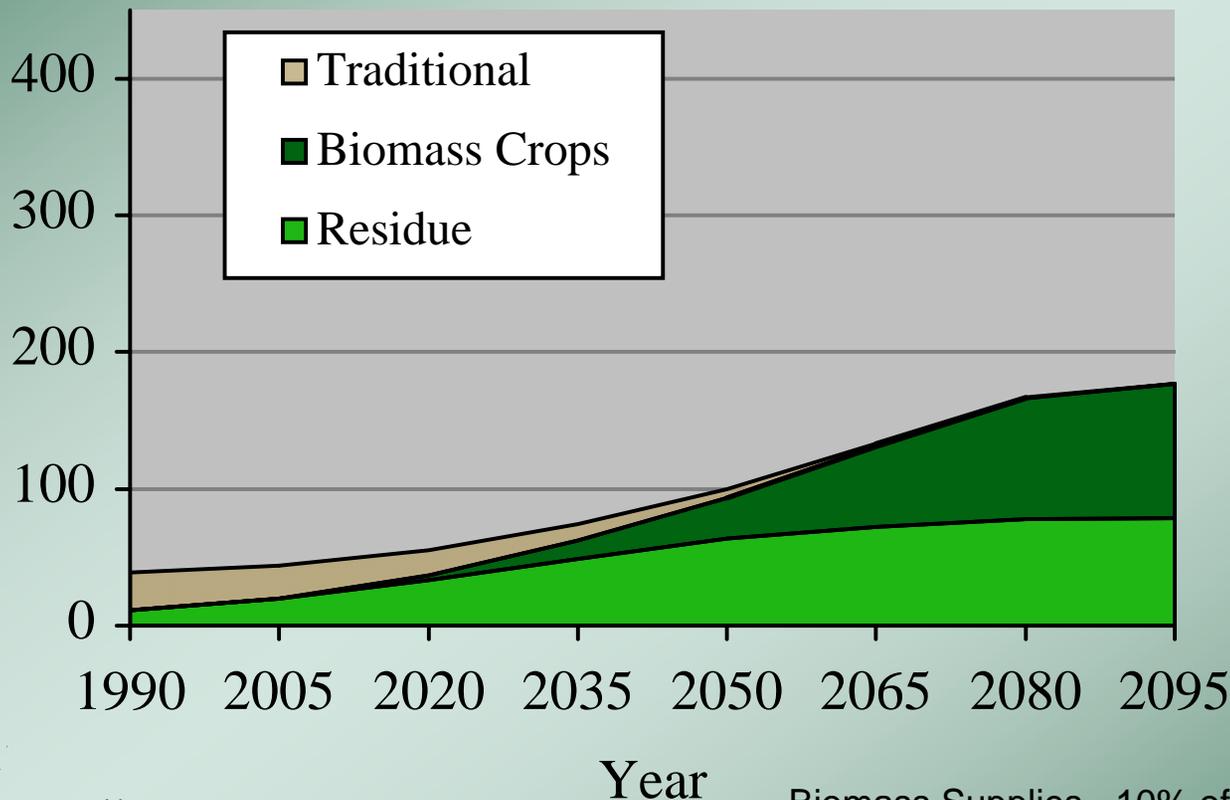
- Despite petroleum as a common source, there are many fuels in the current market.
 - Gasoline, diesel, kerosene
 - Multiple grades of fuels
 - Local reformulations for environmental reasons
- Fuels will continue to be matched to end-use
- Flexible fueling will grow
 - Bio-ethanol, gasohol etc.
 - Diesel and Bio-diesel
 - Hybrids and using information to create flexibility



Future fragmentation - the case of bio-ethanol

Global Biomass Supply

(Ethanol vehicles - no climate policy)



Use of “modern” biomass increases throughout the century in the base case.

The level of biomass use depends on the cost of biomass production and transformation, and the demand for products such as ethanol.

Biomass Supplies ~10% of total primary energy in this case

Source: ObJECTS 1.0 (MiniCAM)

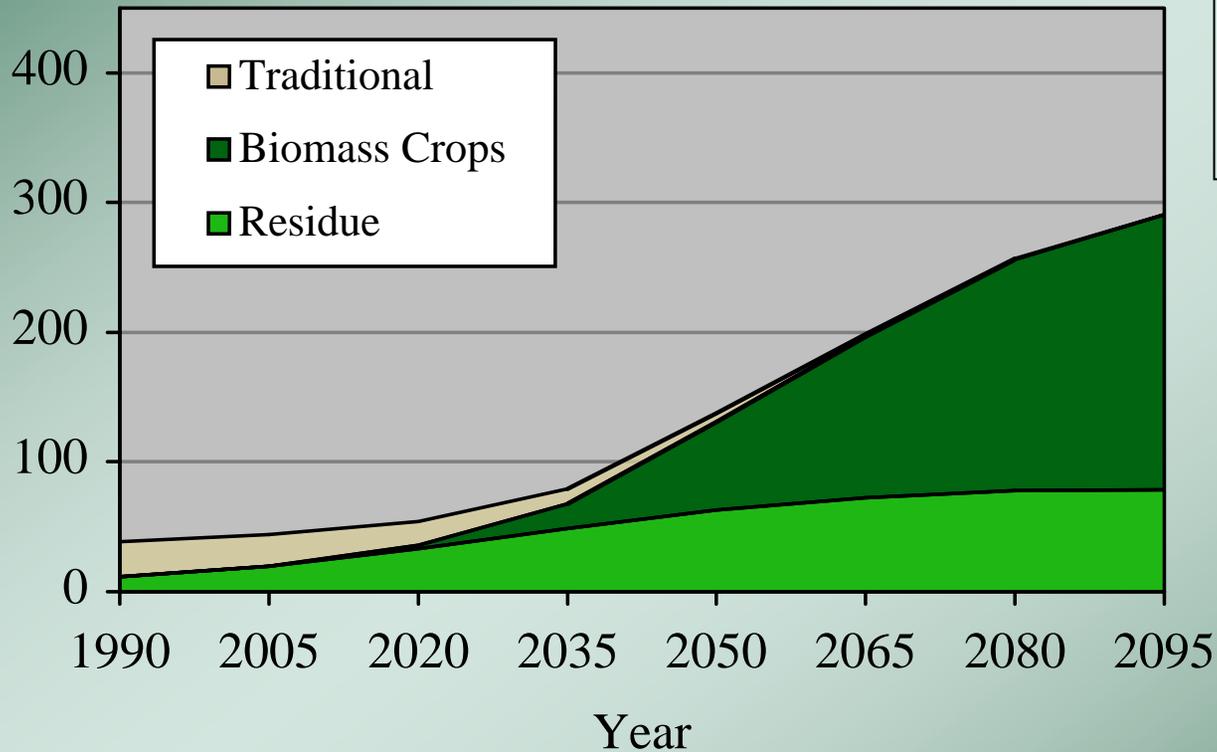


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A stabilization regime (550ppm) increases biomass demand more than 50%

Global Biomass Supply
(B2 550 stabilization case)



While use of residue sources increases, most biomass supply by the end of the century is dedicated crops.

Questions:

Is this level of residue use or biomass crop production sustainable?

Growing biomass crops at a large scale results in land conversion — are the carbon consequences favorable?

Source: ^objECTS 1.0 (MiniCAM)

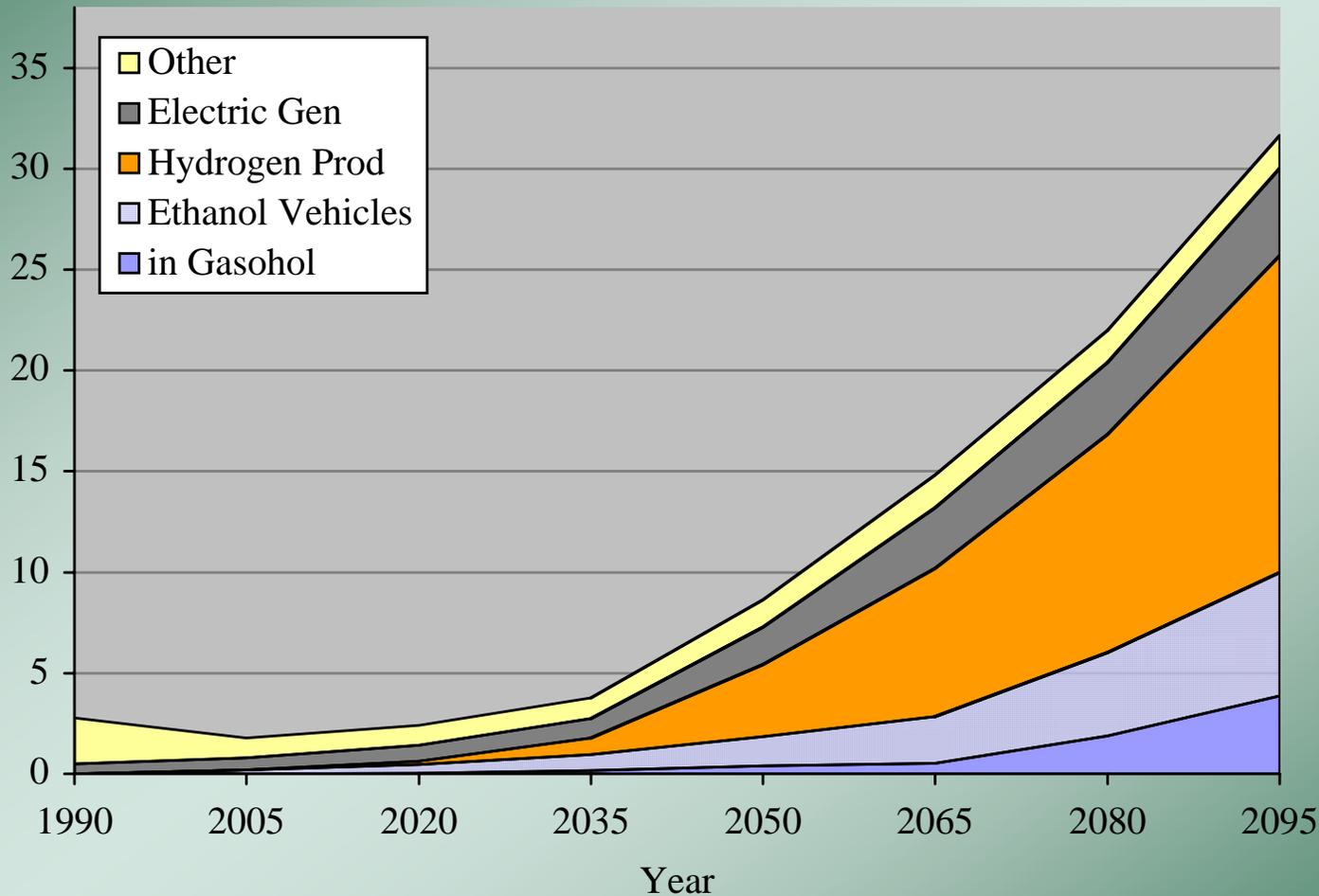


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But availability of vehicles determines how the biomass is used

Biomass Use (USA)
WRE 550 (few Ethanol Vehicles)



With a relatively small demand for biofuels, most biomass is used in other sectors.

Source: ObJECTS 1.0 (MiniCAM)

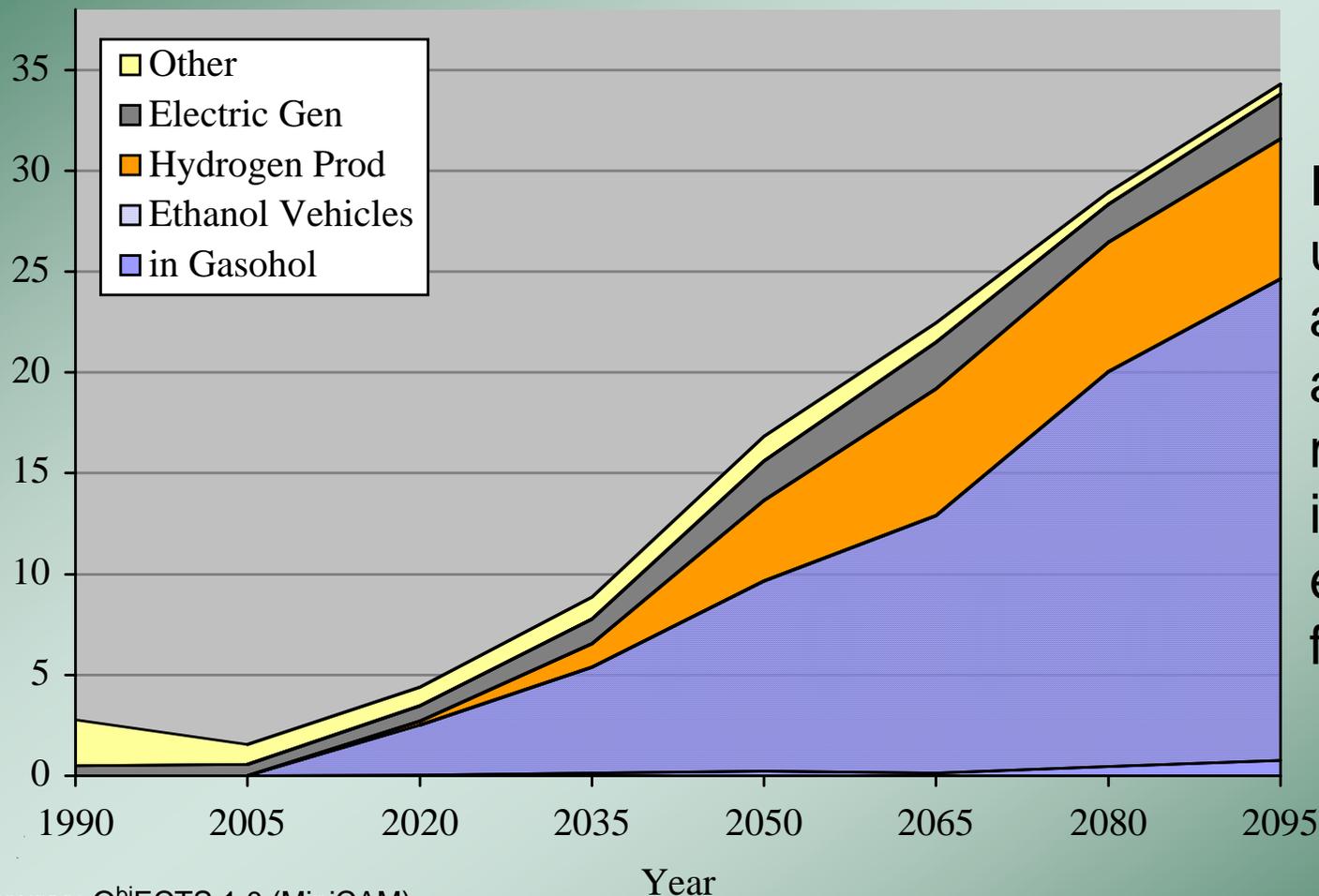


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More ethanol vehicles more demand

Biomass Use (USA)
WRE 550 (Ethanol Vehicles)



If vehicles using biofuels are available, then most biomass is used as an ethanol feedstock.

Source: OBJECTS 1.0 (MiniCAM)

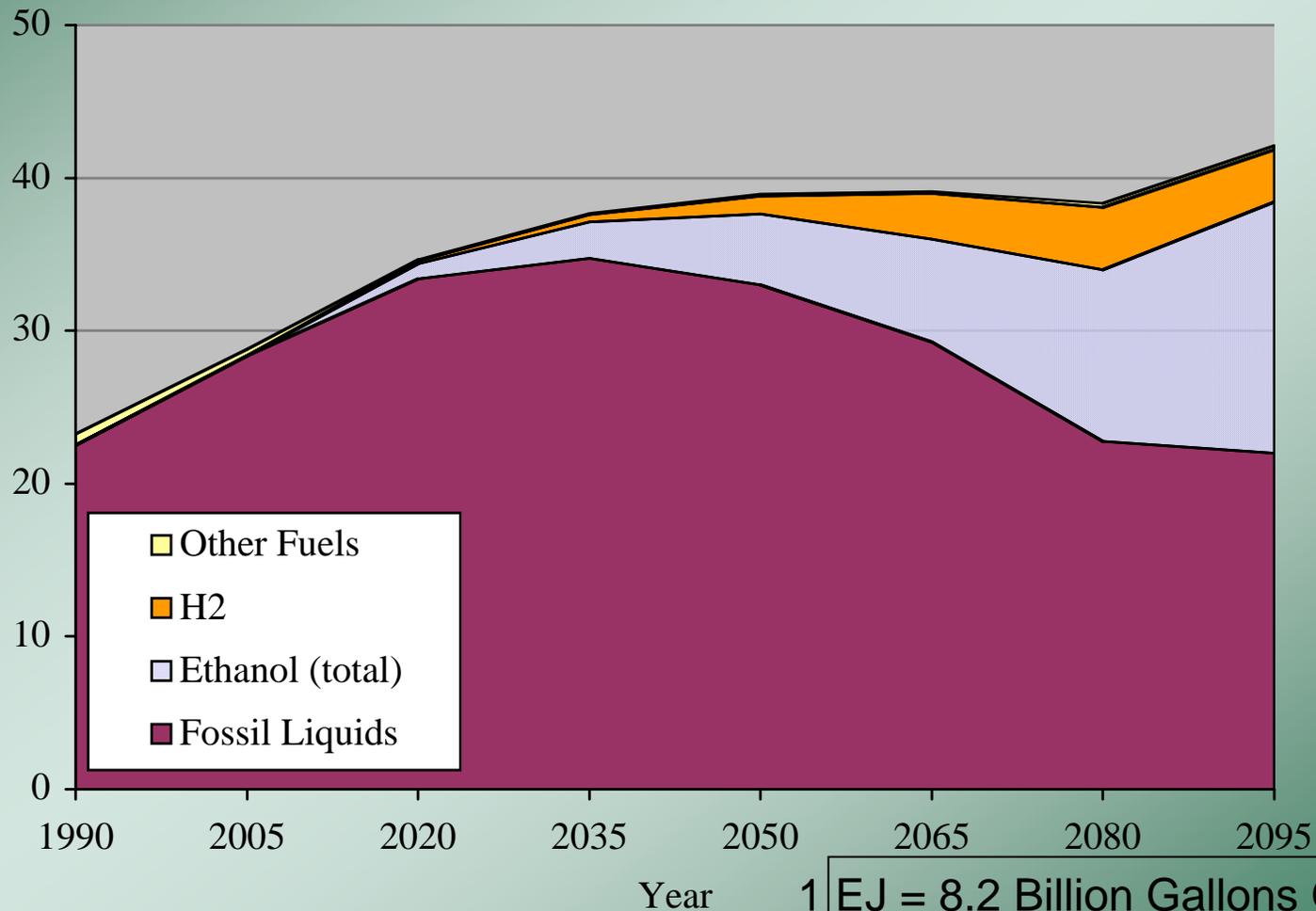


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But fossil fuel use continues to be high

**Transportation Energy Use (USA)
WRE 550 (Ethanol Vehicles)**



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In conclusion, when burnishing your ammunition, remember ...

- There are two parts to the climate solution.
 - Not making it worse - efficiency
 - Driving to zero-carbon emissions - renewable
- Geography will strongly affect the markets and the competition
 - Both local resources and local circumstance can give you an advantage in the market.
- During a period of changing value of carbon, facilitating consumer choice has great value.
 - Diesel engine fuel flexibility may be a critical factor in its developing role.

