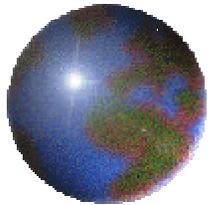


Sharing the Burden—

*Trade, Transfers & Costs Under Hypothetical
Protocols to Stabilize Atmospheric CO₂*

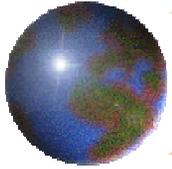


4th Sino-Korea-U.S. Economic
and Environmental Modeling
Workshop

Jae Edmonds & Sonny Kim

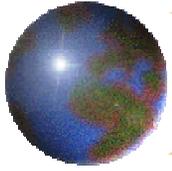
May 21, 2001

Beijing, China



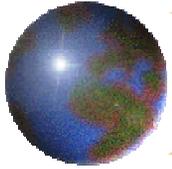
Keystone Analysis

- ✓ Today's presentation examines the cost to participants of some alternative long-term, burden-sharing regimes that stabilize atmospheric CO₂.



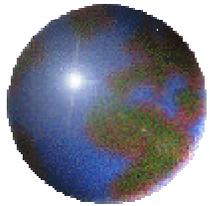
Some Preliminary Observations

- ✓ For the hypothetical protocol, stabilizing CO₂ **concentrations** at 550 ppmv implies that US **emissions** return to 1990 levels between 2020 and 2050, depending on the burden sharing regime. (A 650 ppmv concentration adds 30 years.)
- ✓ The value of carbon emissions rights to be distributed in any burden sharing regime is 10 times greater than the cost of emissions mitigation in the early years of the agreement, raising the importance of Fairness, Equity, and Justice in the discussions,
- ✓ Under some burden sharing protocols domestic mitigation costs are dwarfed by income transfers,
- ✓ The relative advantages of burden sharing can change over a century implying the potential for a “dropout” problem, e.g. China.



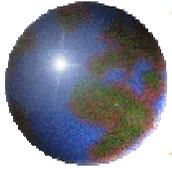
Scenario Analysis

- ✓ Constructing a Reference Case
- ✓ Policy Choices
 - *550 ppmv or 650 ppmv*
 - *Burden Sharing—who does what and when?*



The Reference Case

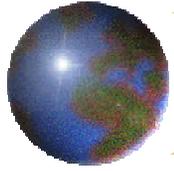
Emissions



Modeling the Future

Climate policy requires a portfolio of responses, including ...

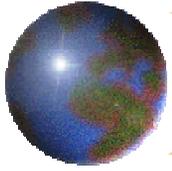
- ✓ **Emissions mitigation,**
- ✓ **Technology development,**
- ✓ **Climate adaptation, and**
- ✓ **Resolving scientific uncertainty.**



Reference CO₂ Emissions

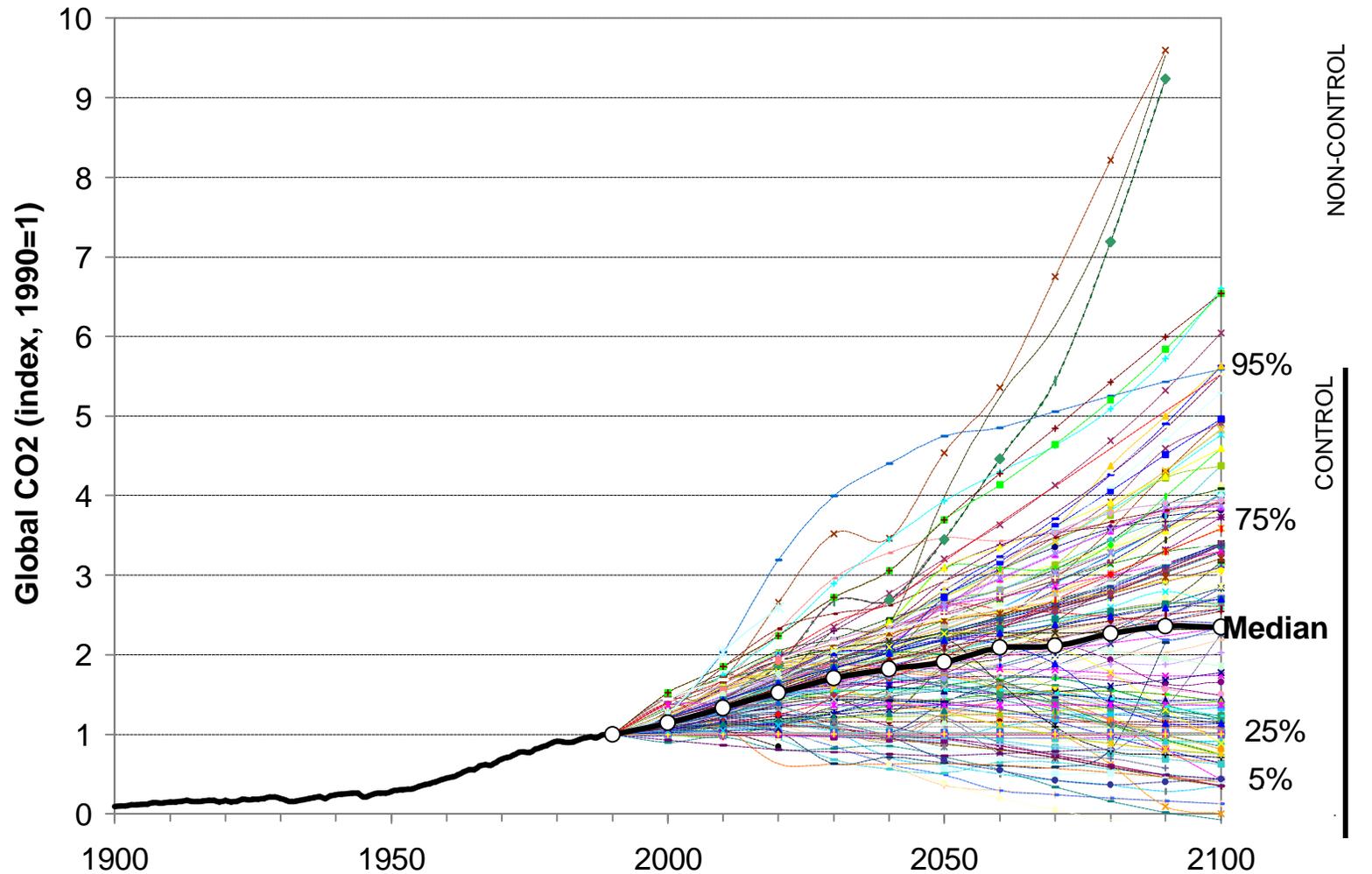
Factors That Drive Emissions

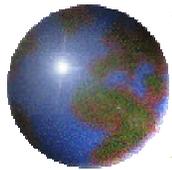
- ✓ Emissions Are Driven by Population, Economic Growth, Energy Intensity and Carbon Intensity
- ✓ In the Absence of Climate Policy, Population and Economic Growth Will Likely Lead to Increased Emissions



Reference CO₂ Emissions

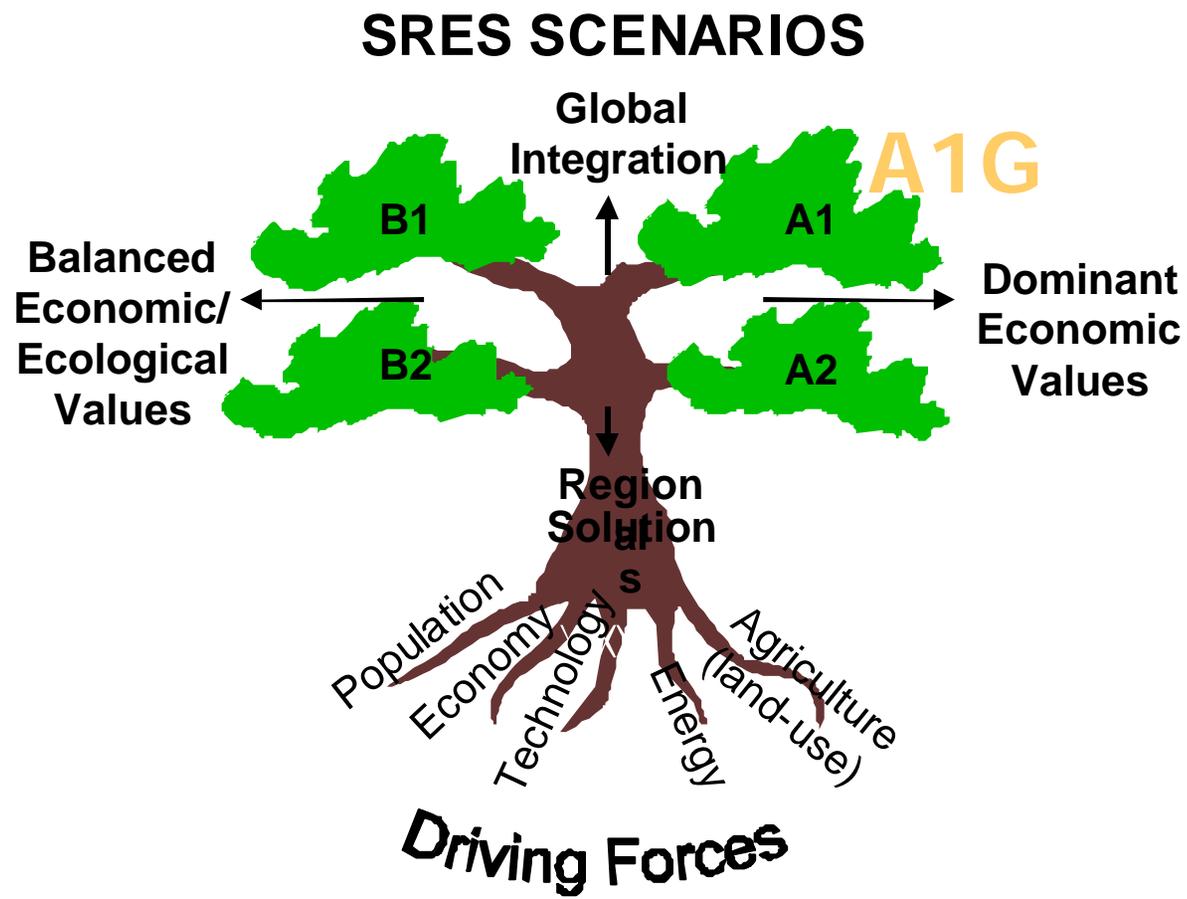
If present trends continue ...

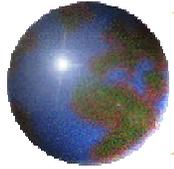




Reference CO₂ Emissions

Using the new IPCC scenarios ... **A1G**

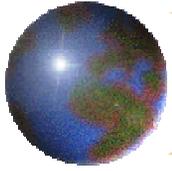




Reference CO₂ Emissions

SRES A1G ...

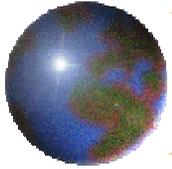
- ✓ An affluent world, with a rapid demographic transition (declining mortality and fertility rates) and an increasing degree of international development equity.
- ✓ Very high productivity and economic growth in all regions, with a considerable catch-up of developing countries.



Reference CO₂ Emissions

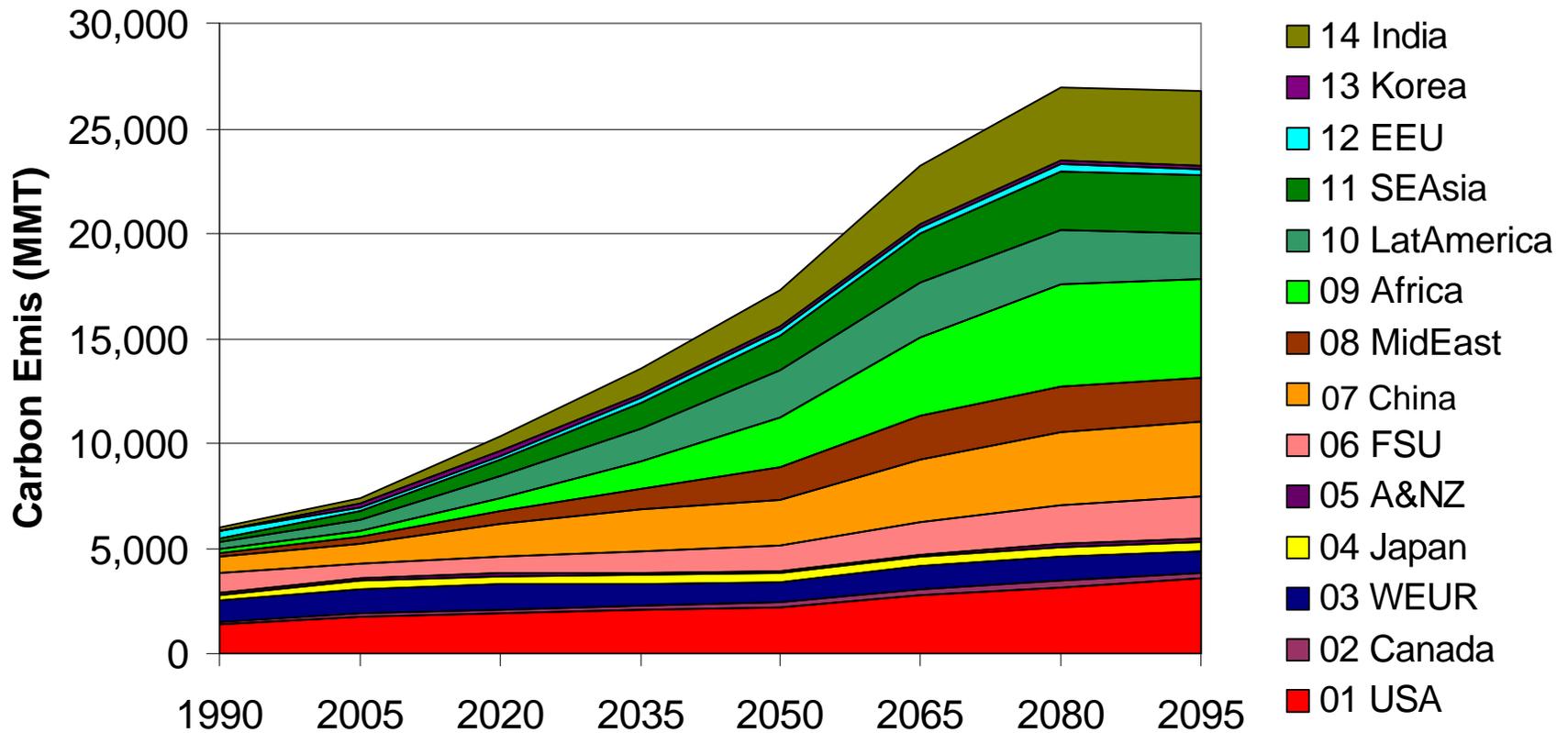
SRES A1G ...

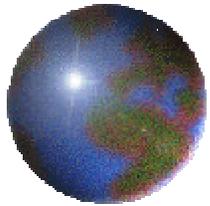
- ✓ Comparatively high energy and materials demands, moderated however by continuous structural change and the diffusion of more efficient technologies, consistent with the high productivity growth and capital turnover rates of the scenario.
- ✓ An oil- and gas-rich future, with a swift transition from conventional resources to abundant unconventional resources including methane clathrates.



Reference CO₂ Emissions

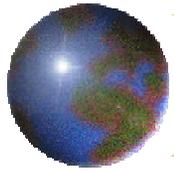
A1G CO₂





Burden Sharing

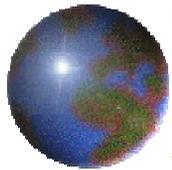
Alternatives



Burden Sharing

Burden sharing options—Who gets the money?

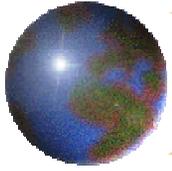
- ❖ **Grandfathered**—*e.g. Kyoto Protocol—low emission, high growth (poor developing) → high emission, low growth (rich developed).*
- ❖ **Equal per capita**—*from rich, low population, high growth → poor, high population, low growth —Would China stay in?.*
- ❖ **GDP based**—*from high emission, high growth → low emission, low growth.*
- ❖ **Historical responsibility**—*from high emission → low emission.*
- ❖ **Mixed**—*e.g. grandfathered initial allocation adjusted for GDP growth—transfers could be small but from those with low rates of C/GDP decline to those with high rates of C/GDP decline.*



Burden Sharing & CO₂ Concentrations

Four Hypothetical Agreements ...

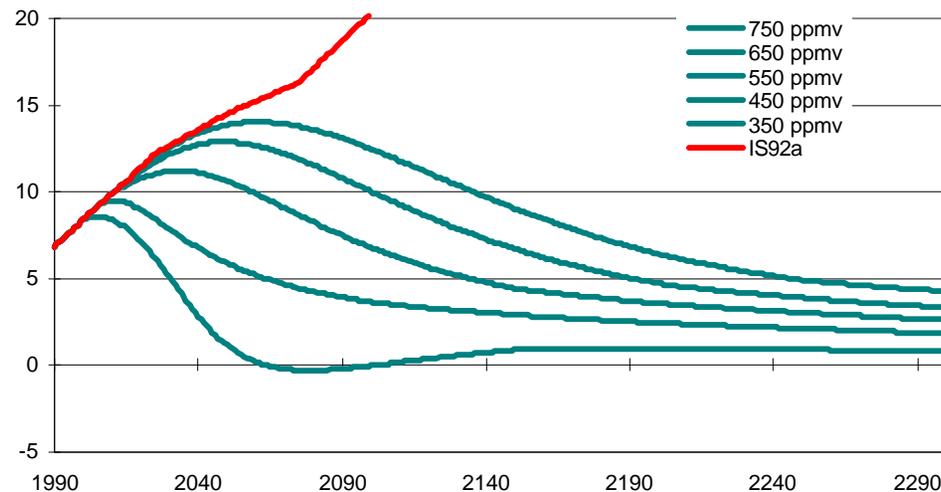
Burden Sharing Agreement		Concentration	
		550 ppmv	650 ppmv
1.	Global, common carbon tax, all nations participating from the beginning	1-550	1-650
2.	Historical emissions 2000, with allocations adjusted for economic growth, all nations participating from the beginning	2-550	2-650
3a.	Historical emissions 2000, with allocations adjusted for economic growth, Annex I nations lead, China follows in 2020 years, other nations follow when they reach China's year 2020 income per capita	3a-550	3a-650
3b.	Historical emissions 2000, with allocations adjusted for economic growth, Annex I nations lead, China follows in 2035 years, other nations follow when they reach China's year 2035 income per capita	3b-550	3b-650
4.	Equal per capita emissions 2000, all nations participating from the beginning	4-550	4-650

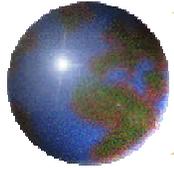


Stabilizing Concentrations

Means Emissions Must Ultimately Begin a Long-term Decline ...

Emissions Trajectories Consistent With Various Atmospheric CO₂ Concentration Ceilings

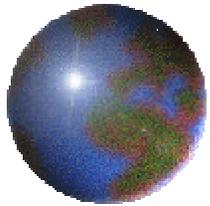




Burden Sharing

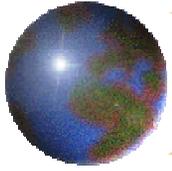
*Efficiency Determines Emissions
Limitation ...*

**Burden Sharing Determines Permit
Trading and Income Transfer.**



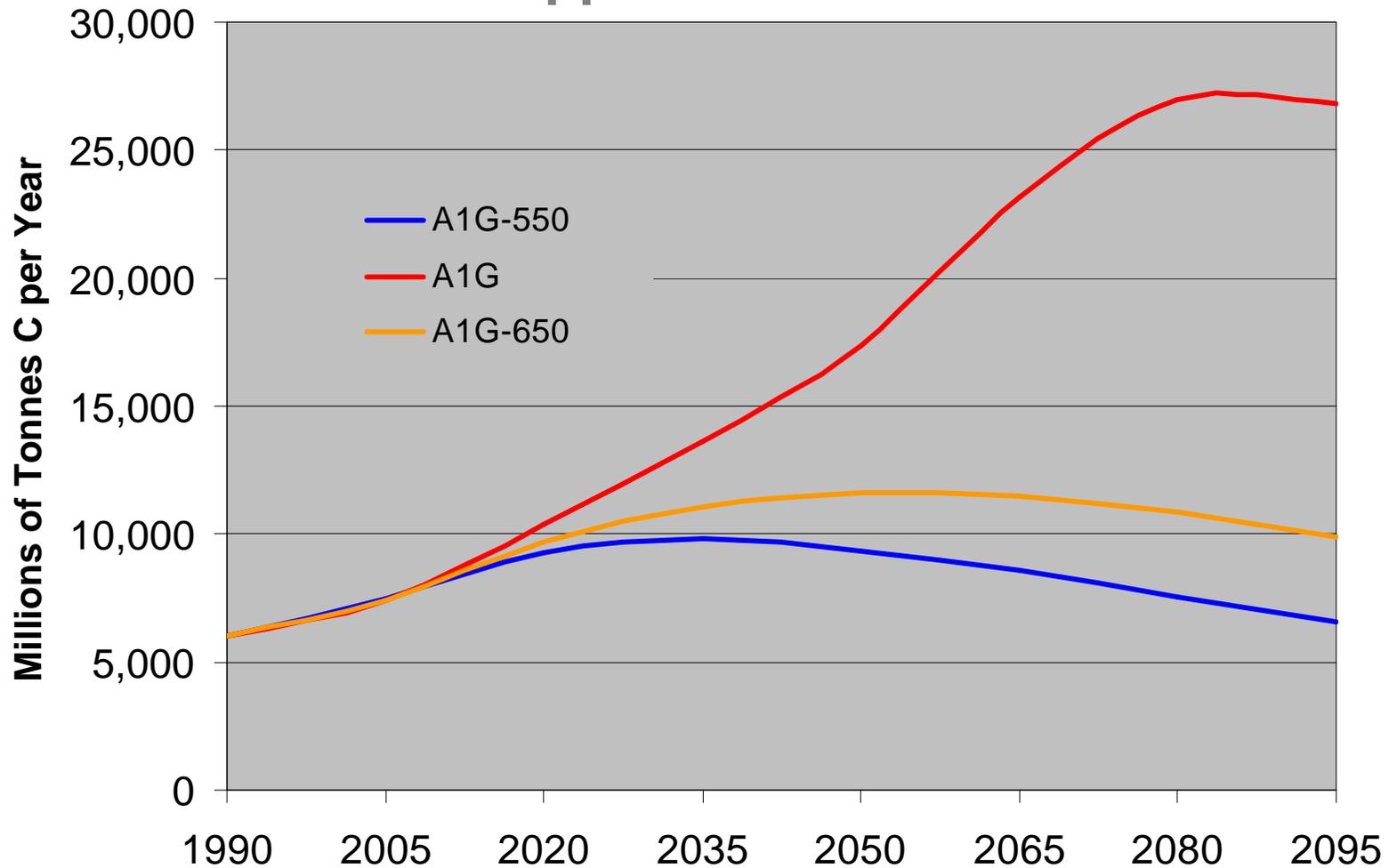
Burden Sharing

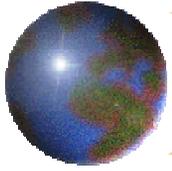
Analysis



Emissions Pathways

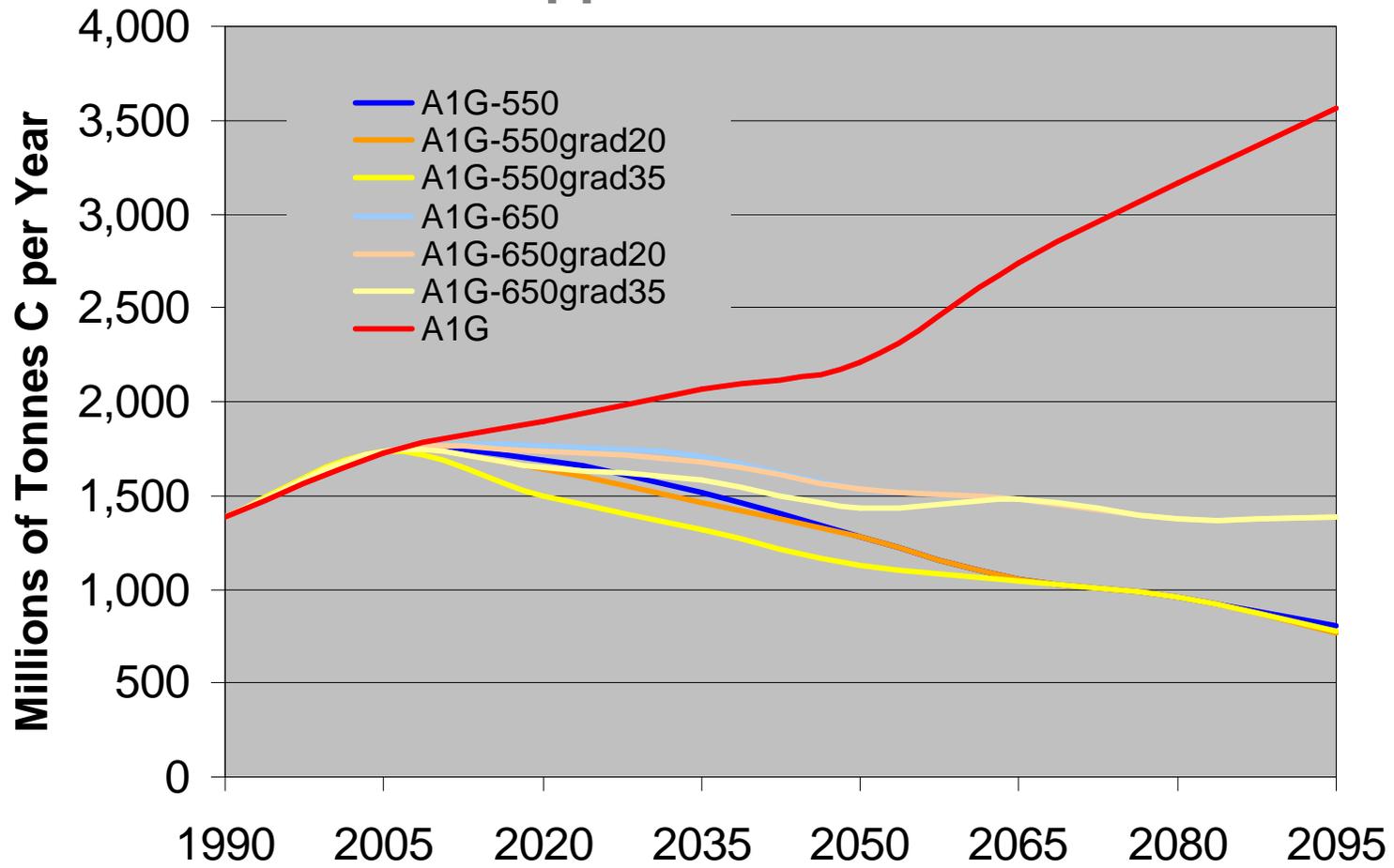
Global CO₂ Emissions 550 & 650 ppmv Concentrations

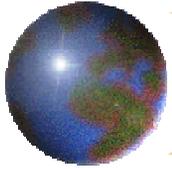




Emissions Pathways

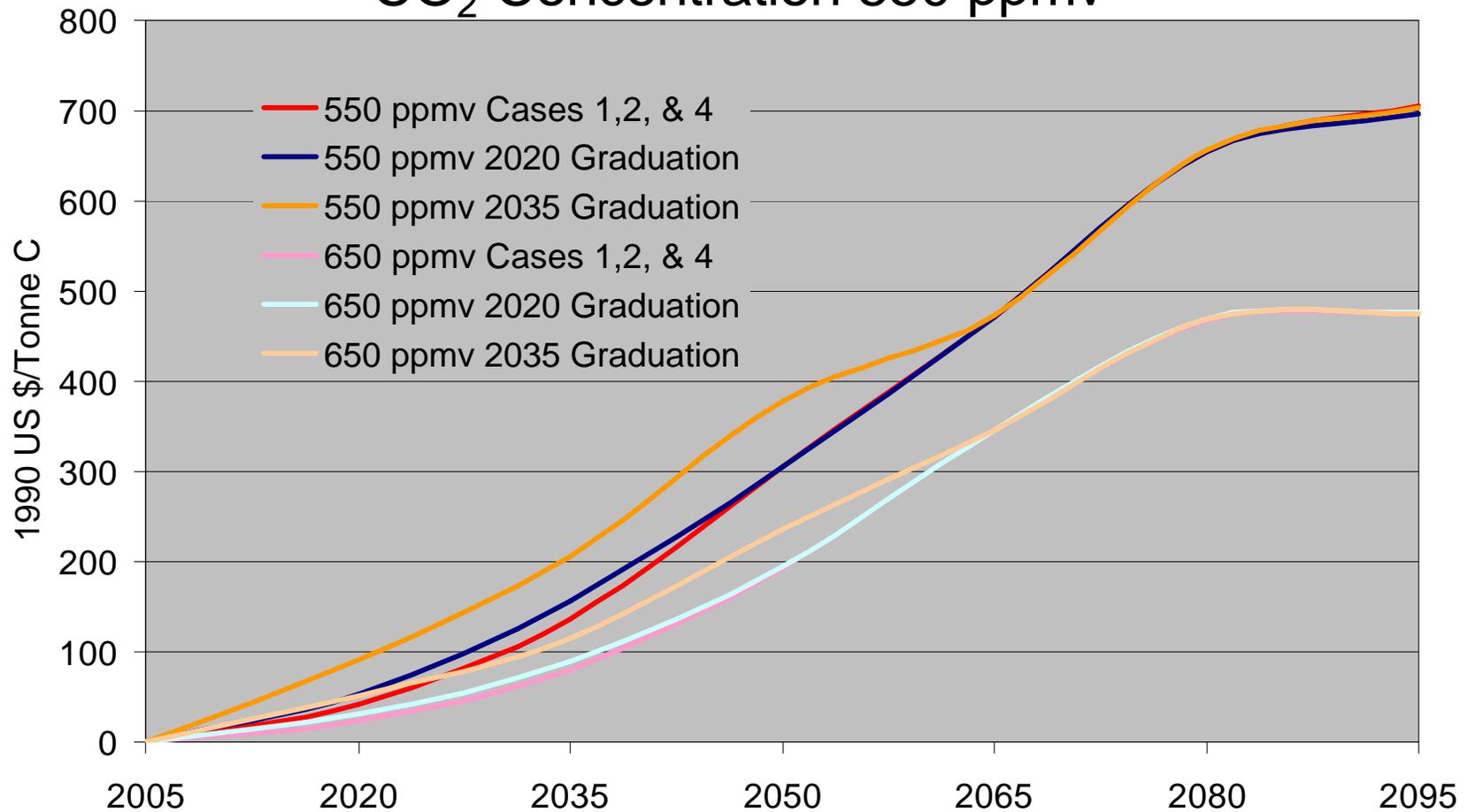
US CO₂ Emissions 550 & 650 ppmv Concentrations

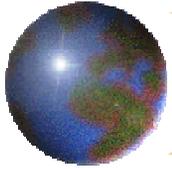




Emissions Pathways

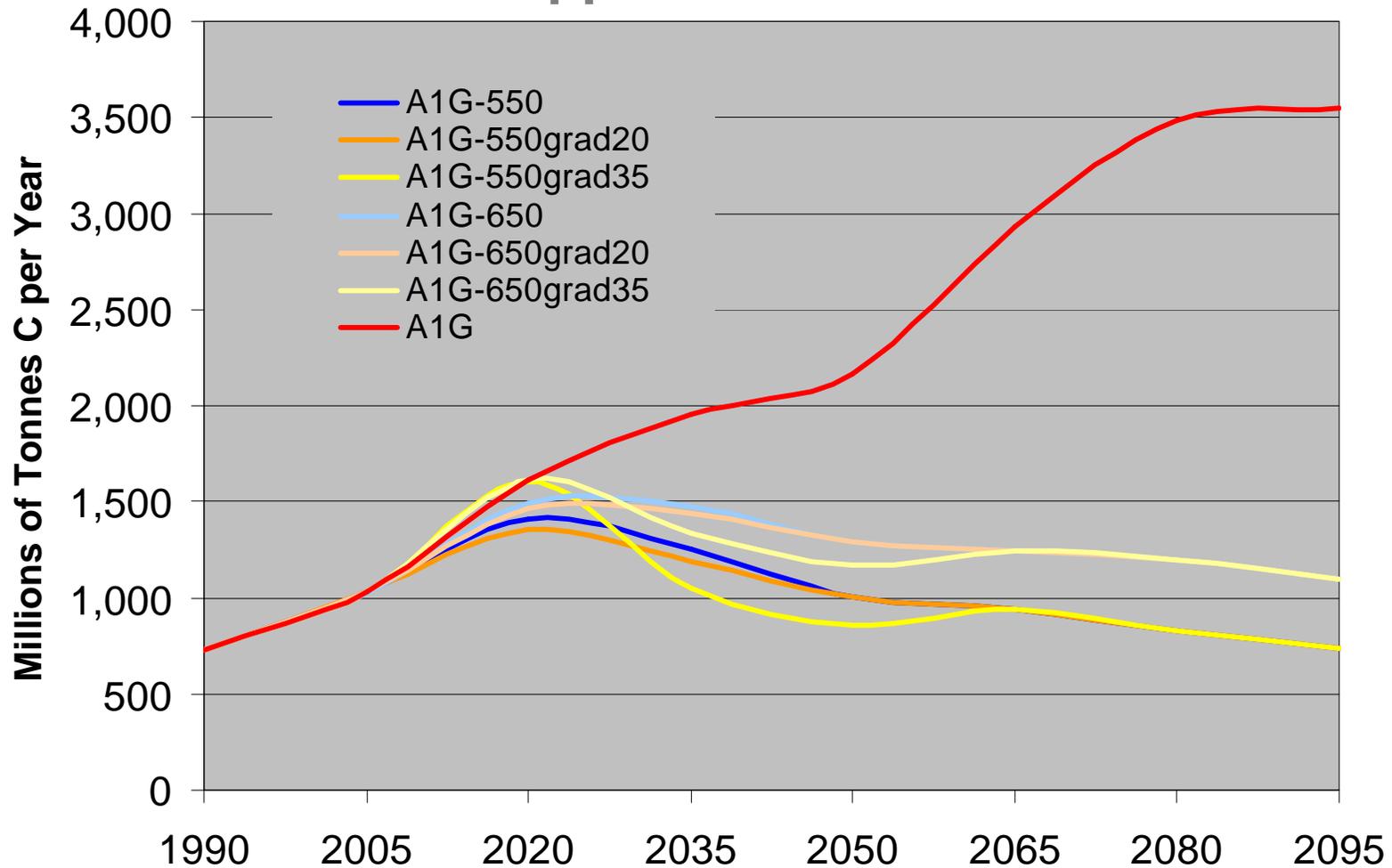
Carbon Tax Rate in the USA CO₂ Concentration 550 ppmv

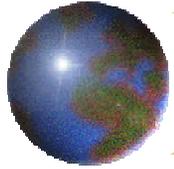




Emissions Pathways

China CO₂ Emissions 550 & 650 ppmv Concentrations

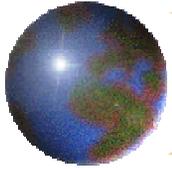




Burden Sharing & Cost

*Efficiency Determines Emissions
Limitation Cost ...*

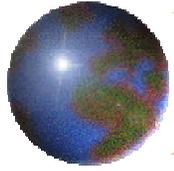
**Burden Sharing Determines Permit
Trading and Income Transfer.**



Burden Sharing

In the early years there is far more at stake in negotiating the burden than there is in the benefits or costs of climate change.

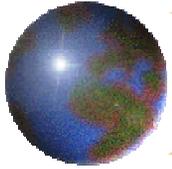
- ❑ Value of emissions rights are roughly an order of magnitude greater than the cost of mitigation.
- ❑ Value of carbon \$50/tonne and emissions at 10 billion tonnes → \$500 billion.
- ❑ Mitigation of 2 billion tonnes → \$50 billion.



Burden Sharing

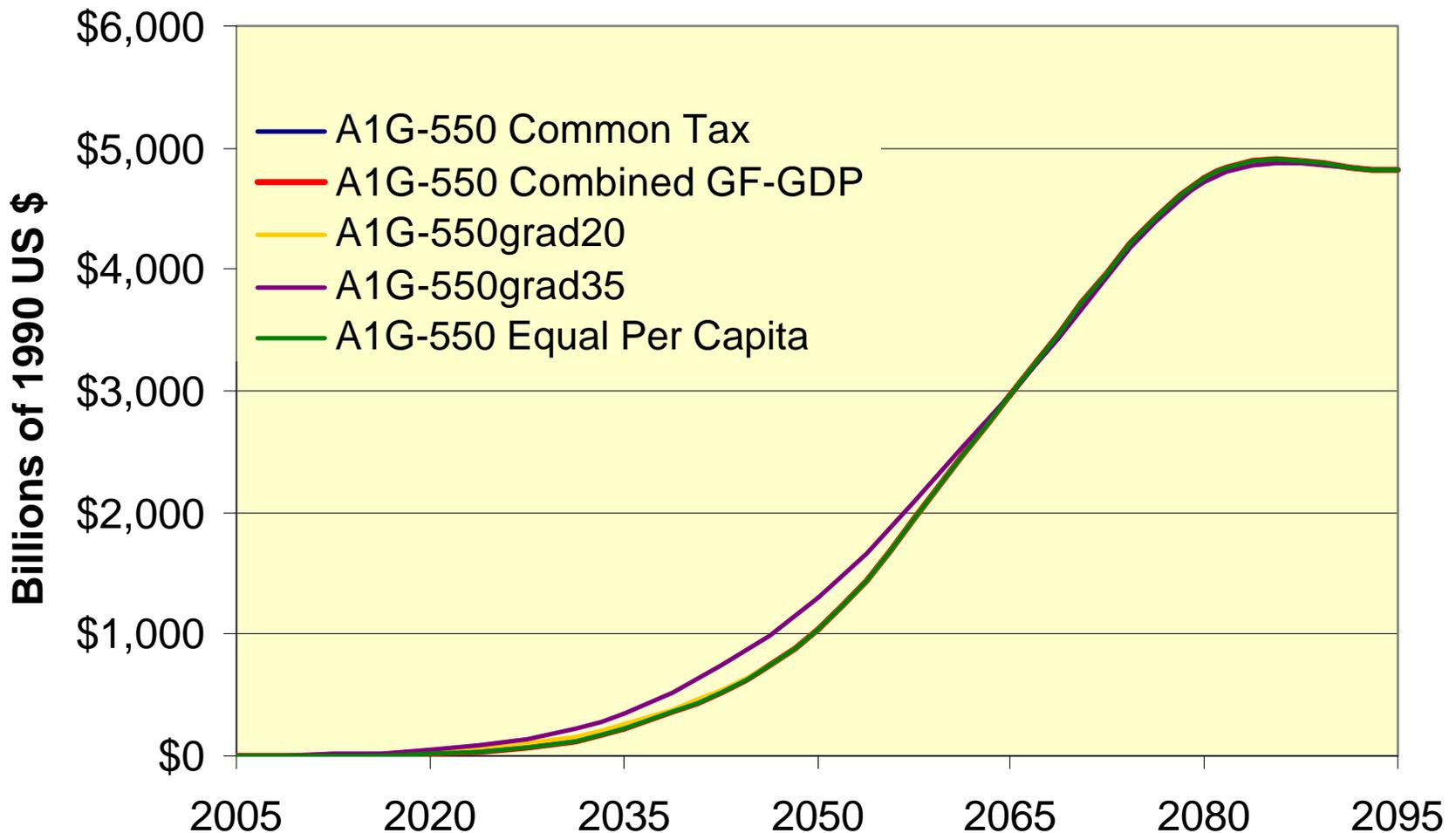
Burden sharing implies wealth transfers

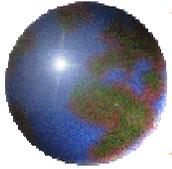
- ✿ Most countries don't like to transfer wealth to other countries.



Burden Sharing & Cost

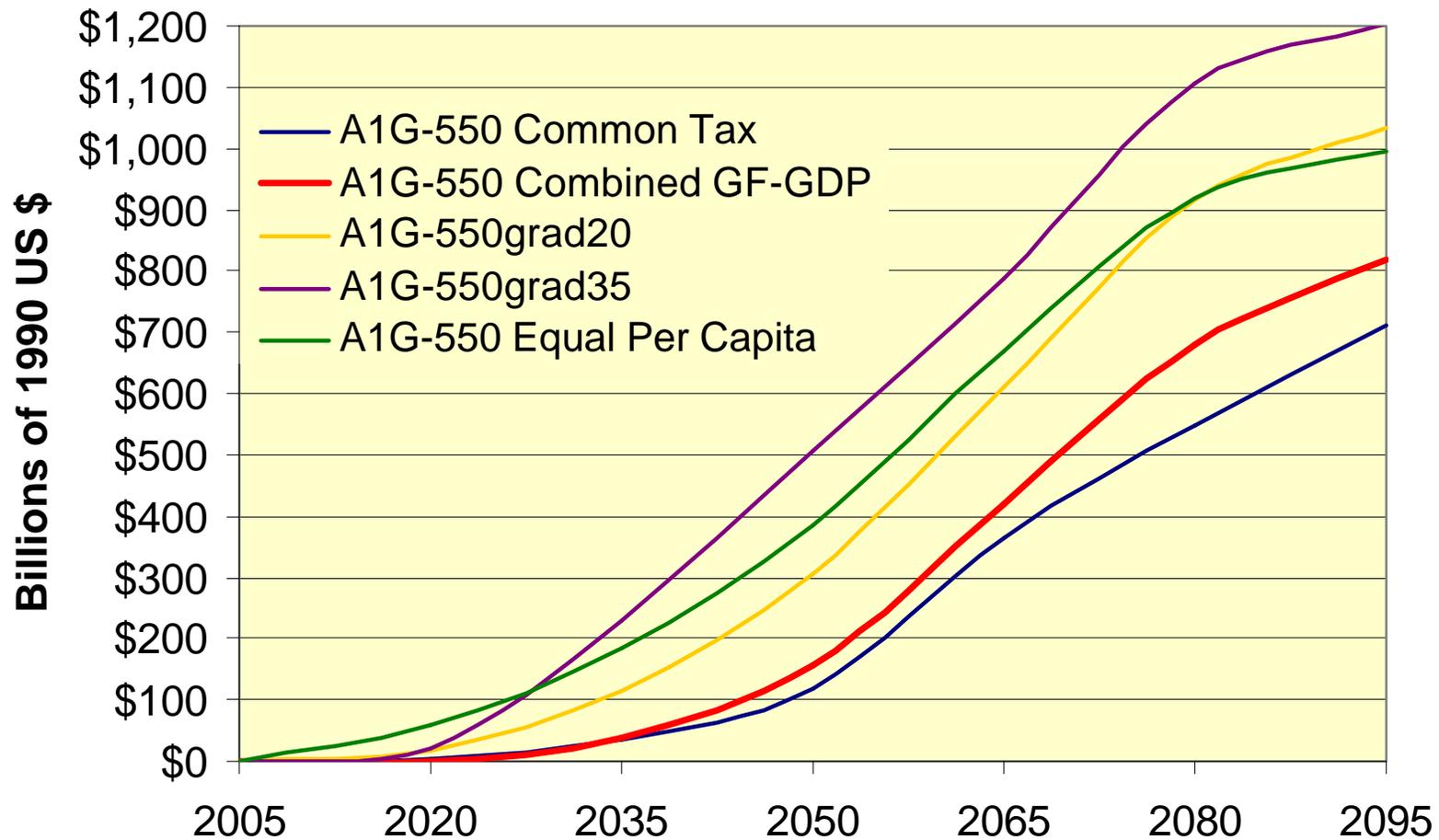
Global Cost of Alternative Burden Sharing Regimes

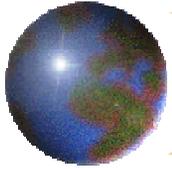




Burden Sharing & Cost

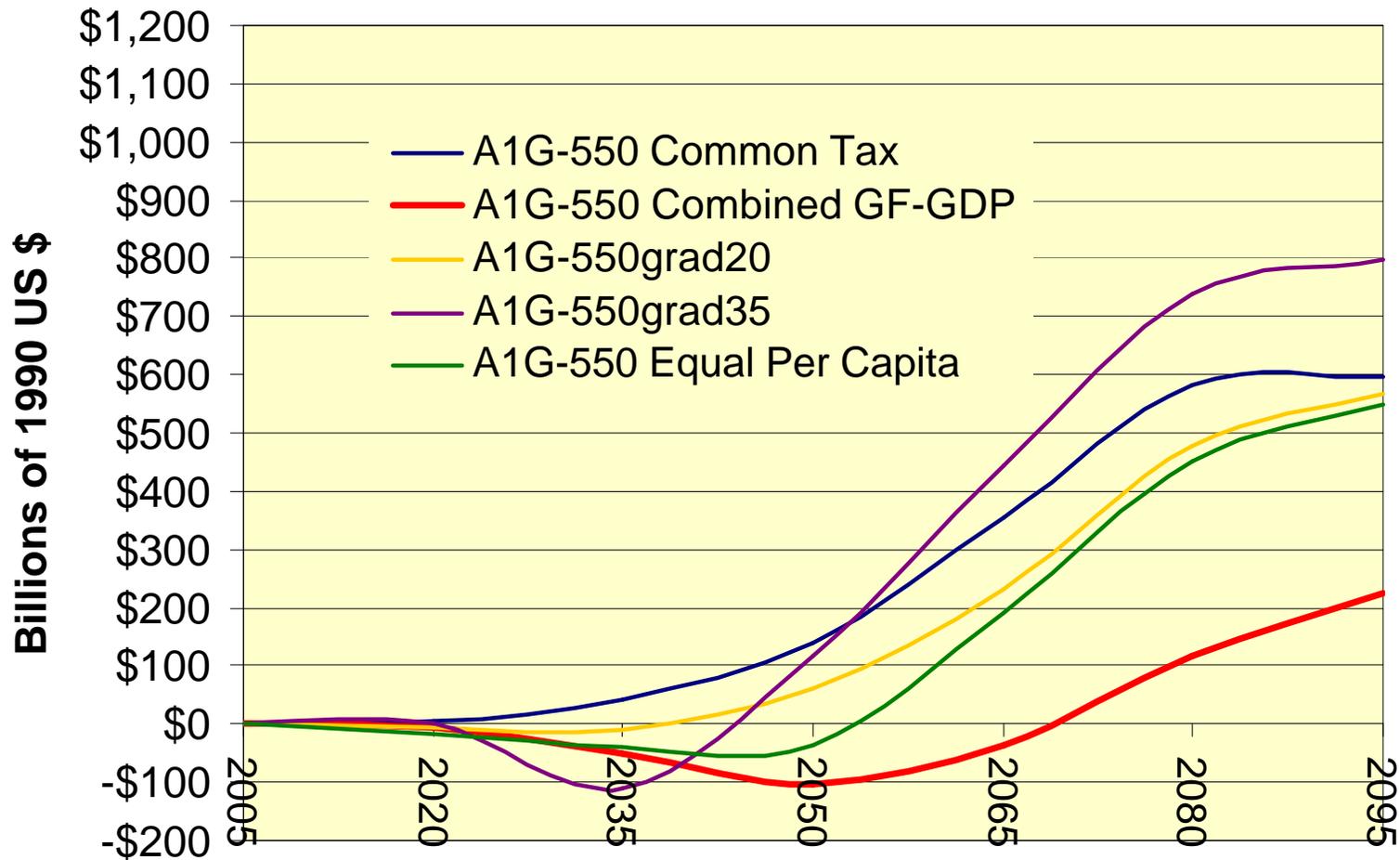
Cost in US of Alternative Burden Sharing Regimes

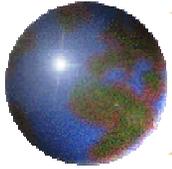




Burden Sharing & Cost

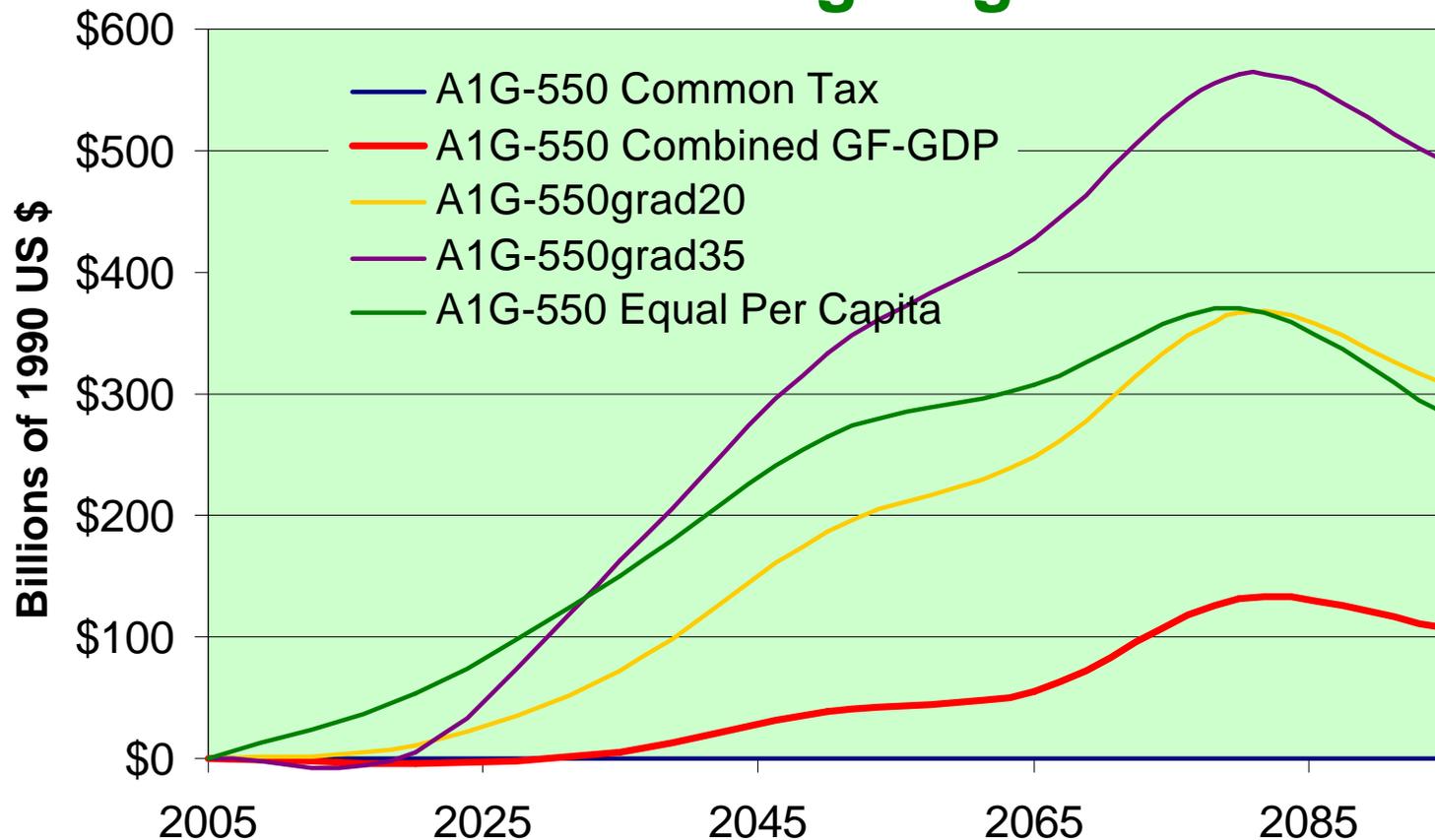
Cost in China of Alternative Burden Sharing Regimes

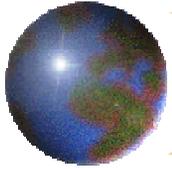




Burden Sharing & Cost

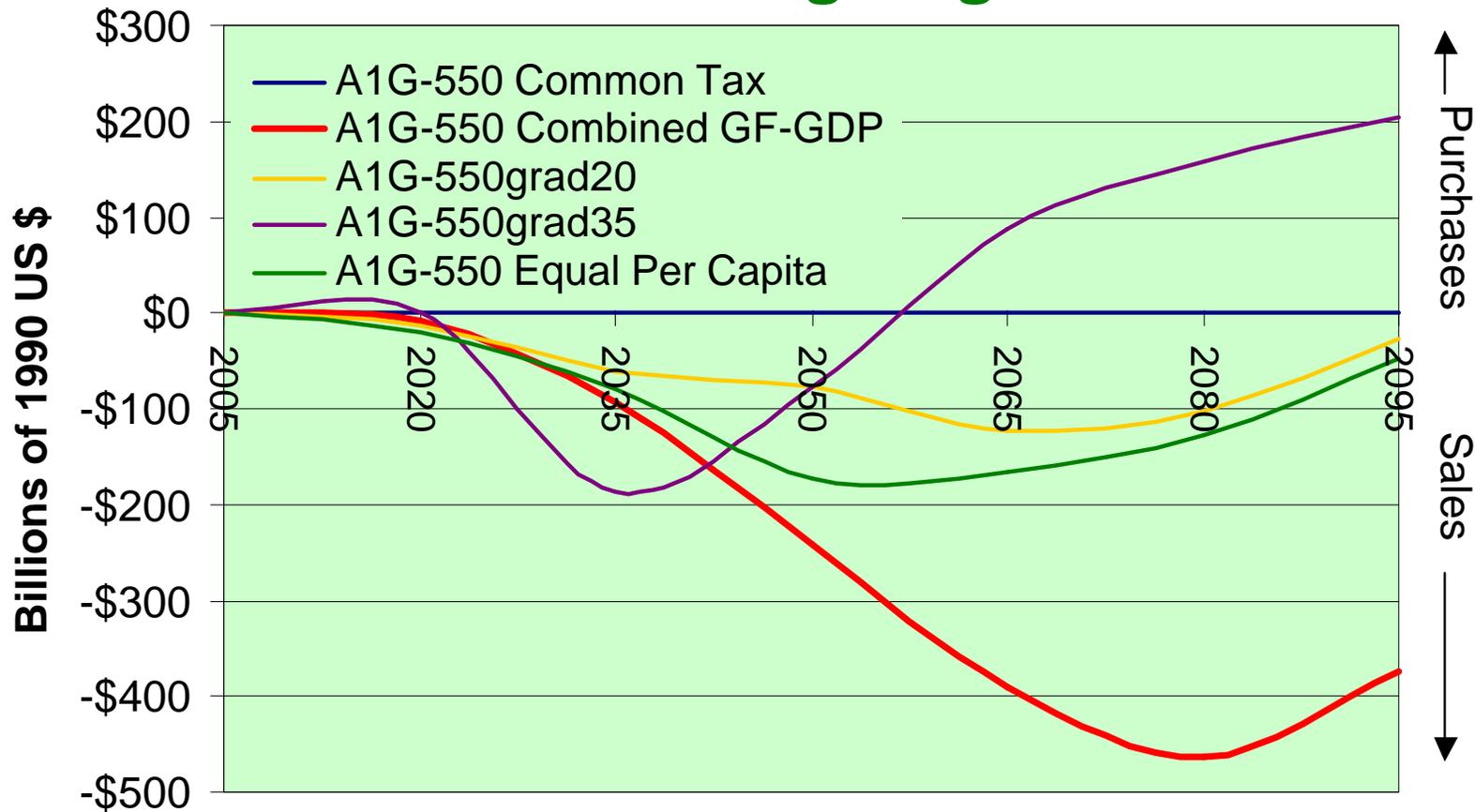
International Transfers of Income From the US Under Alternative Burden Sharing Regimes

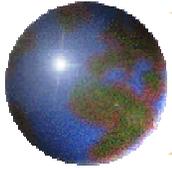




Burden Sharing & Cost

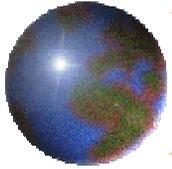
International Transfers of Income To & From China Under Alternative Burden Sharing Regimes





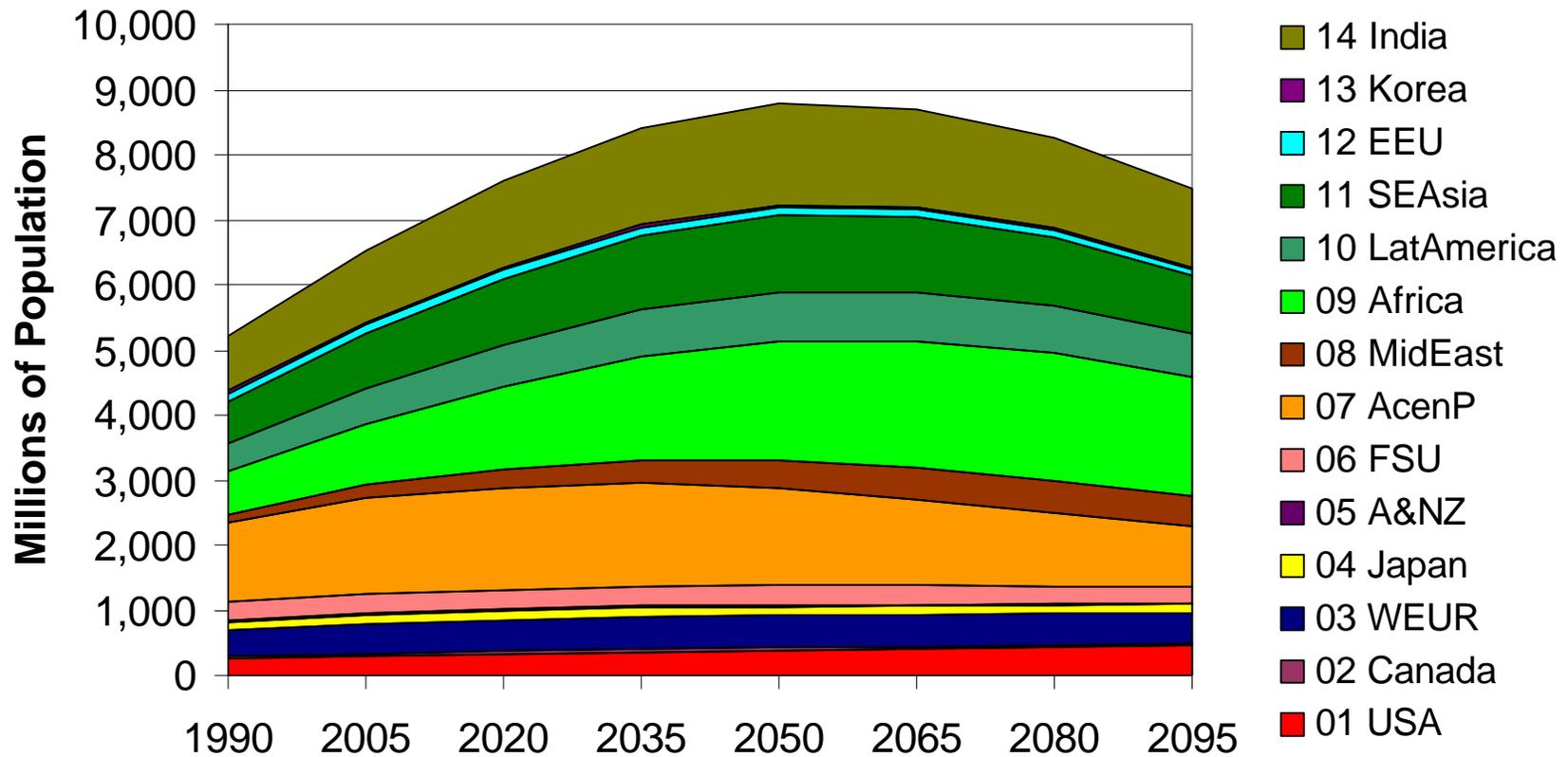
Some Preliminary Observations

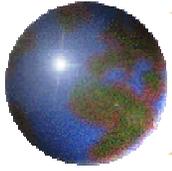
- ✓ Stabilizing CO₂ **concentrations** at 550 ppmv implies that US **emissions** return to 1990 levels between 2020 and 2050, depending on the burden sharing regime. (A 650 ppmv concentration adds 30 years.)
- ✓ The value of carbon emissions rights to be distributed in any burden sharing regime is 10 times greater than the cost of emissions mitigation in the early years of the agreement, raising the importance of Fairness, Equity, and Justice in the discussions,
- ✓ Under some burden sharing protocols domestic mitigation costs are dwarfed by income transfers,
- ✓ The relative advantages of burden sharing can change over a century implying the potential for a “dropout” problem, e.g. China.



Reference CO₂ Emissions

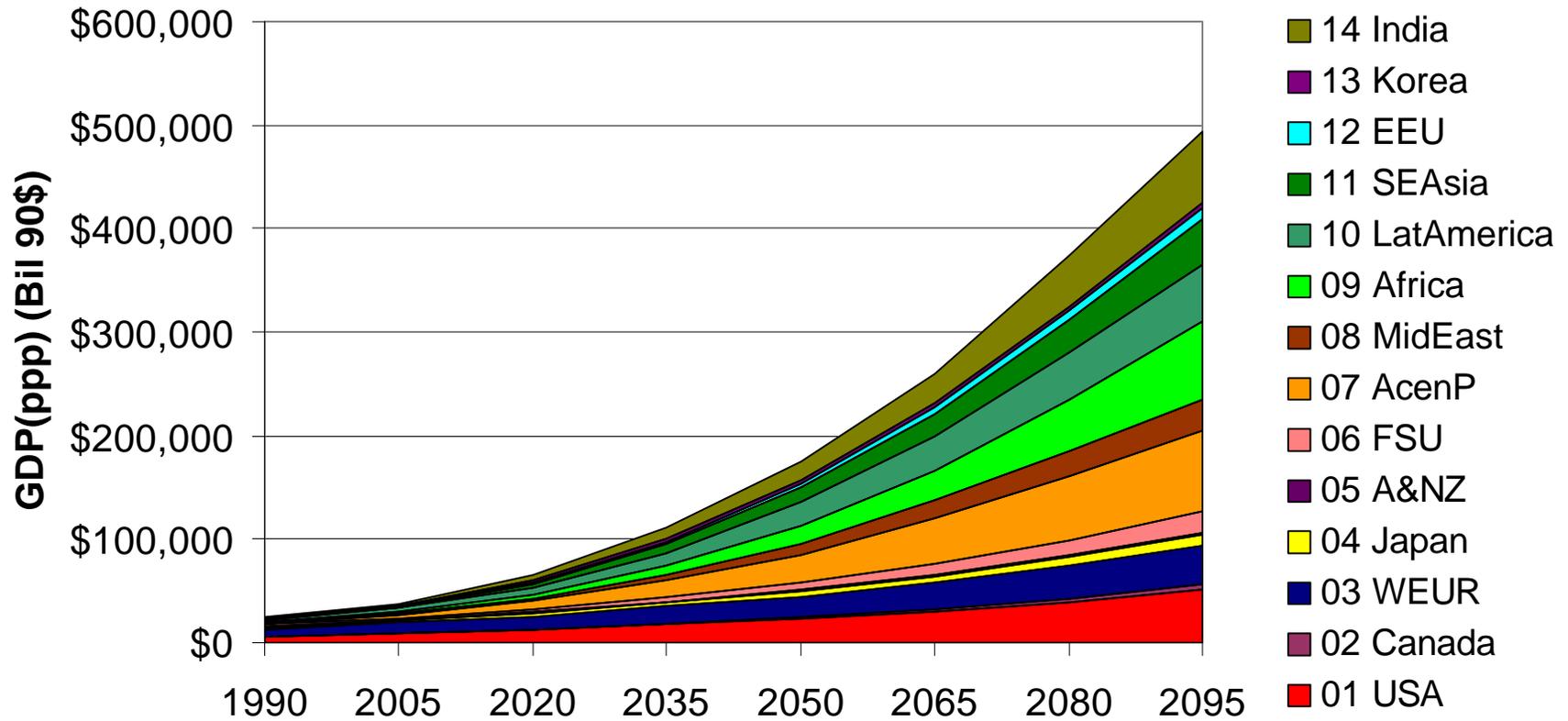
A1G Population

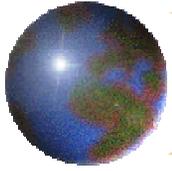




Reference CO₂ Emissions

A1G GDP





Reference CO₂ Emissions

A1G Energy

