Energy Taxation, Emissions Trading and other Approaches to Address Climate Change

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Topics Covered

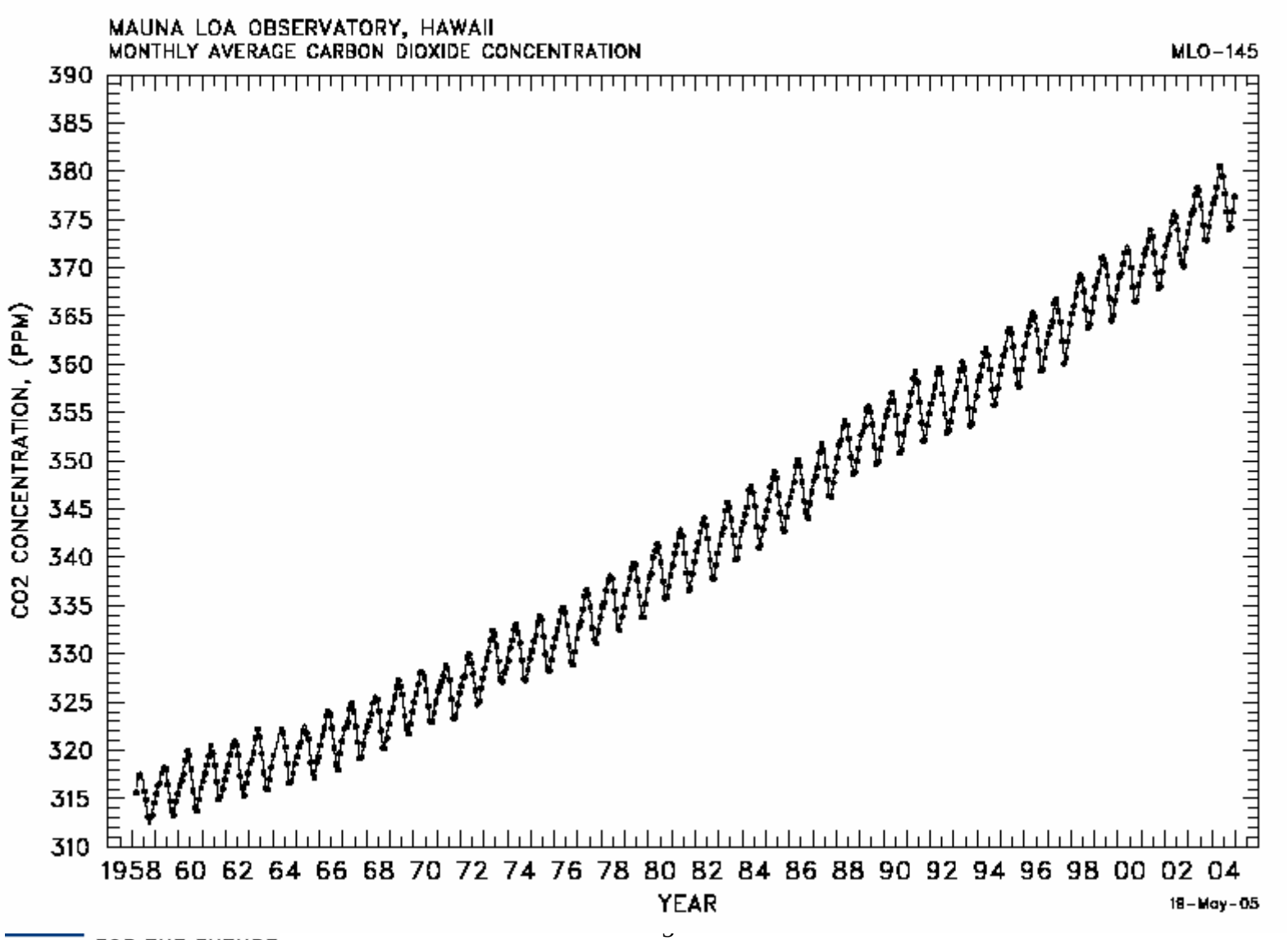
- Background on science, emissions, economics
- Alternative policy approaches
- Current international, regional approaches
- Domestic options in the U.S.
- Future international harmonization

Science, Emissions and Economics

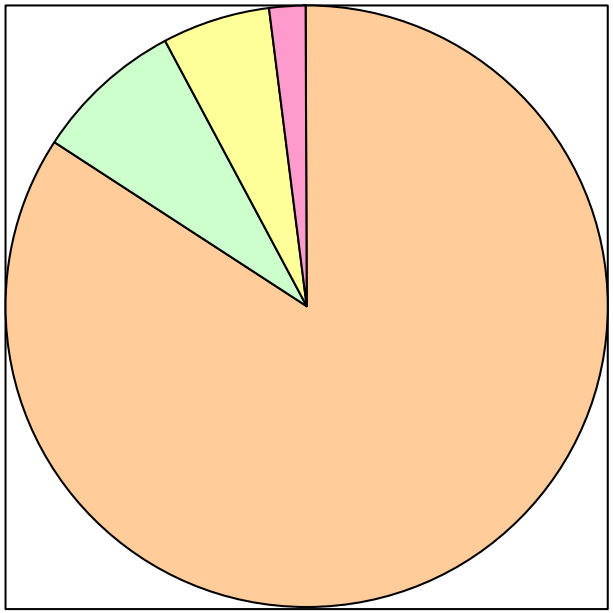
Features of the Climate Change Problem

- Caused by emissions of accumulated gases over long periods of time (decades - centuries).
- Multiple gases, dominated by fossil fuel related emissions of carbon dioxide (but also methane, nitrous oxide, industrial gases, others)
- Location of emissions does not matter for environmental consequences (U.S. is largest emitter, followed by Europe, Russia, China, Japan, India ~75%).
- Great uncertainty about consequences, timing of climate change, *and* costs of mitigation

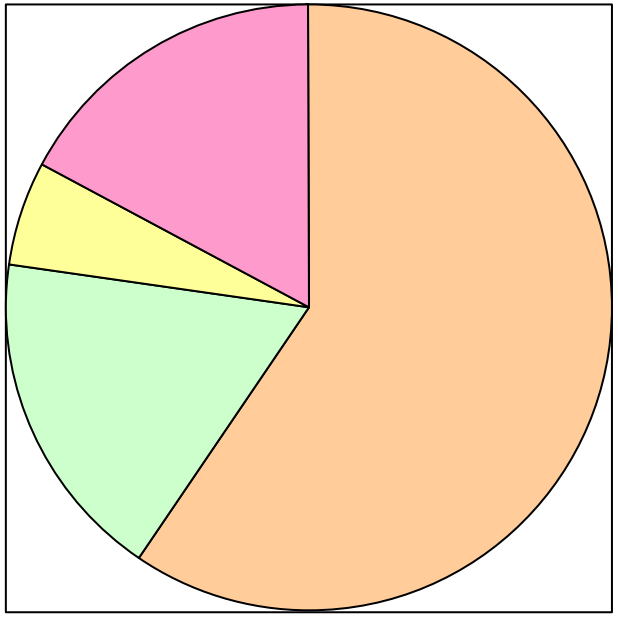
Accumulated CO_2



Shares of Different Gases

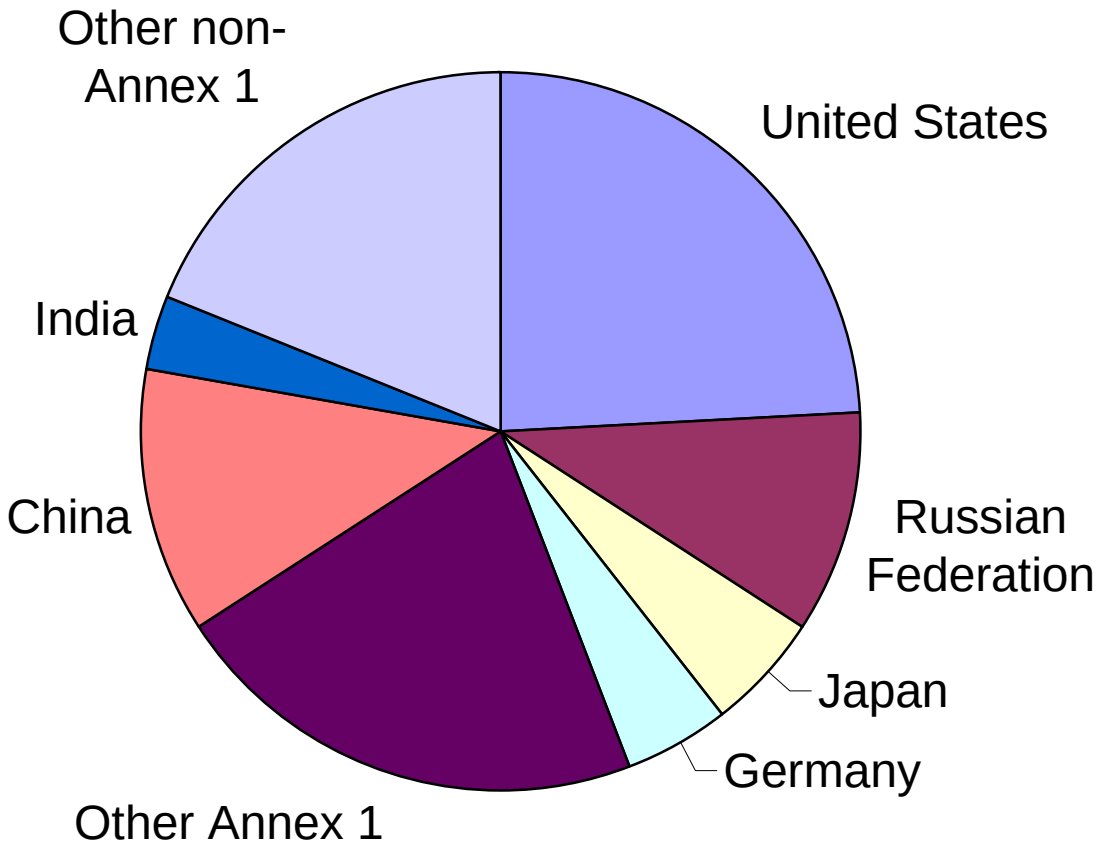


US (2005)



World (1990)

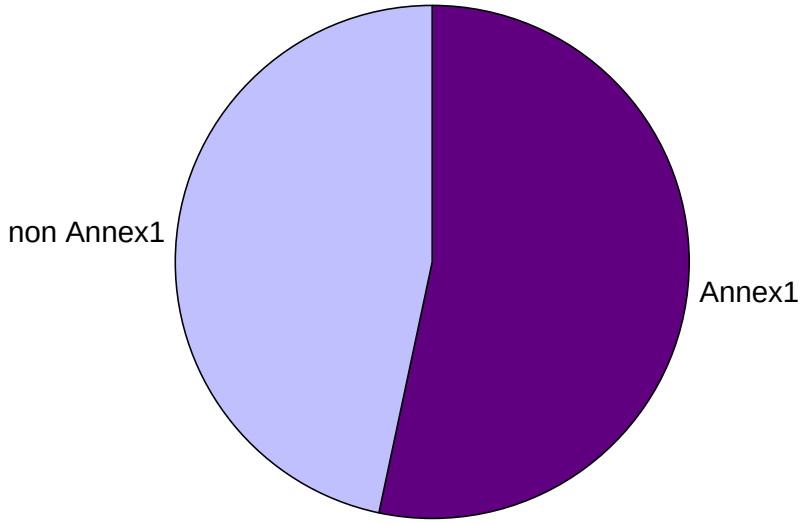
Distribution of Emissions in 1990



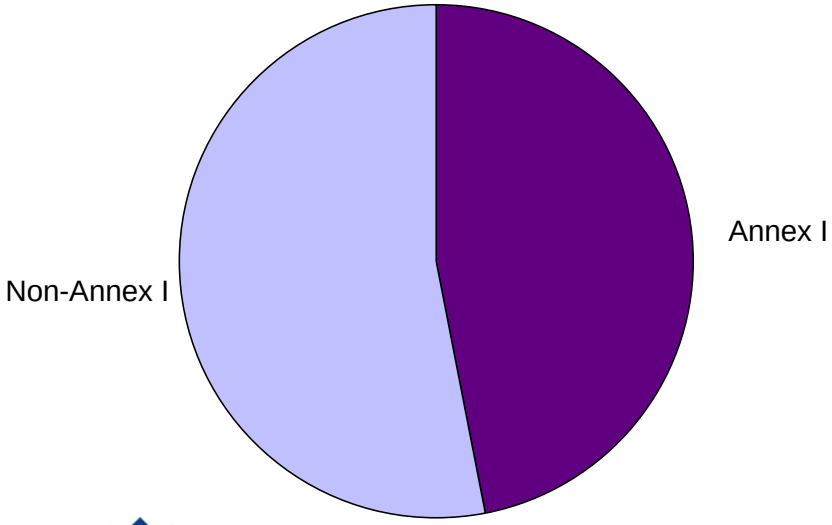
Data from Schmalensee, Stoker and Judson (1998)

RESOURCES
FOR THE FUTURE

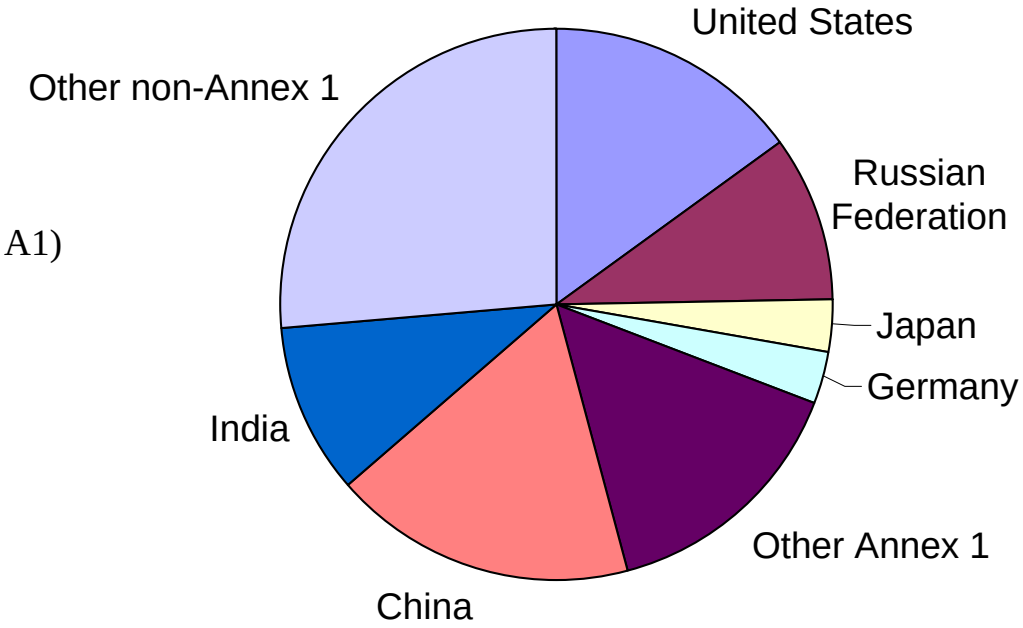
Emission Distribution Scenarios in 2020



Data from WEC/IIASA (1998, A1)

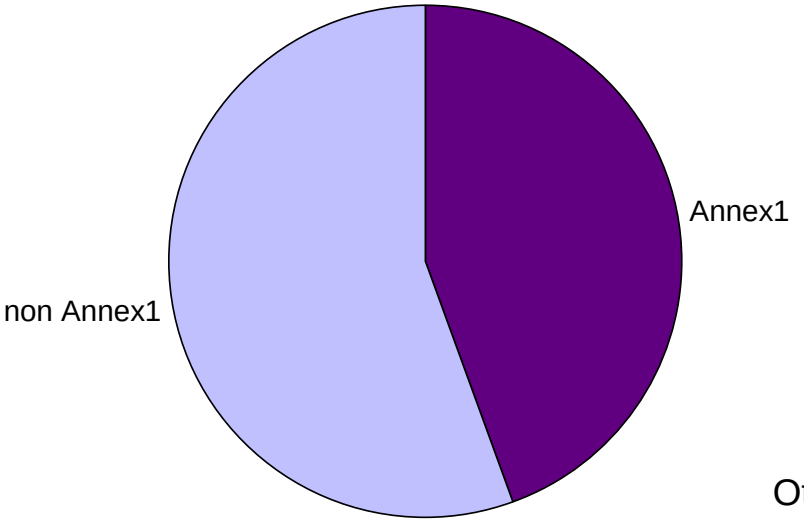


Data from EIA (2000)

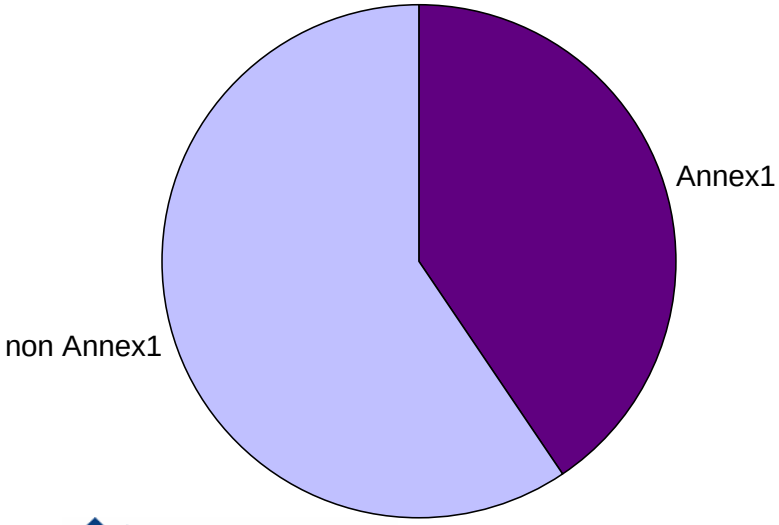


Data from SSJ (1998) + SRESA1

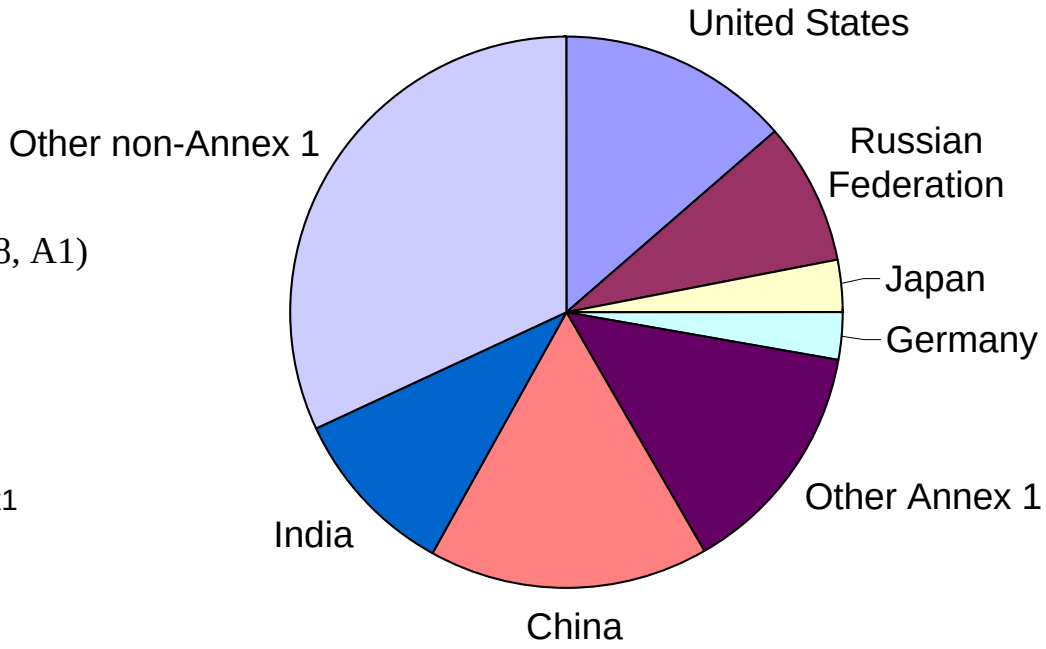
Emission Distribution Scenarios in 2050



Data from WEC/IIASA (1998, A1)



Data from WEC/IIASA (1998, B)



Data from SSJ (1998) + SRESA1

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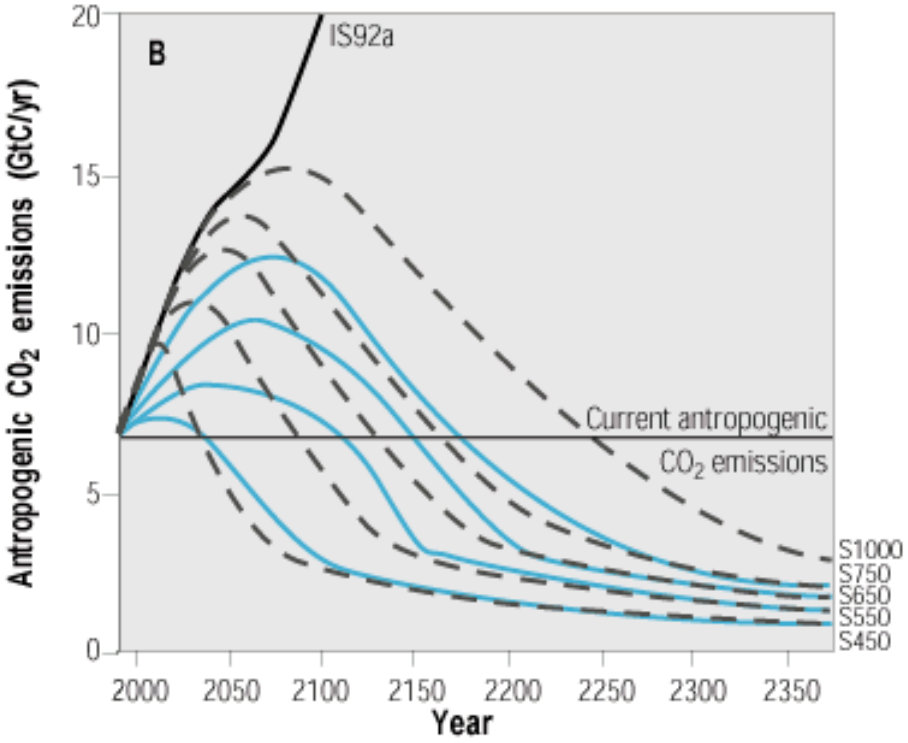
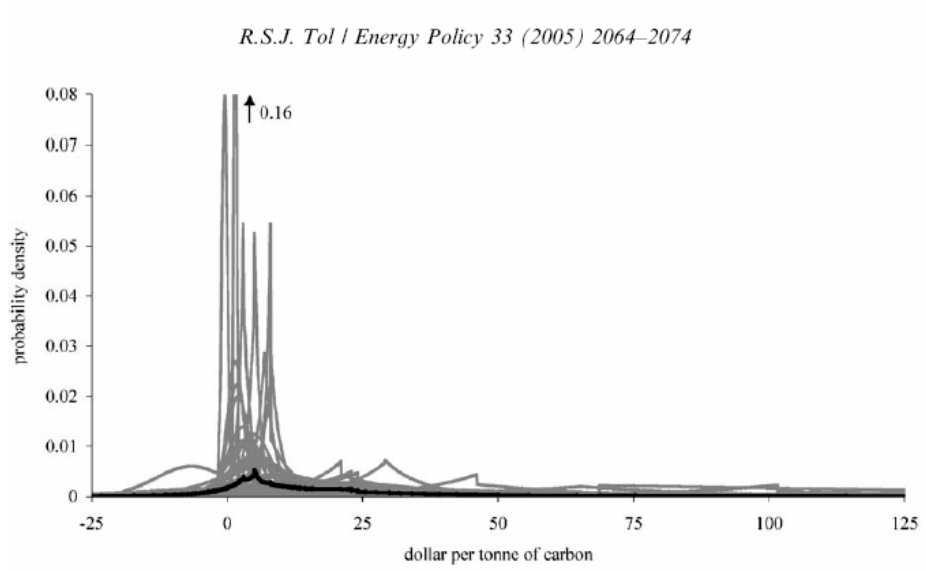
Alternate Long-term Targets



"safe concentrations"



"cost-benefit"

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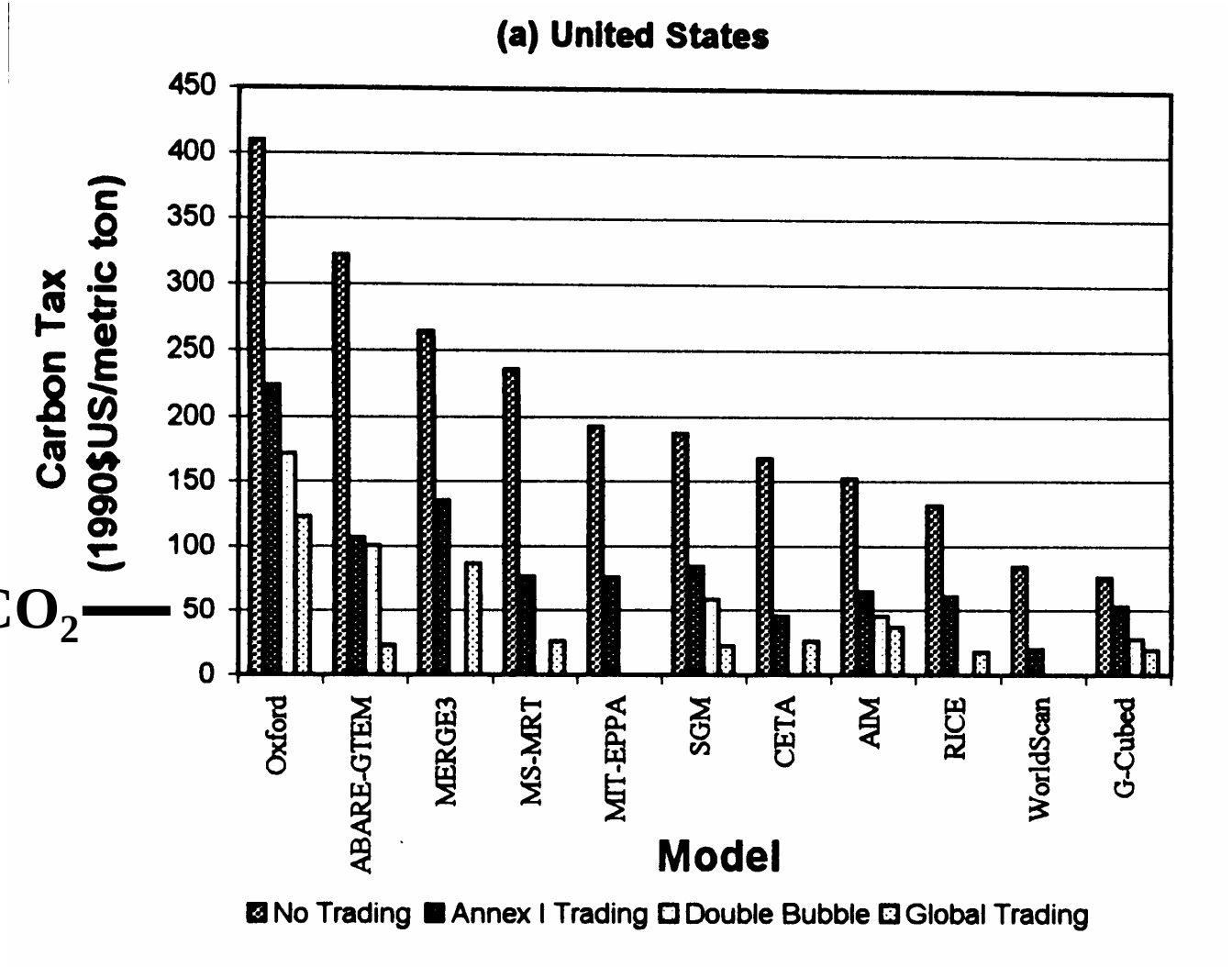
Cost of Kyoto



$14/tCO$_2$

Alternative Policy Approaches

Policy Options

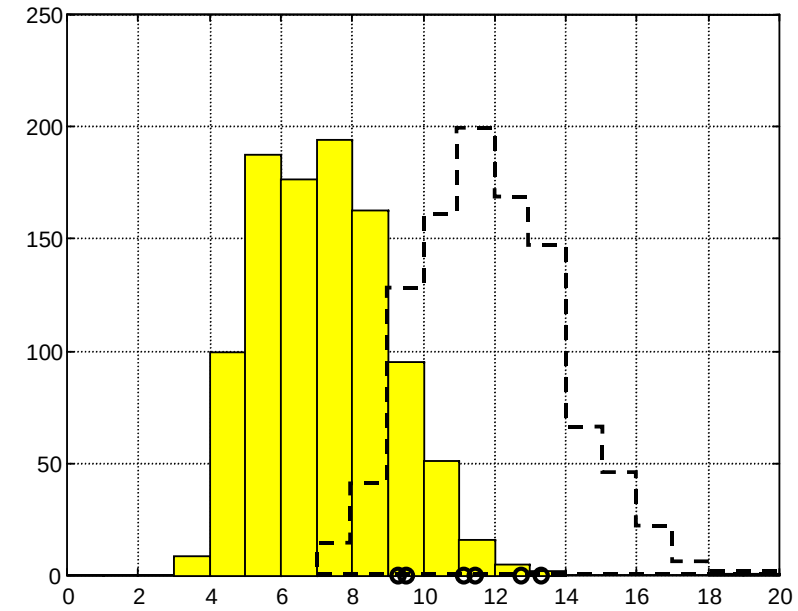
- ‘Wait and see’
- Research focus
- Voluntary programs
- Mandatory control of GHG emissions
- Combination of research and mandatory controls

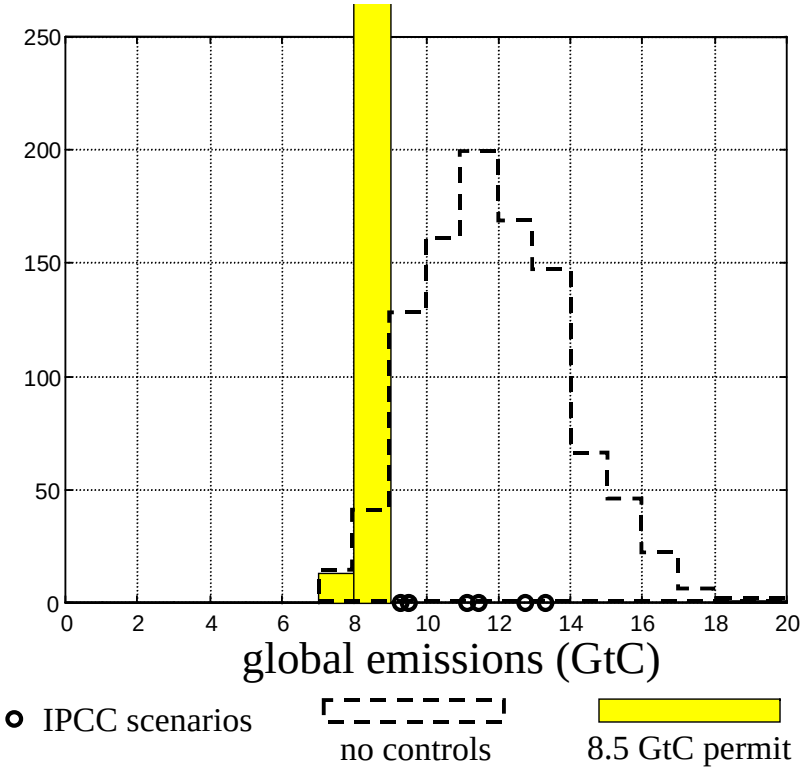
Mandatory Emissions Limitations

- Direct controls via emission standards/prohibitions
- Indirect controls via incentive mechanisms
  - Restrict overall **quantities**: cap and trade
  - Raise **price** of emissions: fees or taxes
  - **Safety valve**: combines price and quantity approaches

Uncertainty about costs and benefits affects relative advantages of different incentives

Prices versus Quantities
(from Pizer 1997)





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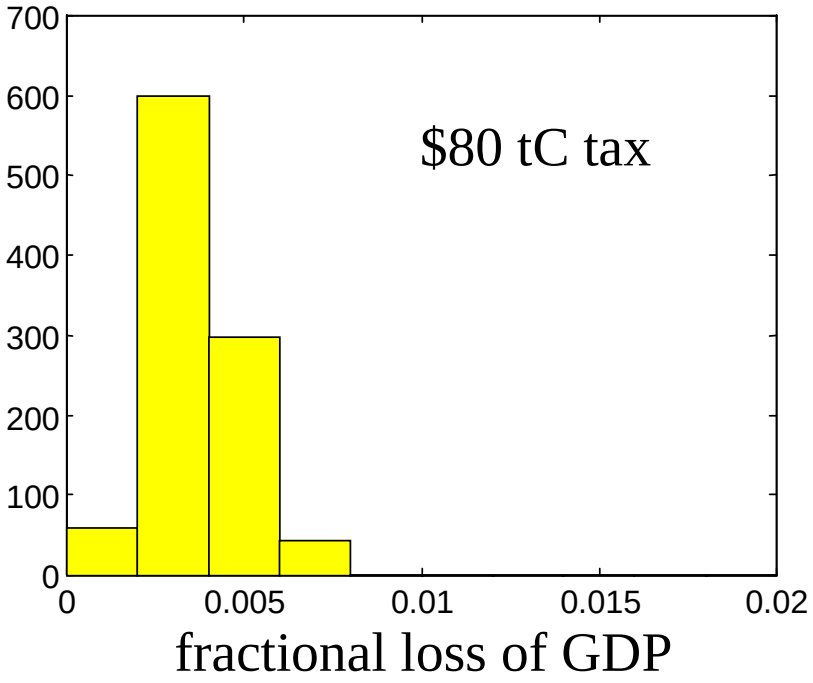
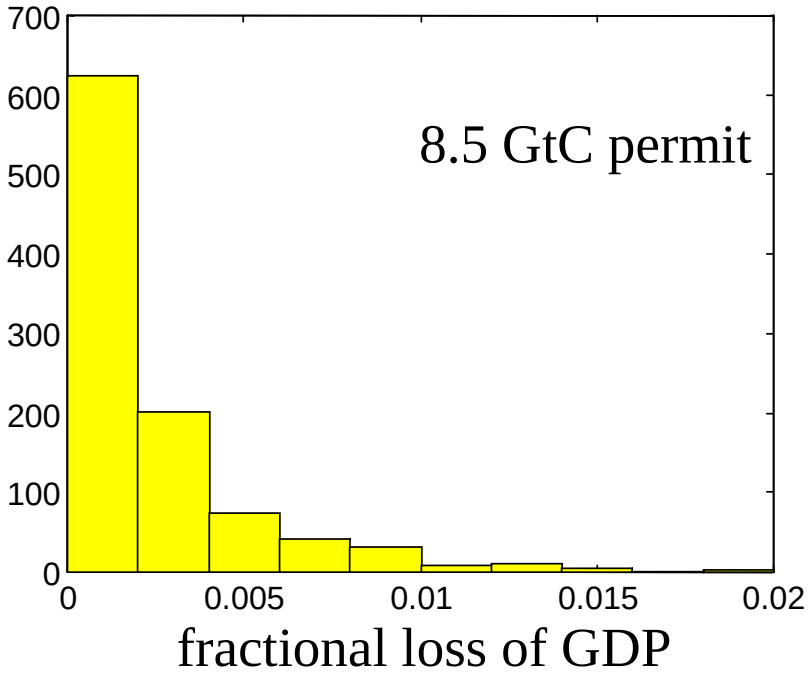
Prices versus Quantities (2)
(from Pizer 1997)





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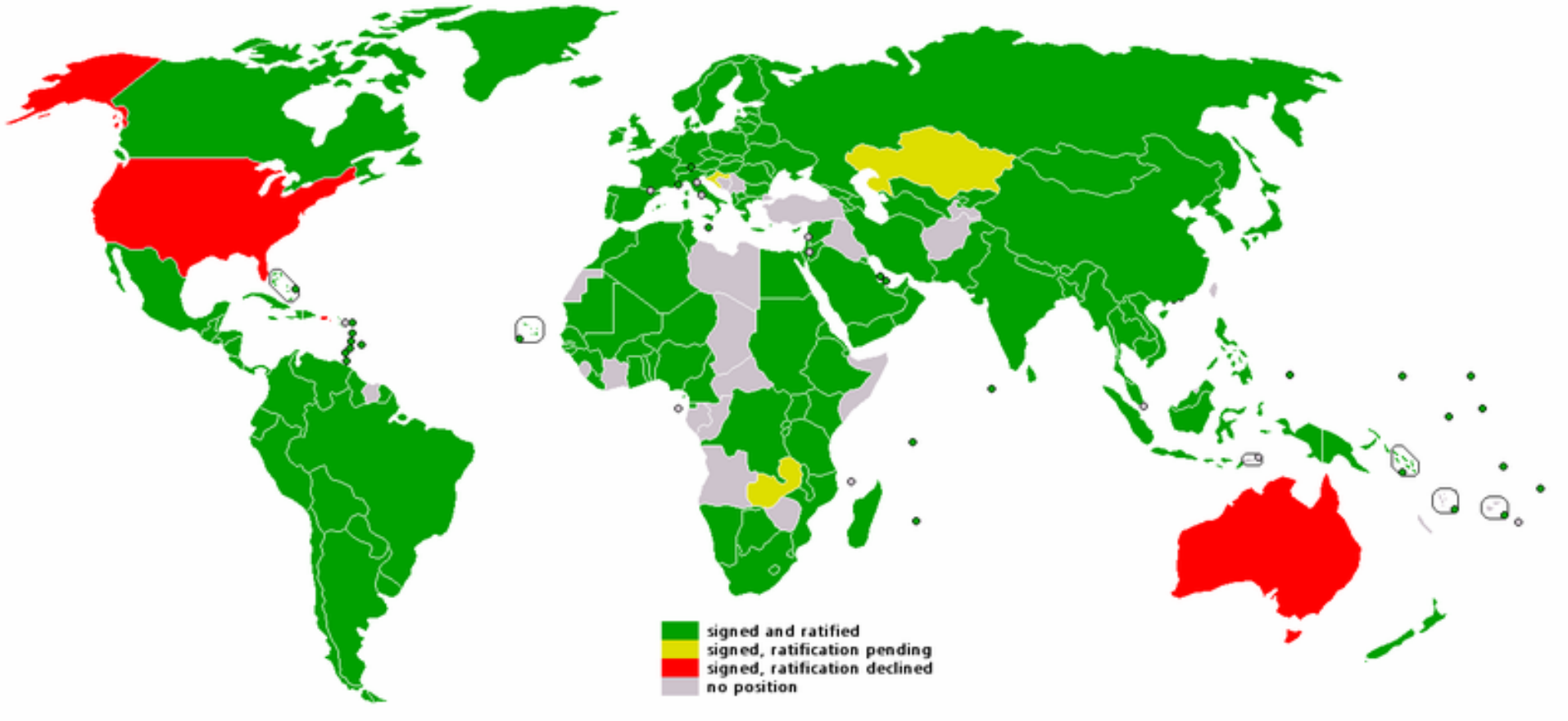
Current International, Regional Experience

Kyoto Protocol

- Specifies legally binding emission limits for industrialized countries, relative to 1990 levels, over 2008-2012.
- Countries are free to trade their requirements, as well as bank them for future use.
- Can generate credits through projects in developing countries (Clean Development Mechanism or CDM) that can be applied to industrialized country commitments.
- Came into force on February 16, 2005, without the U.S. or Australia.
- Compliance with current commitments, as well as possibility of future targets, unclear

Kyoto Protocol



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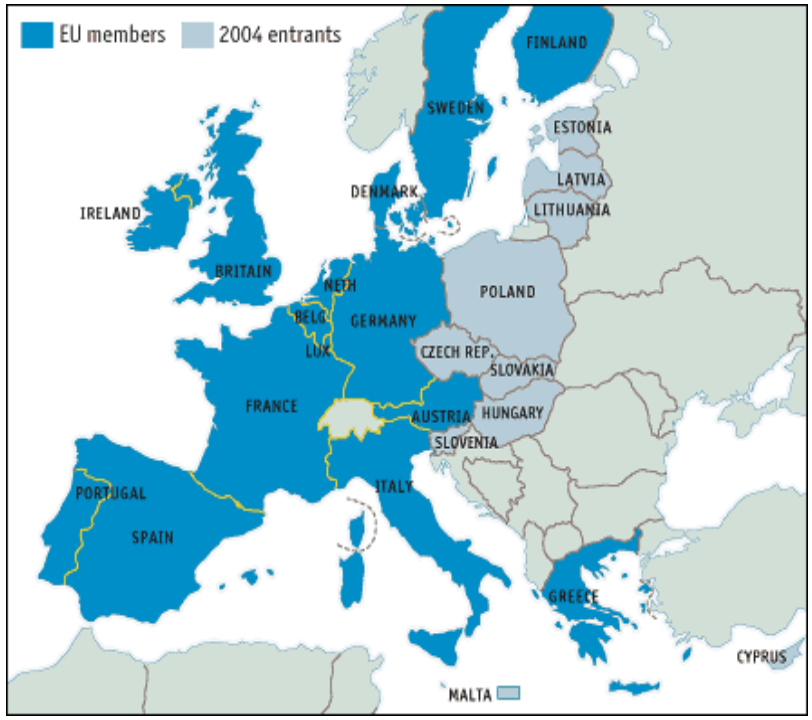
European Union



- Emissions Trading Scheme (ETS) for energy activities (including electric power), iron & steel, minerals, pulp and paper. "warm-up" phase: 05-07, Kyoto: 08-12
- ~12,000 installations covering 46% of CO_2 emissions
- 25 Member States (MS) propose allocation *and cap* in National Allocation Plans (NAP)

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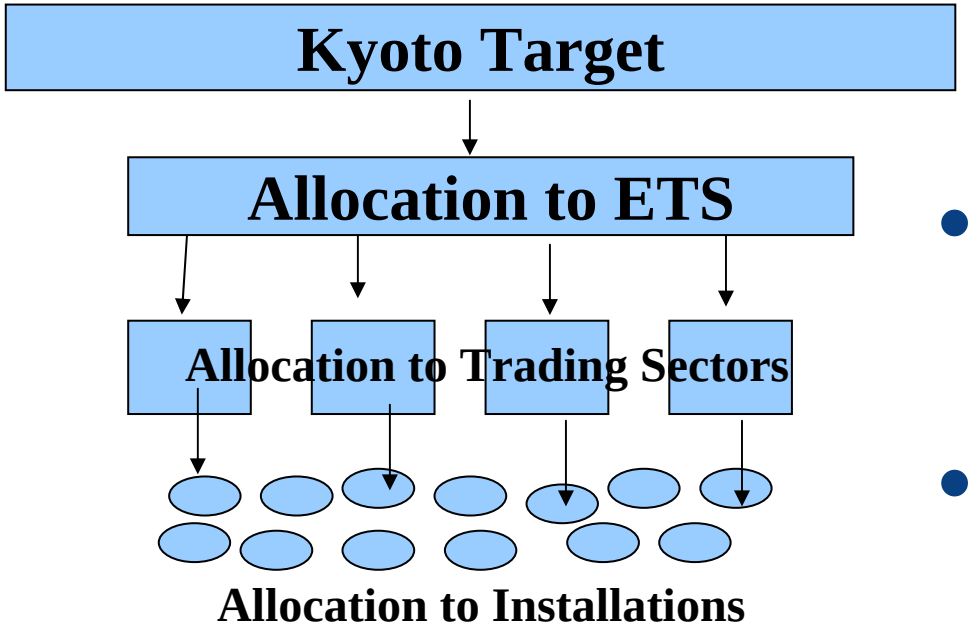
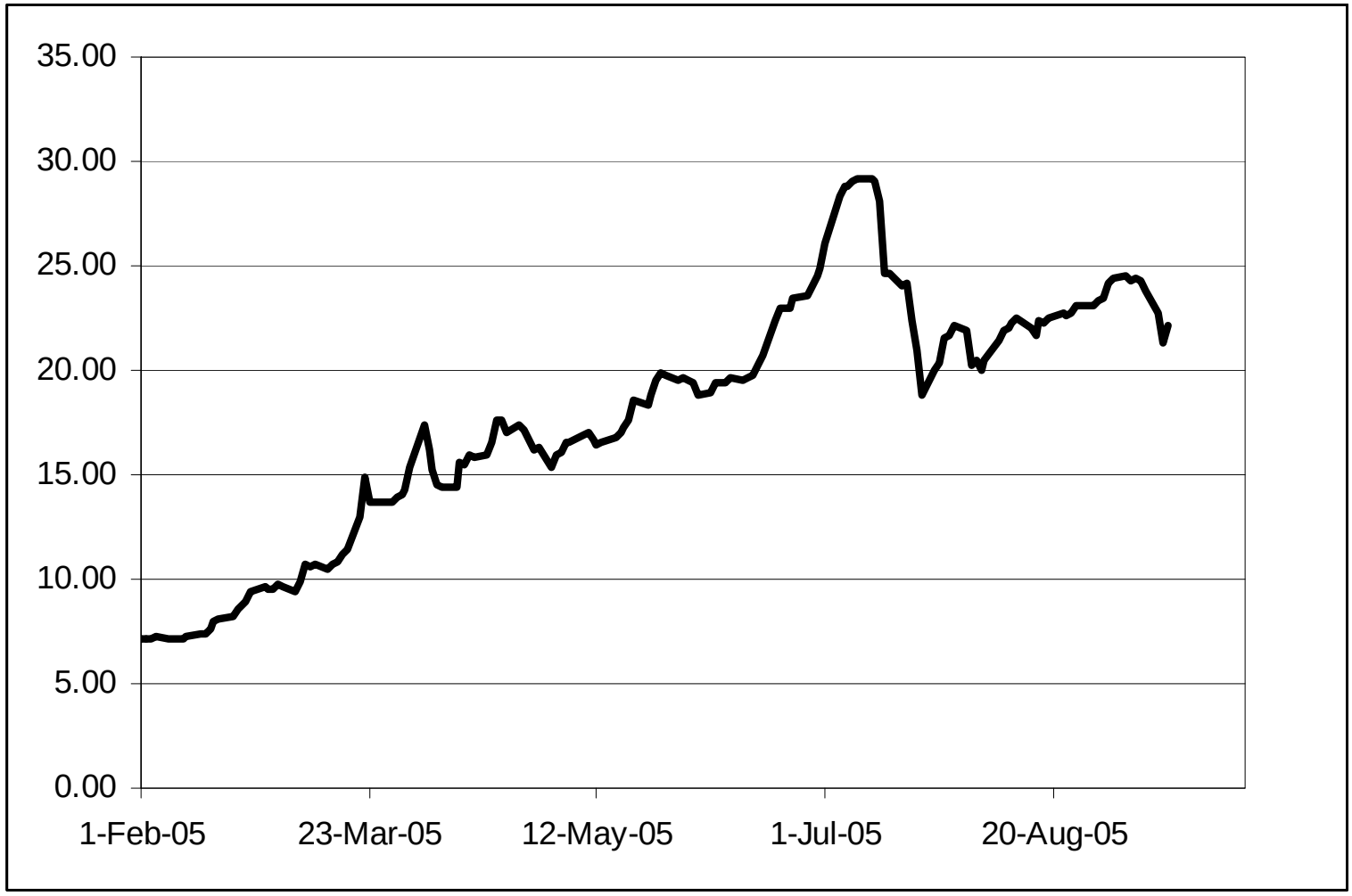
NAPs: Multiple Decisions



- Decision #1: How much of Kyoto target will be in trading program?
- Decision #2: What will be the allocations for each sector?
- Decision #3: How will allowances be allocated to each installation?

EU Allowance Price (€/tCO$_2$)



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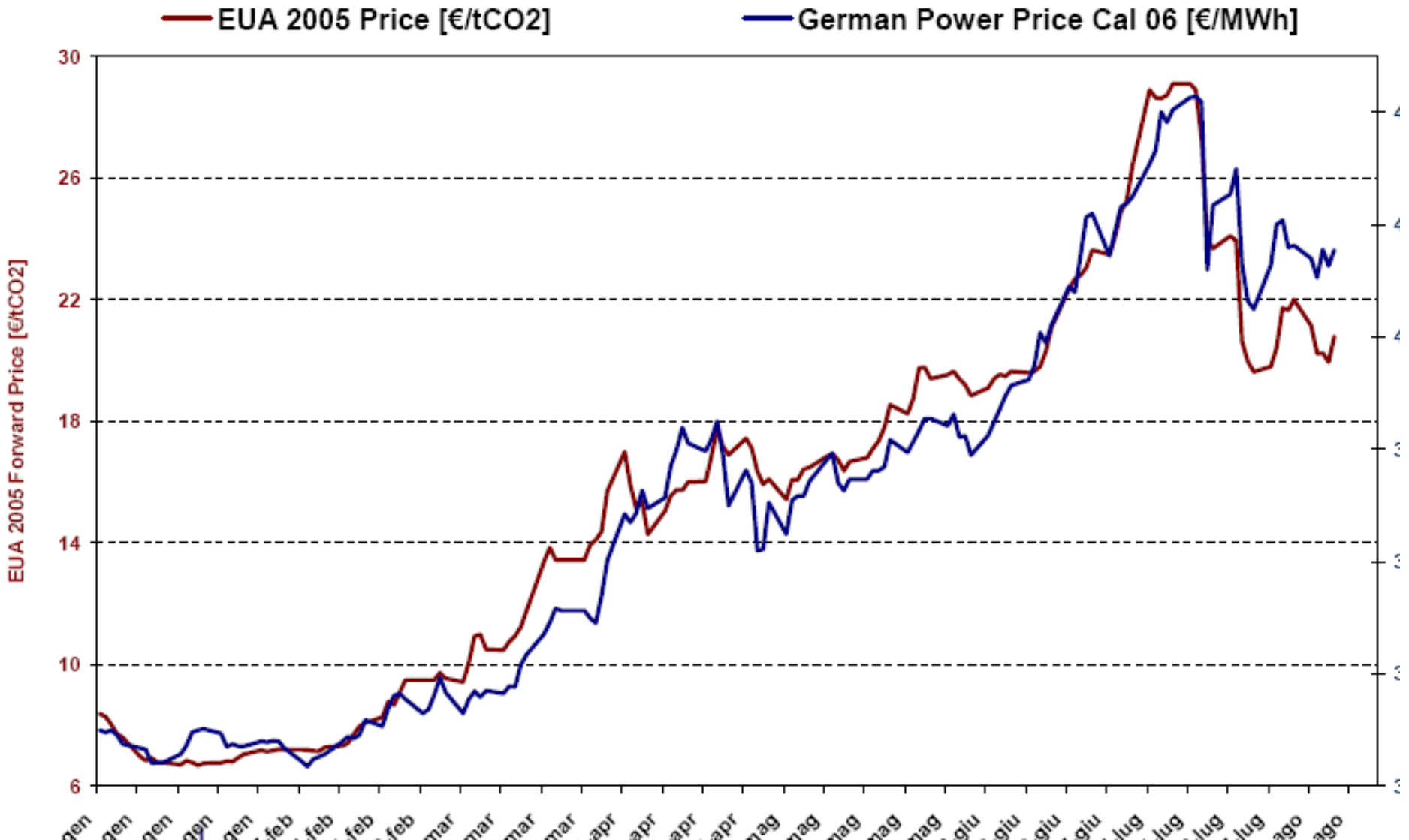
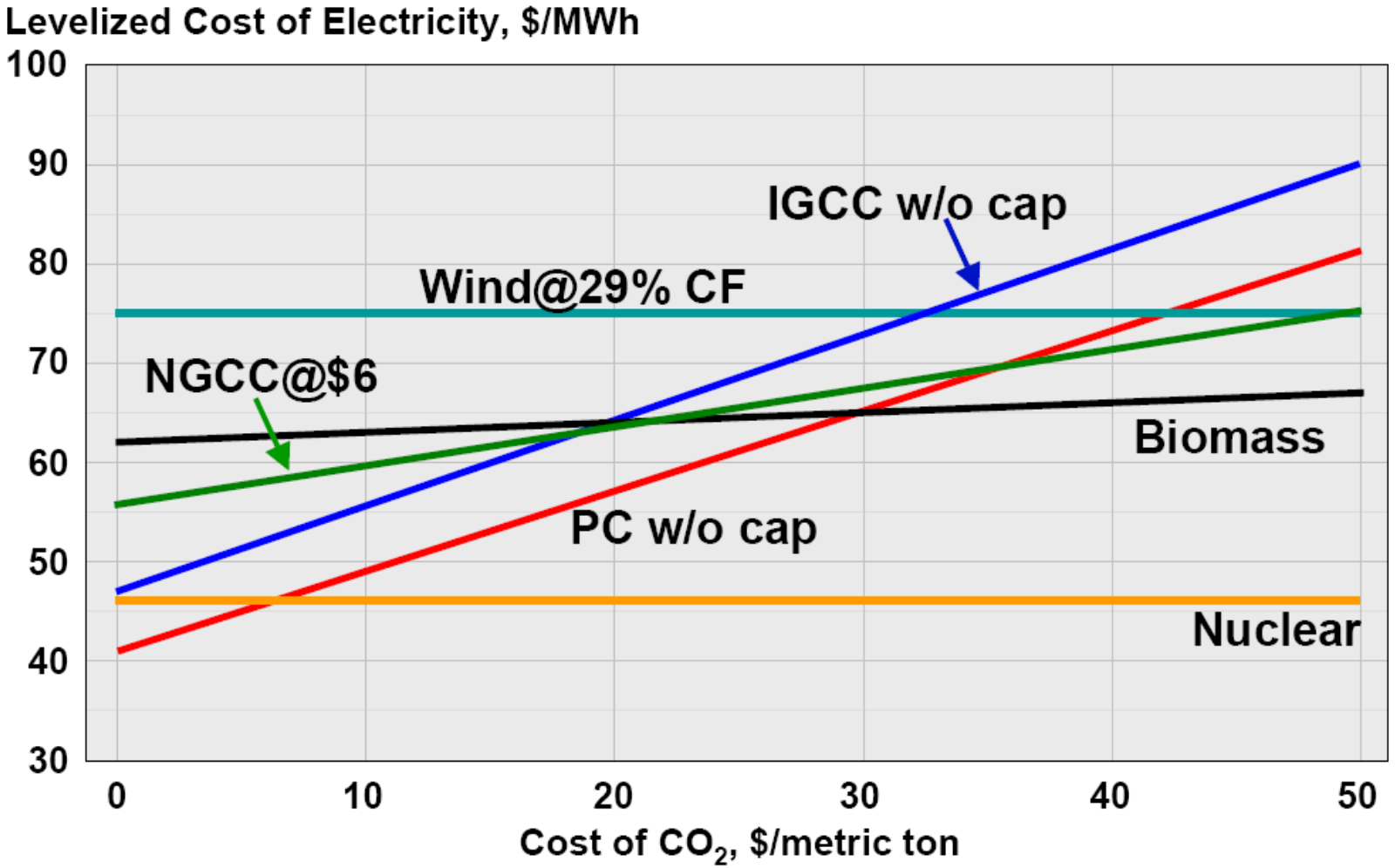
The relationship between the European allowance pric and the German power price, Jan. – Aug. 200



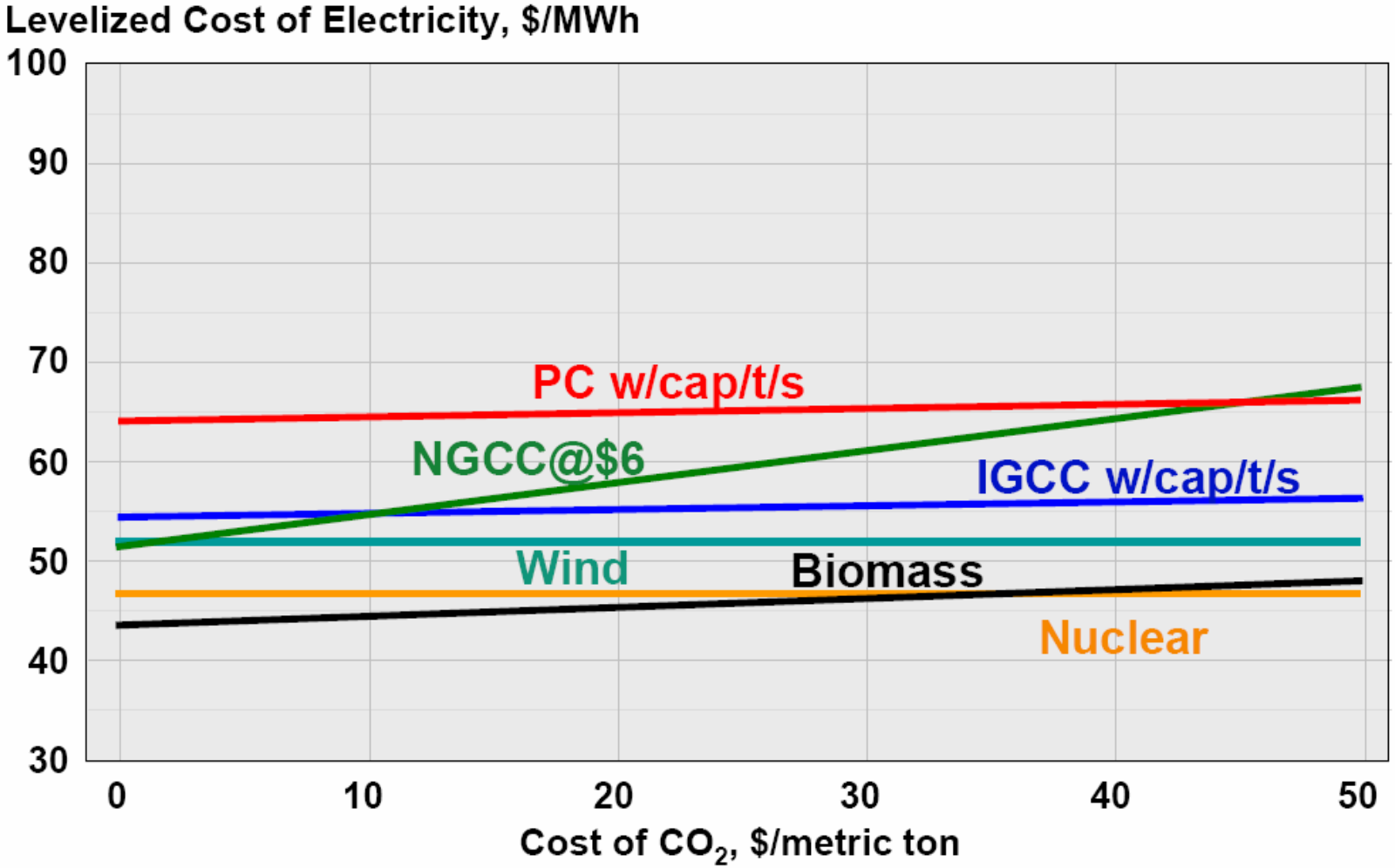
Fondazione Eni Enrico Mattei

Domestic Options in the U.S.

Comparative Costs of 2010 Generating Options



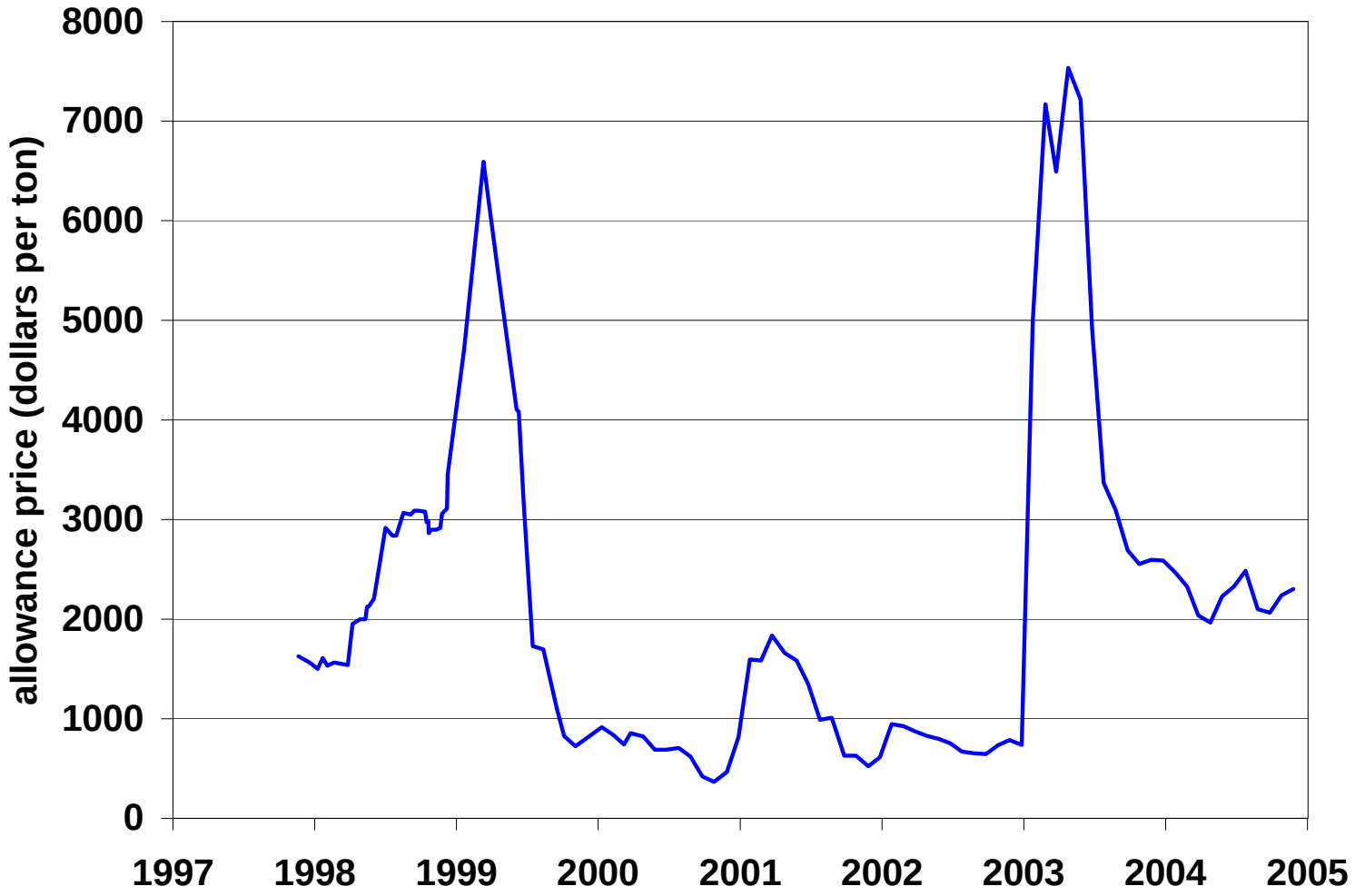
Comparative Costs in 2020



Prices v. Quantities Again

- Additional concerns: *initial volatility*, *cost certainty*
- Design options: *tax*, *safety valve*, *market management*, *borrowing*
- Shifting debate: *from question of environment to question of cost*

NO_x OTC Current Vintage Price



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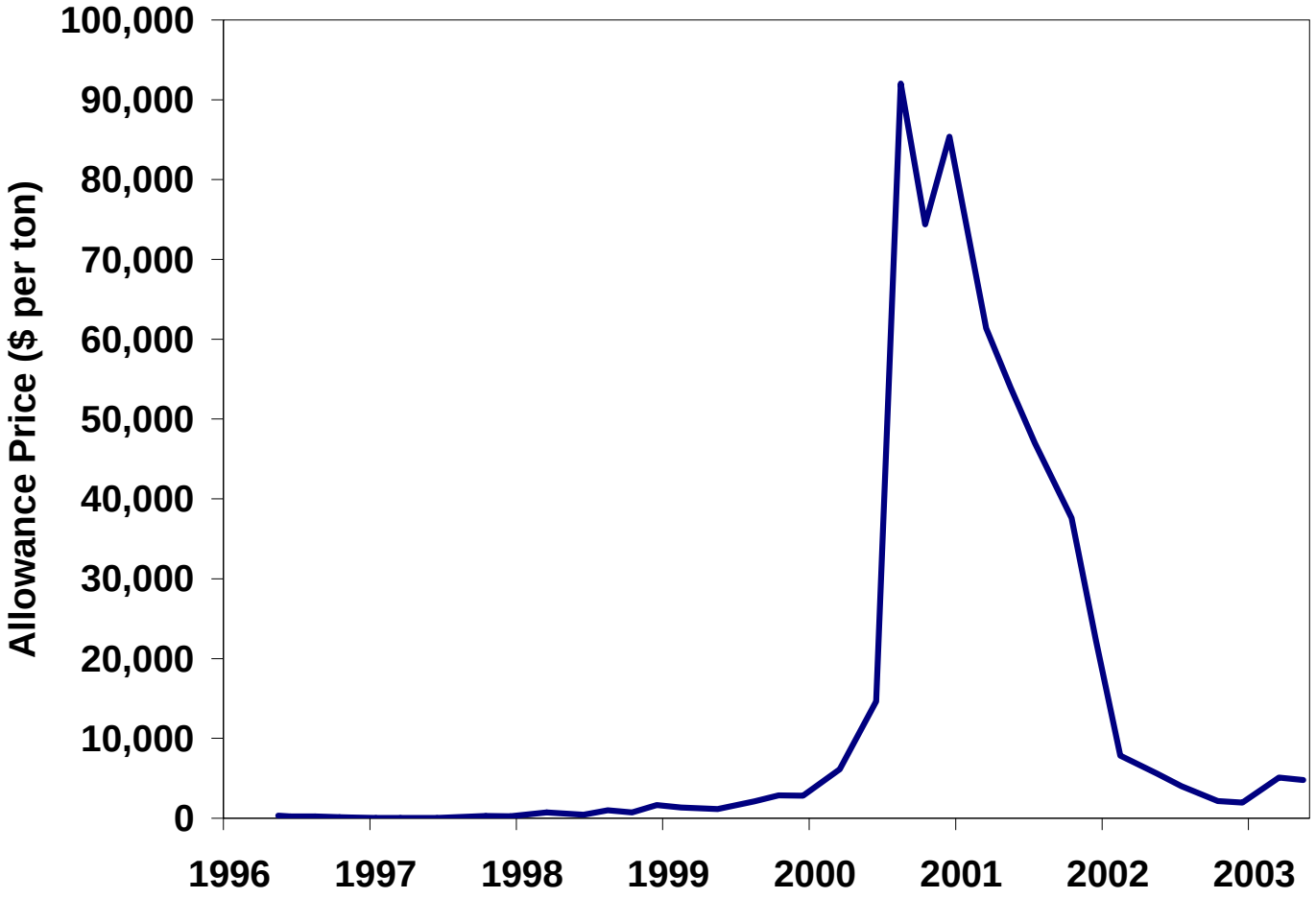
NOx RECLAIM Market



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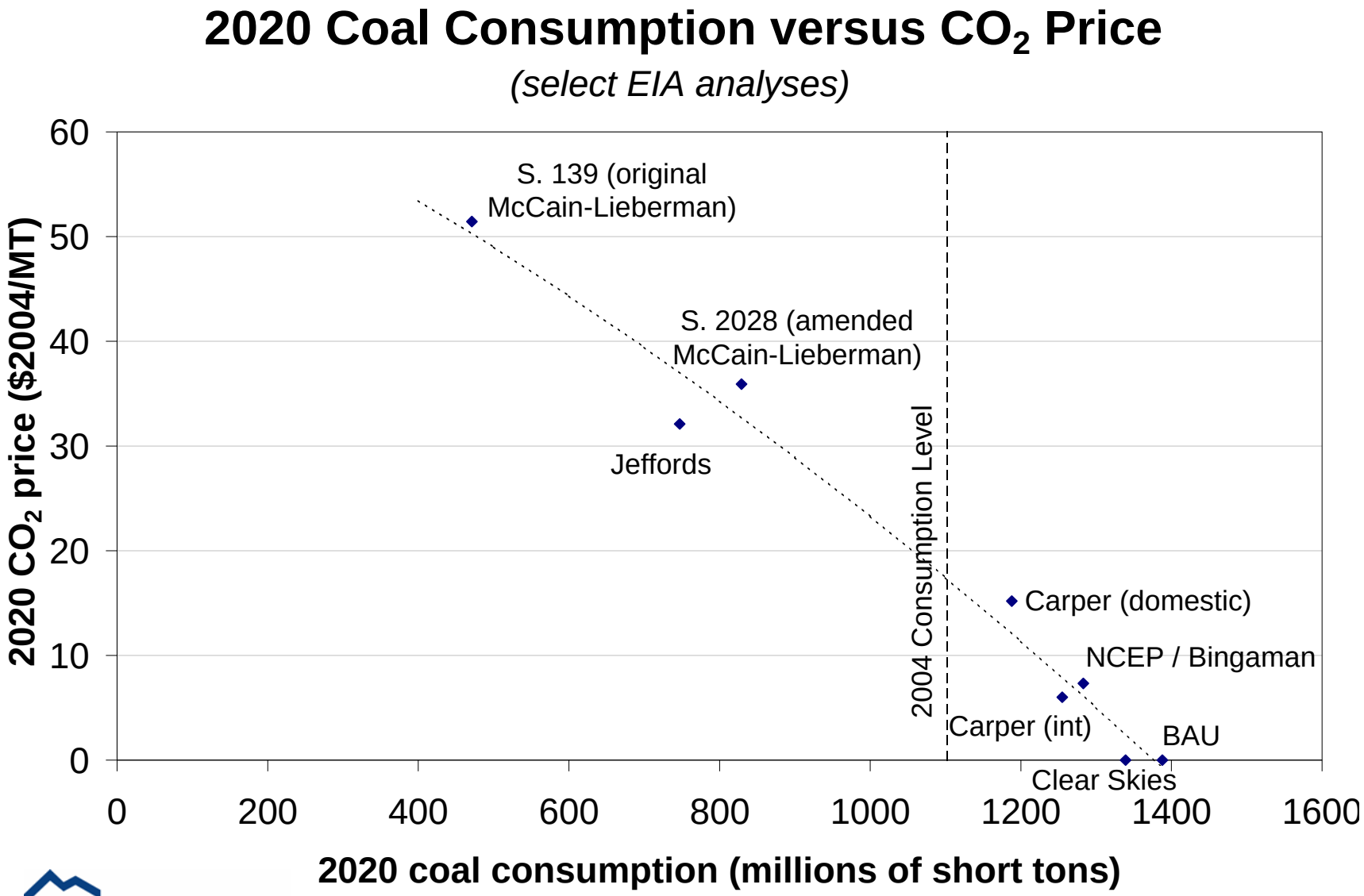
The role of coal



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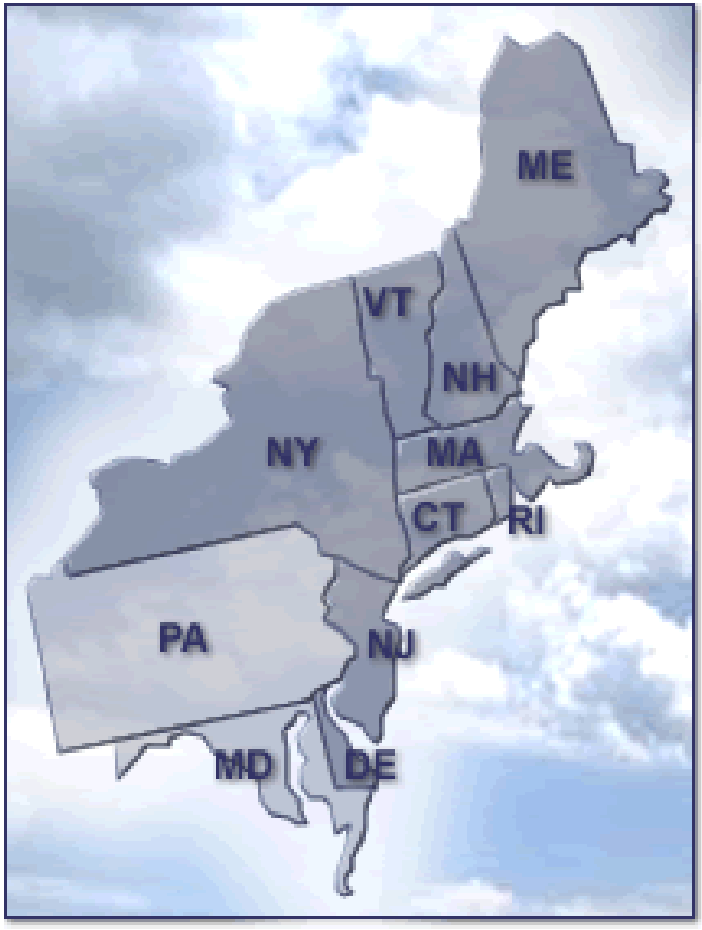
Regional GHG Initiative (RGGI)

- Regional cap and trade program proposed by (former) Governor Pataki
- Nine states in New England and Mid-Atlantic have joined (2006: MA & RI may be out; MD may be in)
- *Recommended 25% auction; pressure in MA & NY for 100%*



California Initiative: AB 32

- Builds on State's policies on autos, RPS (20% by 2010), efficiency standards, GHG registry, etc
- Mandates cap and trade program on GHG emissions to reach targets:
  - 2010 (2000 levels)
  - 2020 (1990 levels)
  - 2050 (80% below 1990 levels)
- California Air Resources Board leading program development

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Why Regulate Upstream?

Because virtually all of the carbon in fossil fuels is emitted as carbon dioxide during combustion, these emissions can be regulated at any point in the fossil fuel production / consumption chain

UPSTREAM
(Fuel Producers)

DOWNSTREAM
(Fuel Consumers)

Extraction

Total Sources

22,000

Oil & gas wells

1,500

Coal mines

Refineries
Gas pipelines

Fuel Processing / Transport

Total Sources

1,500

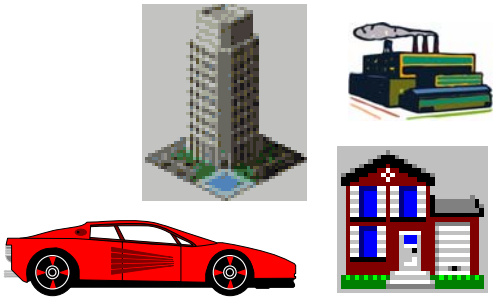
Electric Generators
Industrial Plants

Major Emitters

Total Sources

10,000

Cars and trucks
Homes and office buildings
Small industrial facilities



Other Direct Emitters

Total Sources

100s of millions

Least number of sources

Energy Bill Climate Amendments

- SA 817 Hagel Amendment (passed)
- SA 826 McCain-Lieberman Amendment (failed)
  - Added nuclear provision
  - 38 yea votes; 5 less than October 2003
- SA 868 Bingaman Amendment (filed)
  - Based on NCEP proposal
  - Bingaman decided against vote because Domenici withdrew support
- SA 866 Bingaman-Specter Amendment (passed)
  - Called for mandatory action, encourage developing countries and avoiding significant harm to the economy
  - Passed with 53 votes, including 12 Republicans – 6 who had never previously voted favorably on climate change
- SA 844 Kerry Amendment (failed)

Conference report contains Hagel amendment, coal, nuclear, efficiency provisions.

Bingaman Amendment

- Target based on a 2.4% annual intensity decline (0.4% annual growth) starting in 2010; accelerates to 2.8% (no growth) in 2020; implemented as absolute target.
- Safety valve at \$7/ton CO_2; rises 5% per year.
- 5-10% auction to support technology and adaptation programs: IGCC, biofuels, carbon-free energy.
- Congressional review every 5 years (adjust safety valve, target, allocation via expedited procedures).

Technical Issues Currently Under Discussion in Congress

- Who and where to regulate
  - Sectoral v. economywide
  - Upstream v. downstream
- Allocation
  - Auction v. free allocation
  - Criteria for free allocation
  - Use as technology incentive
  - Use for adaptation assistance
  - Other set-asides
  - Fossil fuel producers
  - Electricity generators
  - Energy-intensive industries
  - Other industries
- Linkages
- Offsets

Future International Harmonization

Elements of a practical international policy

- Domestic mitigation policies \$7-15/tCO_2
- International agreement to nudge domestic action (perhaps fewer number of countries)
- Technology policies to supplement – but not substitute for – mitigation efforts.
- Developing country engagement at multiple levels.
- Provide evaluation and feedback for national actions.

Natural Harmonization of Prices?

Table 1: Summary of CO_2 Prices

Program	Price	Price ($)	Notes
EU Emissions Trading Scheme	€15-25/tCO2	$20-30/tCO2	Trading range in 2006
Canada LFE program*	C$15/tCO2	$13/tCO2	Safety-valve price
New Zealand tax*	NZ$15/tCO2	$9/tCO2	Initial rate
Japan tax*	¥2,500-3,000 / tC tax	$5-6/ tCO2	Proposed rate
Bingaman (U.S.)*	$7/tCO2	$7/tCO2	Safety-valve price
McCain-Lieberman (U.S.)*	$15-30/$tCO_2$	$15-30/tCO2	Estimated price

*Proposed
**NCEP (2004).

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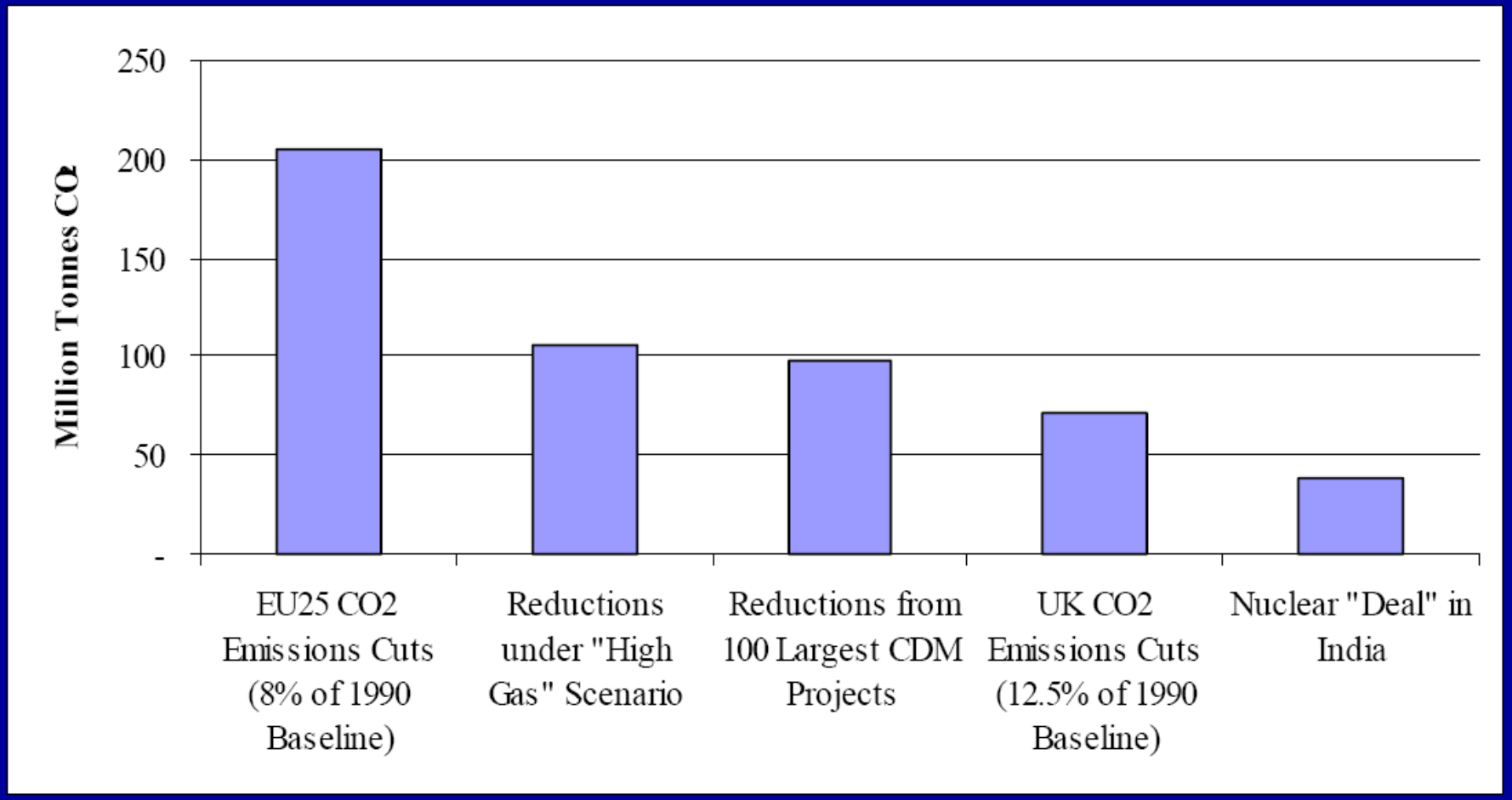
Suggestions for Expansion of Developing Country Engagement

- Extension of CDM to sectoral policies (efficiency standards, energy pricing reform).
- Linking of climate policy to other areas of interest – development, security.
- Focus on “deals.”

CO_2 Savings in Perspective



Summary Points

- Climate change is problem featuring long time horizons, multiple gases, international cooperation, and significant uncertainty.
- Actual policy experience to date – Kyoto Protocol and EU ETS provides useful information, but not necessarily future (global) path.
- Domestic policy needs to balance technology / mitigation effort, address cost certainty, deal with allocation (and point of regulation).
- International policy needs to prod but mainly embrace domestic action, provide forum for evaluating policies, and forum for coordinating developing country efforts.