India-U.S. Economic and Environmental Modeling Workshop

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Why We Are Here?

- Climate change, with its potential to impact every corner of the world, is a problem that must be addressed by the world
- Both India and the U.S. have roles to play
  - U.S., with 25% of world greenhouse emissions today, has been involved in initial efforts and will continue to work to address climate change
  - India, as a leader of the developing countries, will be involved in any global solution as well

Why Are We Here?

- The climate problem is complex compared to many other environmental problems
  - Global in nature
  - The science of climate change is evolving so policymakers have to make decisions with less than perfect information
  - Since many gases contribute to climate change, a multi-gas abatement strategy will be required
  - Changes in behavior/new technologies will be required; low/no emitting technologies will be needed in the long run

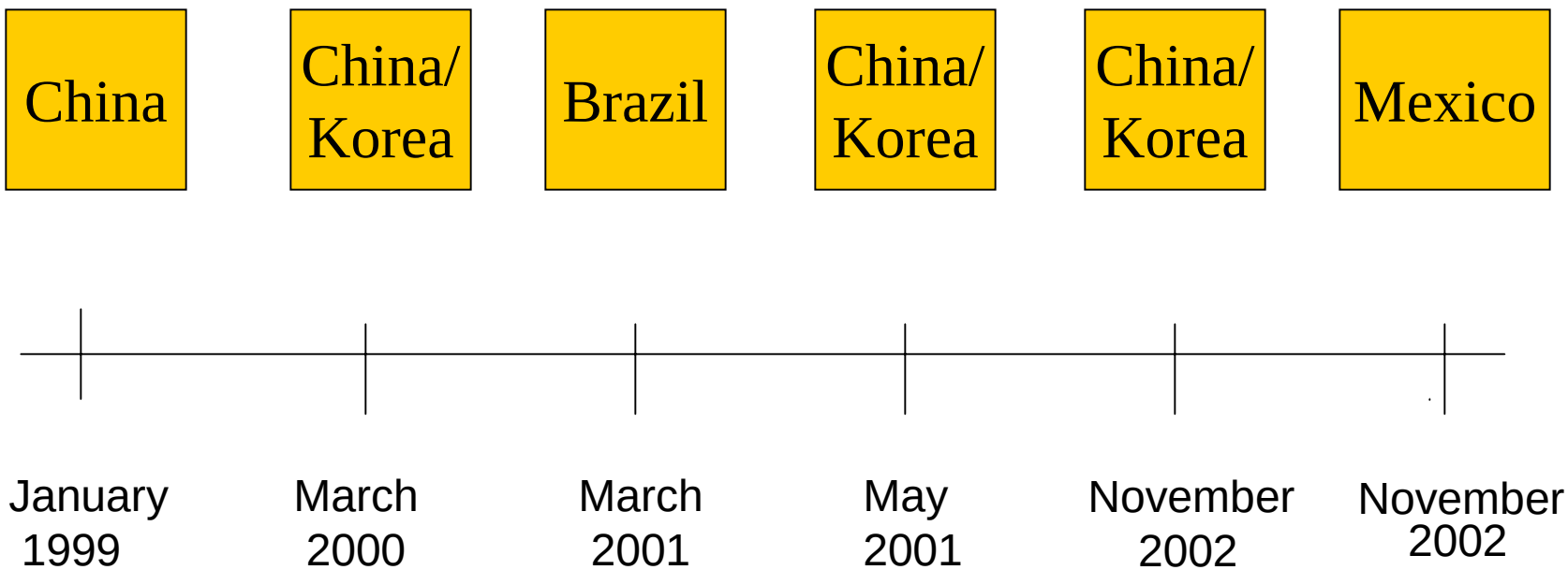
U.S. Bilateral Partnerships

- U.S. has made bilateral engagement with key partners a climate policy priority
- U.S.-India partnership designed to enhance ongoing projects and explore new opportunities
- Economic modeling workshop is one of several activities that U.S. EPA is supporting under the U.S.-India framework

Goals of Workshop

- Enhance cooperation between U.S.-India technical experts on climate economic issues
- Exchange information and improve understanding of analytical tools and results
- Encourage cooperation to improve methods of economic and environmental analysis
- Provide an informal opportunity to compare modeling results and discuss implications...
- ....ultimately, this will lead to improved modeling to better inform policymakers of policy options

U.S.-Non-Annex One Country Workshops to Date



- Each participating country is a large Non-Annex I country with substantial current/projected greenhouse gas emissions

Major Topics of Previous Workshops

- China/Korea: CO_2/non-CO_2 emissions scenarios in EMF setting; technology, international trade, energy efficiency, co-benefits
- Mexico: top down/bottom up energy sector models; land use patterns; international trade, co-benefits
- Brazil: global/Brazilian emissions trends; land use emissions; co-benefits

See http://www.pnl.gov/aisu/pubs/index.htm#model

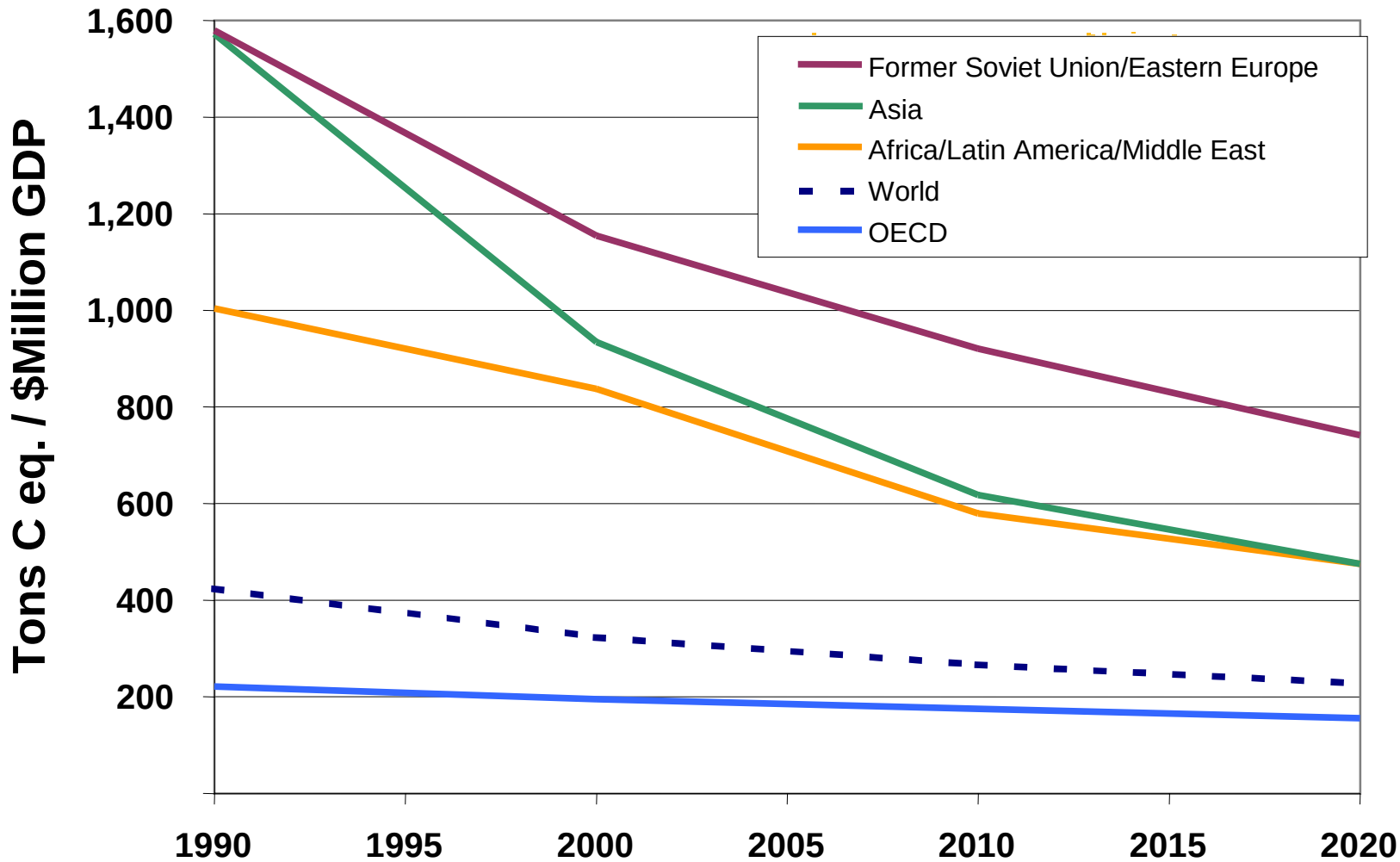
U.S. Views in Brief

- U.S. is not ratifying Kyoto Protocol
- U.S. remains an active party to the Framework Convention process
- U.S. has domestic program to control climate-related emissions and has set a goal of an 18% reduction in emissions intensity of GDP by 2012
- This workshop is not a forum for debating climate change policy positions
- For more information on U.S. position on climate change
  - http://www.state.gov/g/oes/rls/fs/2002/14576.htm
  - http://www.state.gov/g/oes/rls/fs/2002/14577.htm

Role of Economic and Environmental Modeling

- Make significant contributions to design of climate solutions
- Examine the feasibility and likelihood of achieving a policy goal
- Point out ways to achieving a climate objective at least cost
- Identify promising, cost effective technologies
- Address the question of “who pays?”...so that policies can be designed to achieve an equitable solution

GHG/Economy Intensity Trends



CO_2: Energy-Economy Models

- Wide variety of energy-economy models available to project energy demand and evolving fuel use
- Historical data needed as well as projections of:
  - population and GDP
  - sectoral/socioeconomic trends
  - energy efficiency improvements, technology penetration rates and energy price elasticities, etc.
- Either “bottom up” (technology-rich) or “top down” (economy-wide) models can be utilized

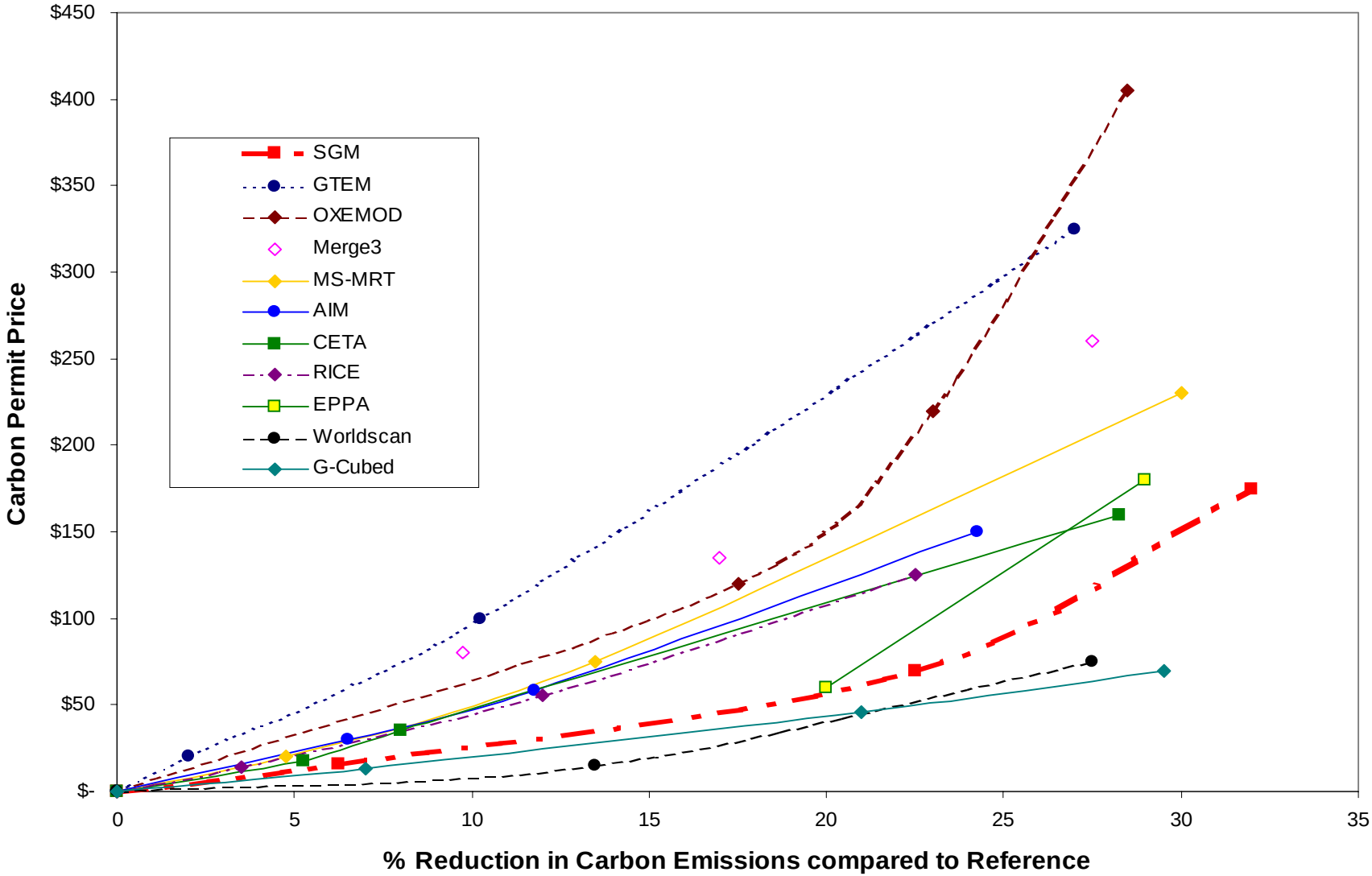
CO_2: Energy-Economy Models

- Top Down models
  - more realistic economy-wide market interactions
  - can lack transparency
- Bottom-up models
  - Rich in technical and economic information
  - Can lack “cause-effect” interaction
- Using diversity of models provides wide range of insights

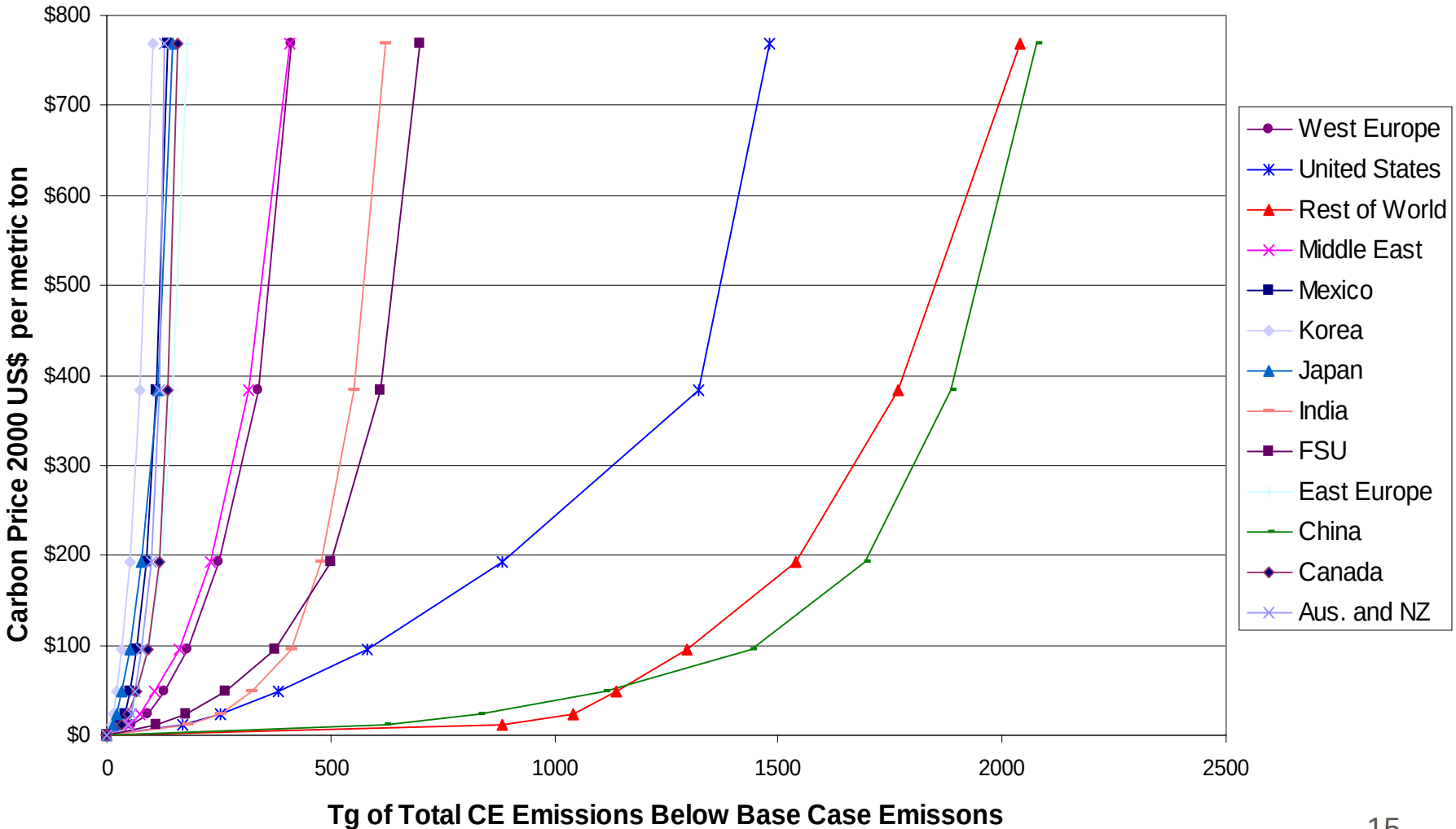
Examples of U.S. Energy/Economic Models

		Characteristics	Examples
Top Down Models	Computable general equilibrium	Multi-sectoral, dynamic optimization, economy-wide	MIT-EPPA, SGM, MS-MRT, Goulder, Jorgensen-Wilcoxen
	Aggregate production / cost function	Energy sector with aggregated economy	RICE, MERGE
	Macroeconomic	Aggregate, business cycle models with rigidities	DRI
Bottom Up Models	Least cost optimization	Technology rich, vintaged capital	MARKAL
	Detailed energy sector	End use modules linked to technology-rich supply side	NEMS, AMIGA

Cost of U.S. Carbon Emission Reductions, 2010



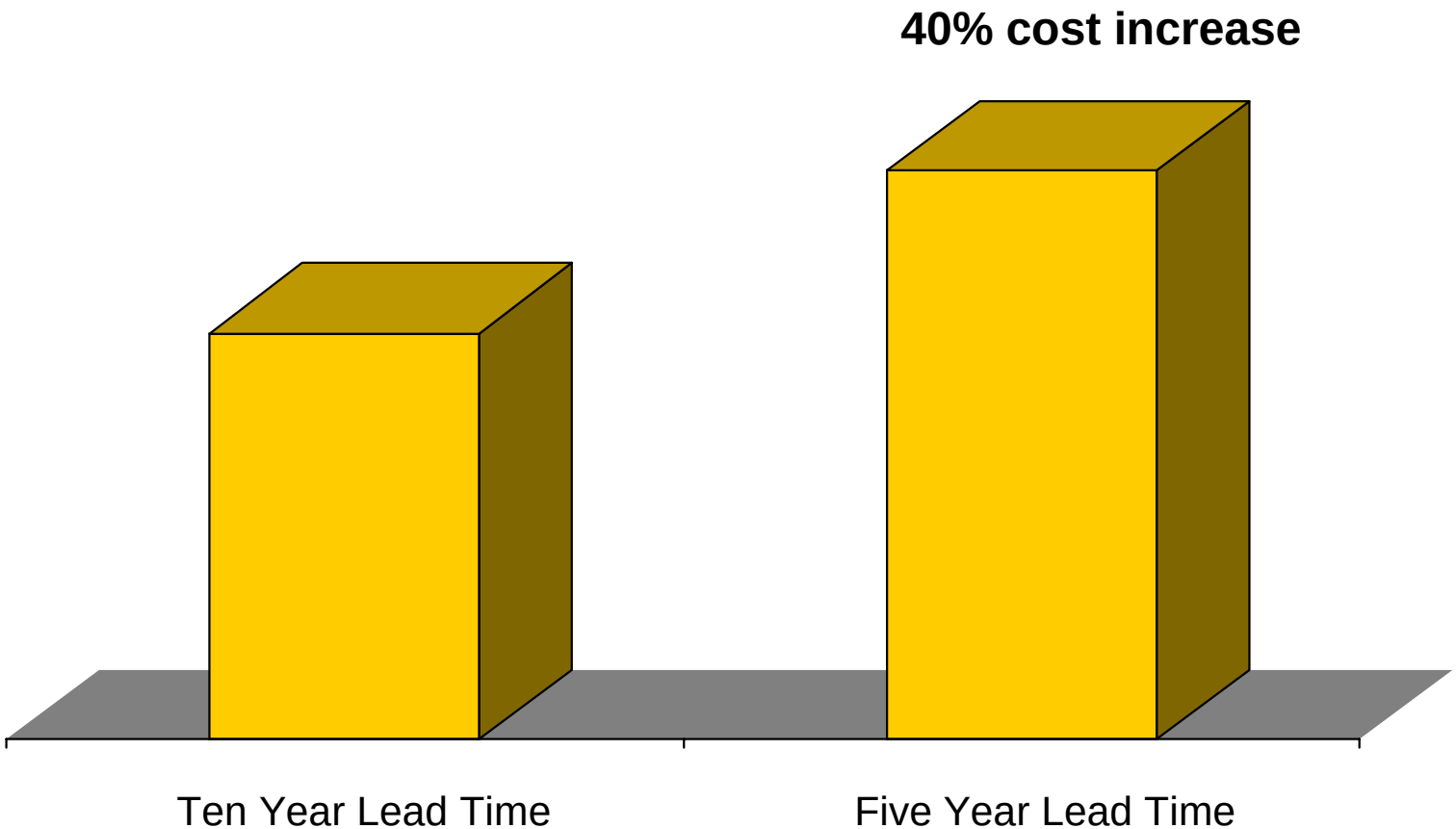
Potential Multi-Gas Abatement Options Globally in 2050



Common Insights from Economic Modeling

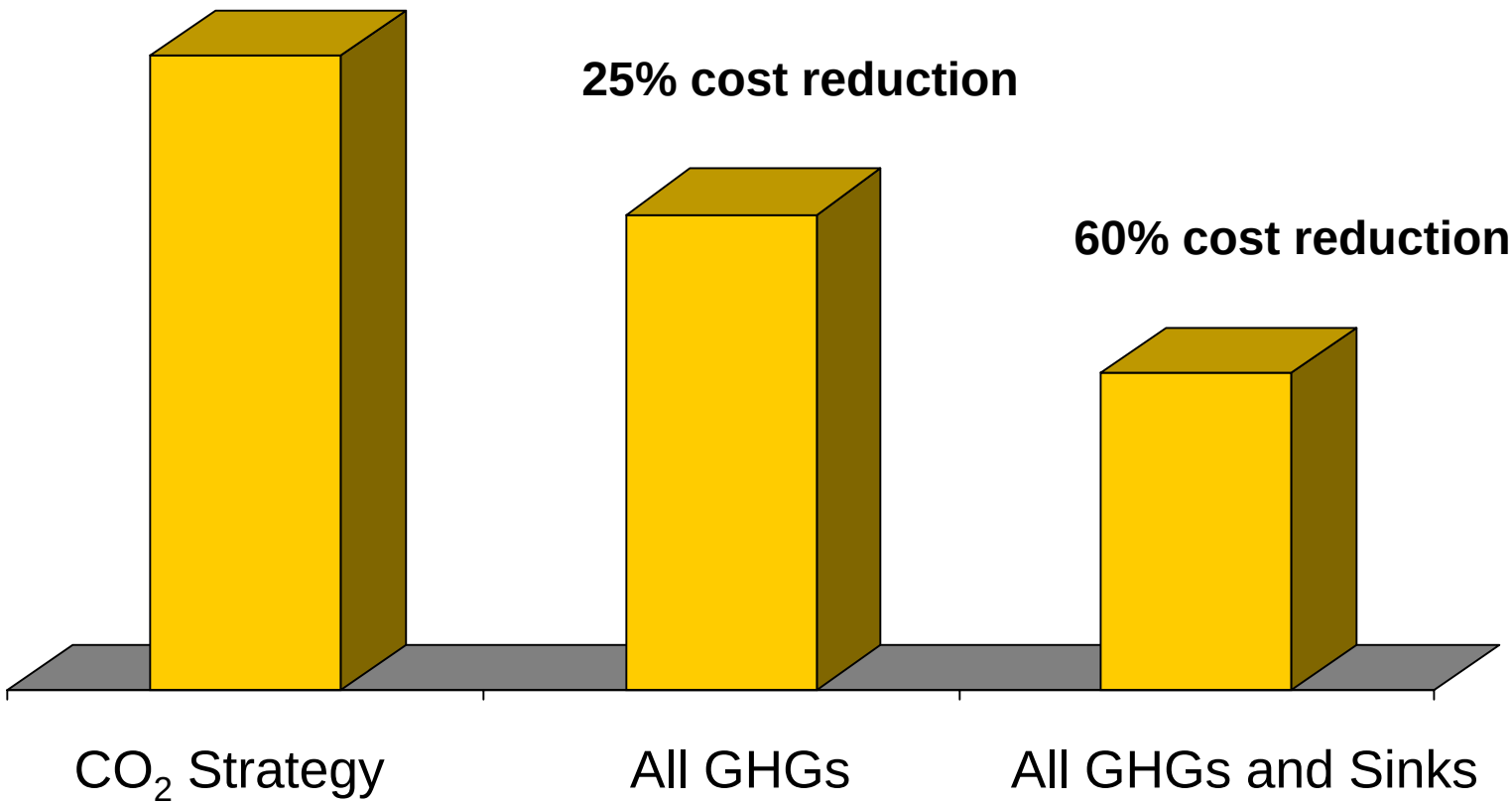
- Flexibility in the design of greenhouse gas mitigation strategies can significantly lower costs
  - “when”: when to time the abatement program
  - “what” : what to target when designing a strategy
  - “where”: where to achieve emissions reductions
- To the extent that new technologies can be deployed more rapidly that abate greenhouse gas emissions, costs will be lower as well
- Co-control (e.g., air pollution benefits) of climate policies can lower climate mitigation costs, sometimes substantially

“When” Flexibility: Lead Times Matter



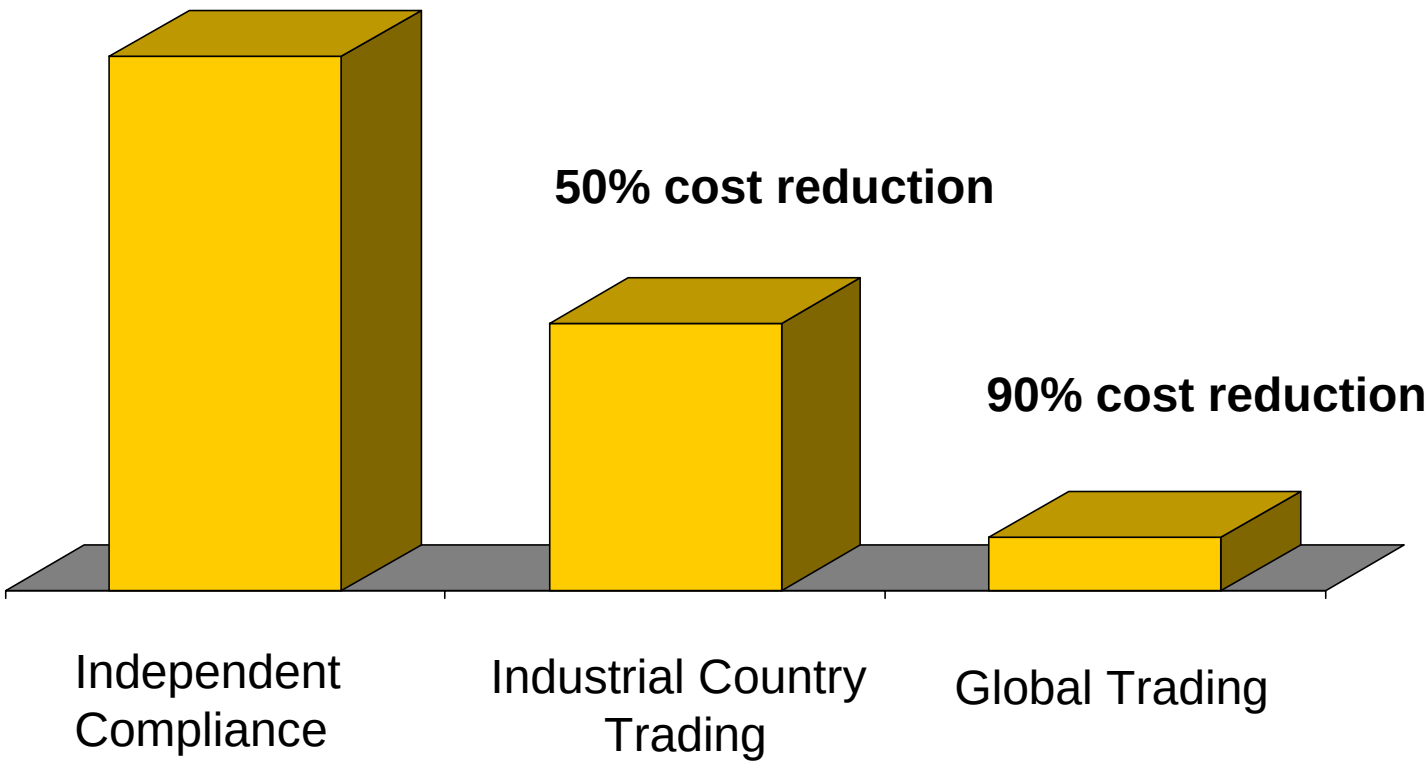
Costs of Achieving a Climate Goal

“What” Flexibility: More Abatement Options Lowers Costs



Costs of Achieving a Climate Goal

“Where” Flexibility: More Sources/Sectors Lowers Costs



Costs of Achieving a Climate Goal

Cooperation with India is Important for the U.S.

- Climate change and its adverse impacts is a concern for all nations
- In order for the U.S. to better analyze climate options, we need to understand worldwide trends and options to mitigate emissions
- Collaboration in analyzing and understanding climate solutions should have numerous advantages for both India and the U.S.