

Economic Costs of Mitigating Greenhouse Gas Emissions

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Presentation for the

North Carolina Legislative Commission
on Global Climate Change

April 25, 2006



Economic Costs of Mitigating Greenhouse Gas Emissions

- Determinants of Mitigation Costs
- Cost Implications of Policy Design
- Cost Estimates of Climate Policy Proposals
- Further Issues Meriting Consideration
- Conclusions

Determinants of Mitigation Costs

- Reference/business-as-usual emissions
- Substitution to carbon-lean fuels
- Improving the efficiency of energy consumption
- Technological change
- Policy design

Reference/Business-As-Usual Emissions

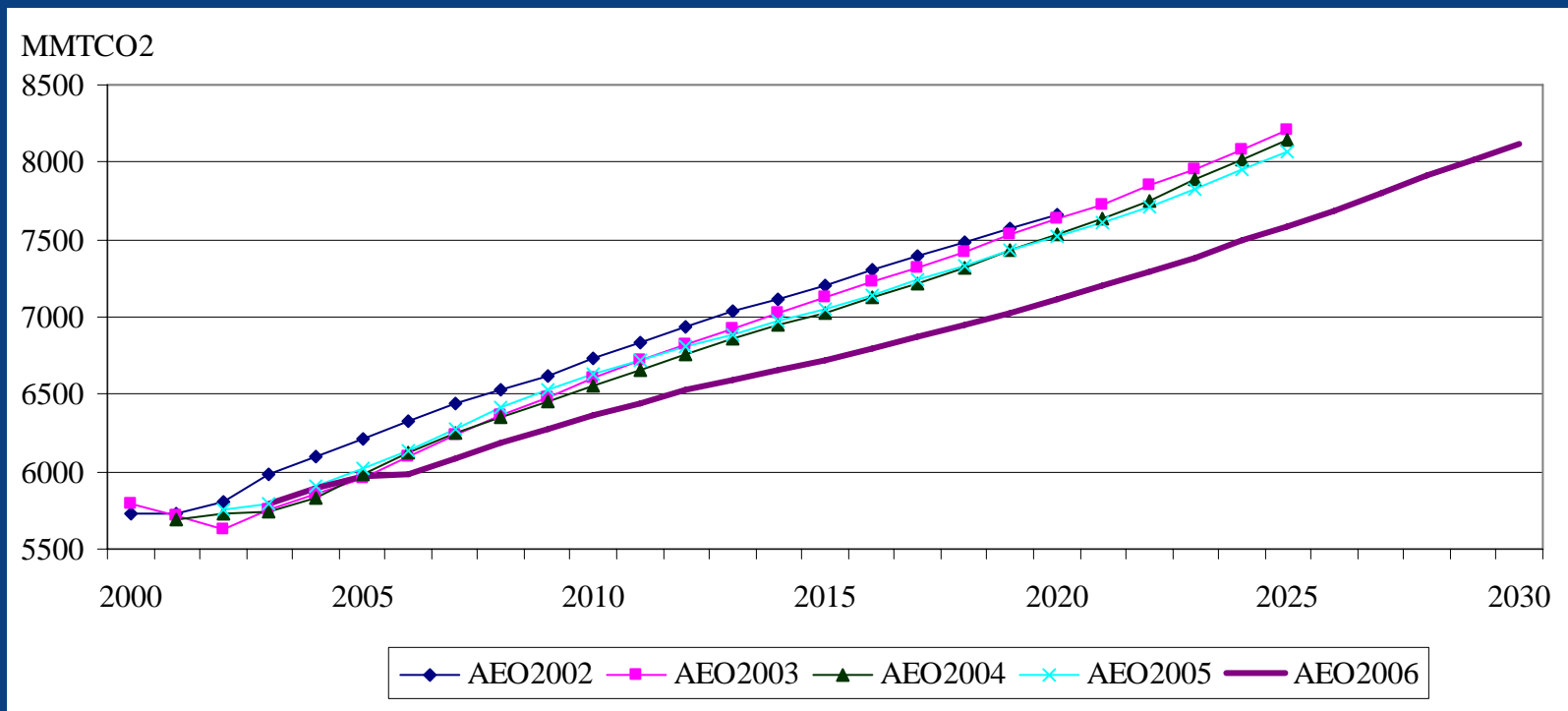
- Forecast a “no new policies” or counterfactual emissions profile
- Reflects changes over time in:
 - economic growth
 - population growth
 - energy intensity of economic output
 - carbon intensity of energy use
- Existing policies, energy prices, innovation matter
- Past can illustrate opportunities for the future

NC and All States' CO₂ Annual Growth Rate Decompositions

Sample	Carbon Dioxide	Population	Income per capita	Energy per unit income	Carbon per unit energy
North Carolina, 1960-1999	0.026	0.013	0.027	-0.012	-0.00084
All States, 1960-1999	0.020	0.011	0.021	-0.012	-0.00091
North Carolina, 1973-1986	0.0022	0.012	0.017	-0.014	-0.013
All States, 1973-1986	0.00023	0.011	0.012	-0.020	-0.0029

Source: Aldy, J.E. 2006. Energy and Carbon Dynamics at Advanced Stages of Development: An Analysis of the U.S. States, 1960-1999. RFF Discussion Paper 06-13, www.rff.org/Documents/RFF-DP-06-13.pdf

U.S. Reference Emissions through 2030



Source: Annual Energy Outlook 2002, 2003, 2004, 2005, 2006, Energy Information Administration, www.eia.doe.gov

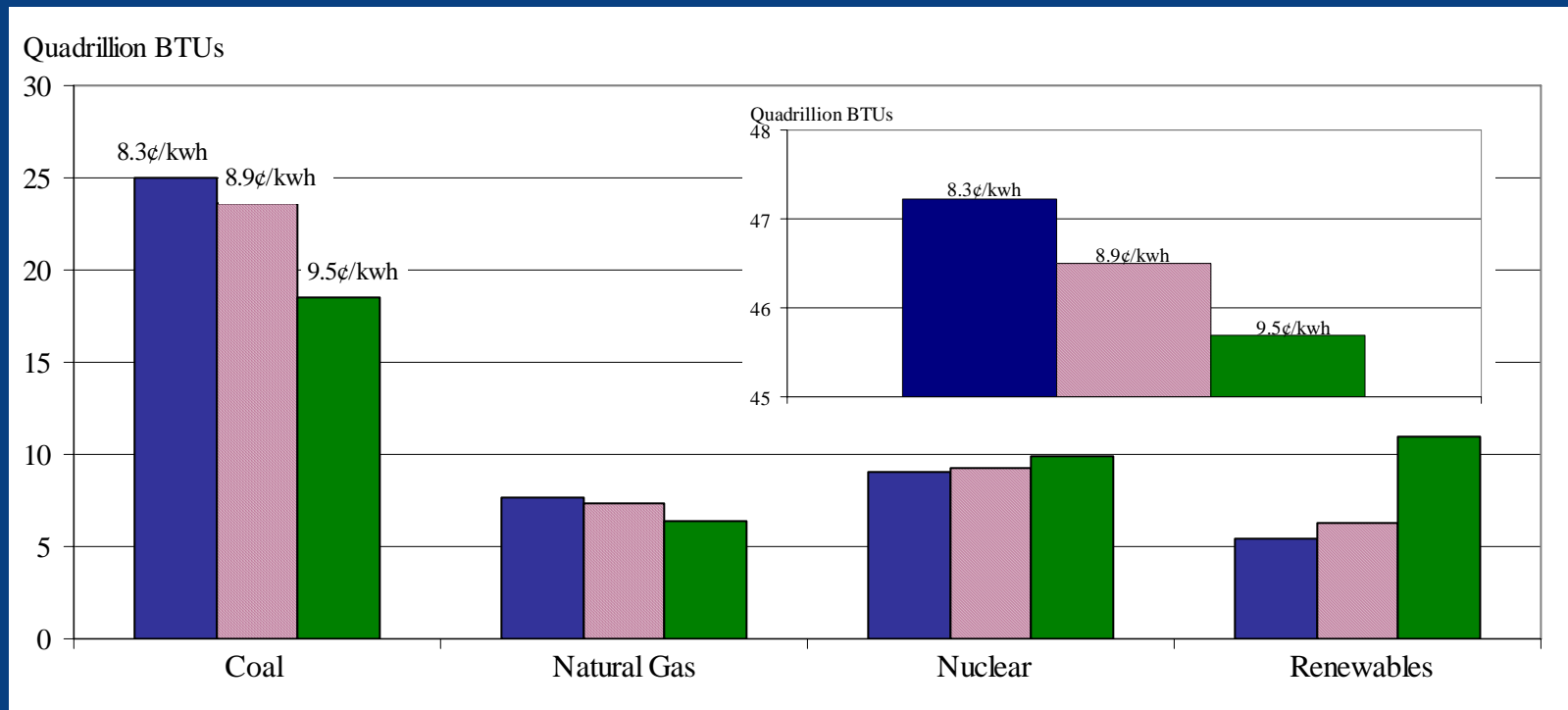
Substitution to Carbon-Lean Fuels

- Costs will be lower the easier it is to switch to low-carbon energy
- Electricity: switch from coal to gas to renewables and nuclear
- Transportation: few substitutes for petroleum
- Prices and existing capital stock matter
- Time matters: lead time and regulatory horizon

Improving the Efficiency of Energy Consumption

- Investments in energy efficiency reflect prices and information
- Consumers care about more than just energy expenditures associated with products they buy
- Prices and existing capital stock matter
- Time matters: lead time and regulatory horizon

2020 Electricity Generation, Reference and Two Cap and Trade Policies



Source: Constructed from EIA, 2006. Energy Market Impacts of Alternative Greenhouse Gas Intensity Reduction Goals.

Technological Change

- Ongoing technological change at current prices, policies
- Policy-induced technological change
 - increases diffusion of on-the-shelf technologies
 - increases R&D expenditures
- Insufficient R&D
 - firms cannot capture all of their innovations' benefits
 - limited incentives for climate-friendly R&D
- Payoffs from innovation may be in more distant future because of long capital stock lifetimes

Cost Implications of Policy Design

- Cost-effectiveness
- Distributional impacts
- Cost certainty
- Examples of market-based environmental policies

Cost-Effectiveness

- Cost-effective implementation minimizes the total cost of achieving a given emissions reduction
- “Where” flexibility: broad geographic coverage
- “When” flexibility: timing
- “What” flexibility: cover sources and sinks
- Cap-and-trade and emissions taxes more cost-effective than technology mandates or performance standards

Distributional Impacts

- Increasing energy prices adversely impacts low-income households
- Energy-intensive industries and carbon-intensive energy producers adversely impacted
- Allocation of permits can create winners/losers
 - 100% free allocation could make firms better off
 - Hybrid free allocation/auction proposed by some
 - Auction/tax revenues could be used to offset impacts

Cost Certainty

- Uncertainty about costs could limit political support and hinder capital investment
- Index emissions caps to economic growth
 - Bush Administration 2002 voluntary goal
 - Some firms have voluntary indexed emissions goals
- Hybrid cap-and-trade program with a safety valve
 - quantitative emissions cap with the option for firms to buy more permits at a predetermined price
 - insurance against unexpectedly high costs

Examples of Market-Based Environmental Policies

- Cap-and-Trade
 - Acid Rain Program for sulfur dioxide emissions
 - Lead phase-out from gasoline
 - EU Trading System for carbon dioxide emissions
 - RECLAIM – southern California local air pollutants
- Emissions Taxes
 - Limited experience in U.S.
 - Unit-based pricing of solid waste collection

Cost Estimates of Climate Policy Proposals

- Brief description of climate change policy proposals
- Estimates of energy price increases and economic costs
- Comparison of policy impacts with recent increases in energy prices

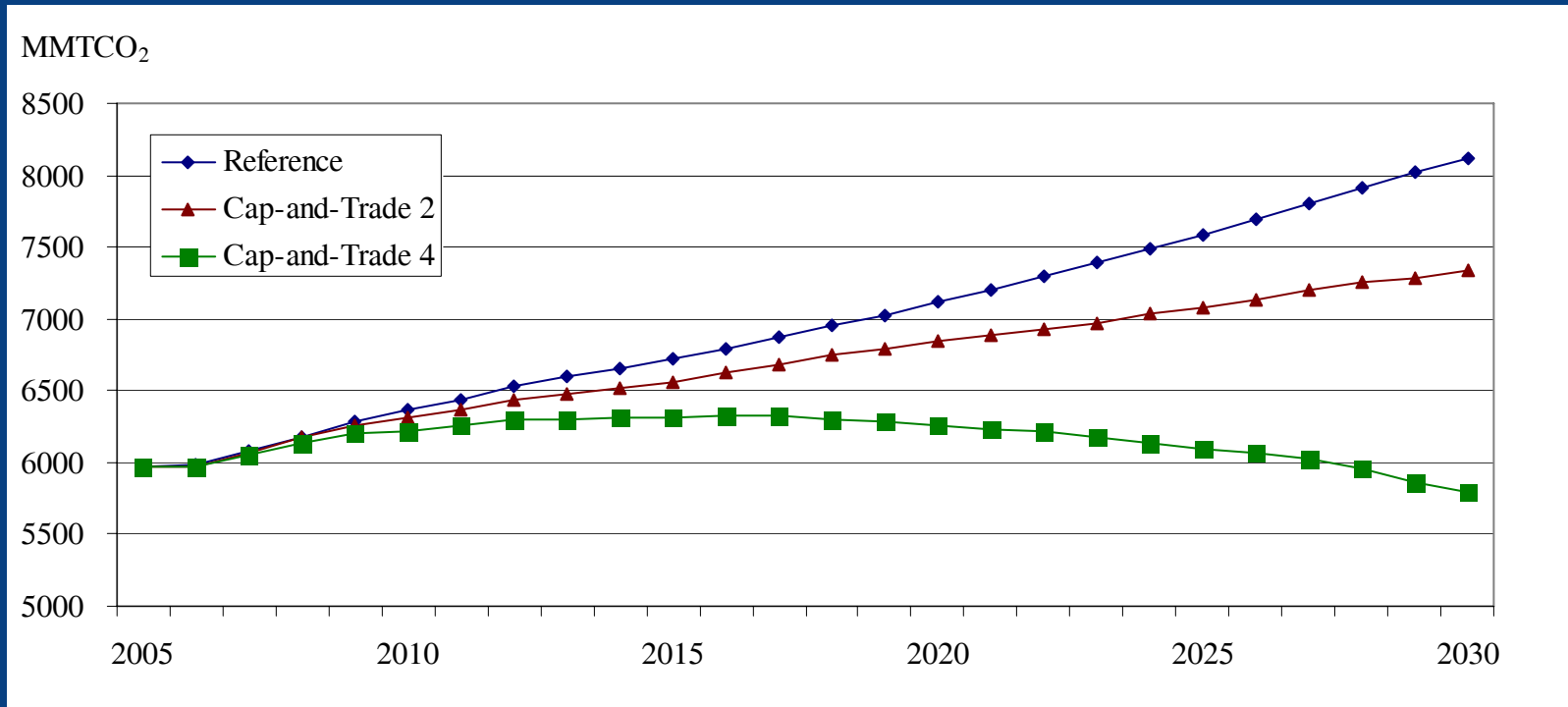
Climate Change Policy Proposals

- Utility Sector Proposals (“4P” Bills)
 - Carper
 - Jeffords
- Economy-Wide Proposals
 - McCain-Lieberman
 - Bingaman/NCEP
- Recent Proposals

Cost Estimates

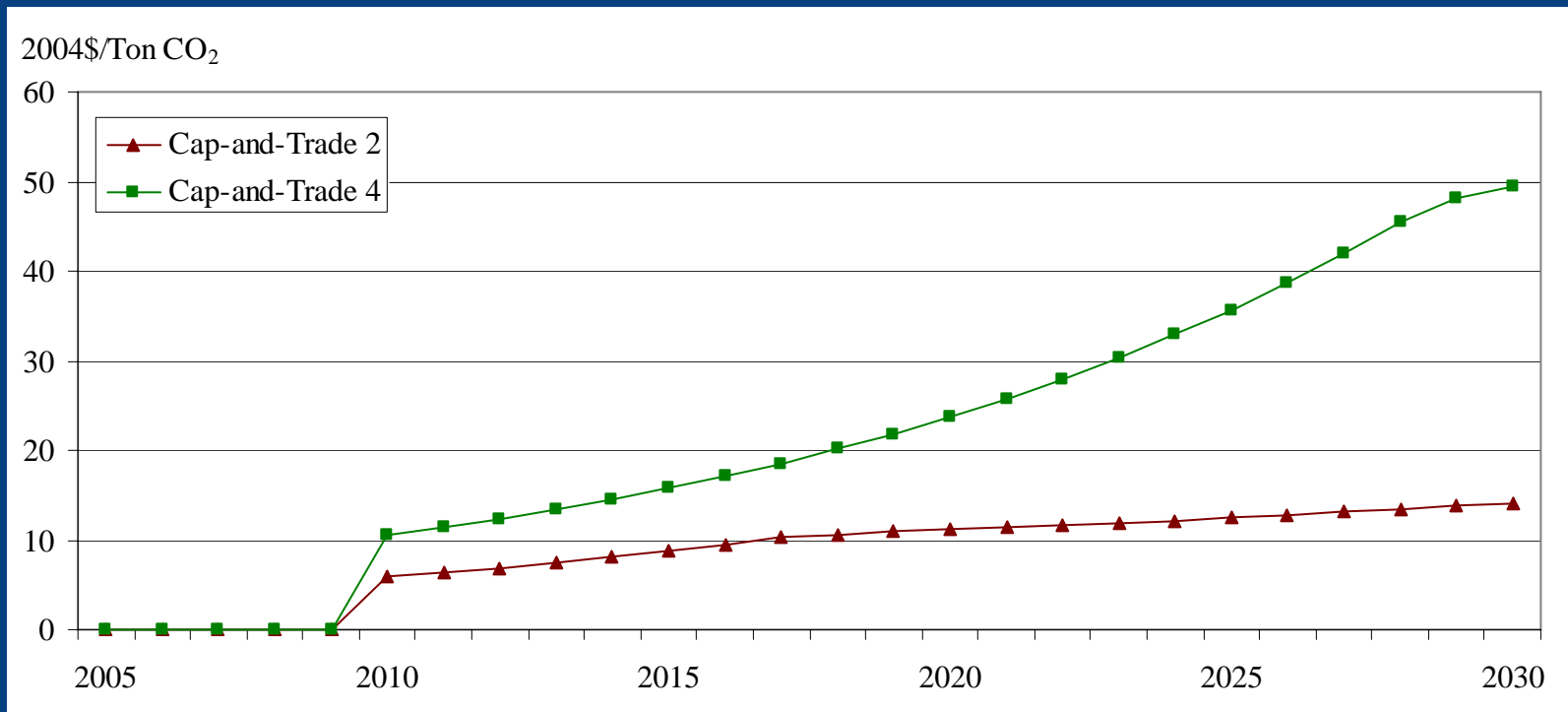
- Based on recent economic modeling work by Energy Information Administration
 - important to account for new lower forecast in reference emissions (effects of higher energy prices)
- Three cases: (1) reference; (2) cap-and-trade 2; (3) cap-and-trade 4
- Results on emissions, GDP profiles, energy prices

Carbon Dioxide Emissions, 2005-2030



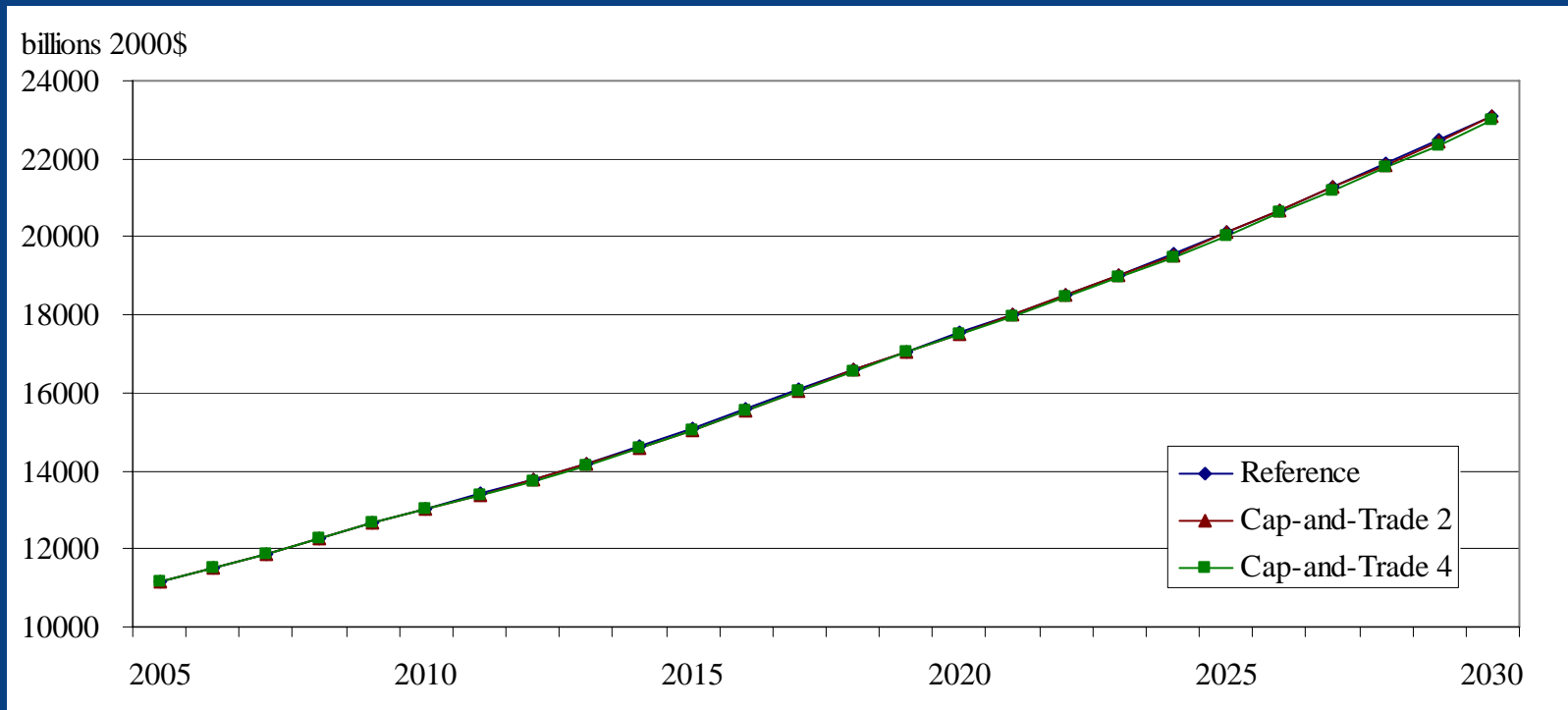
Source: Constructed from EIA. 2006. Energy Market Impacts of Alternative Greenhouse Gas Intensity Reduction Goals.

Carbon Dioxide Permit Prices, 2005-2030



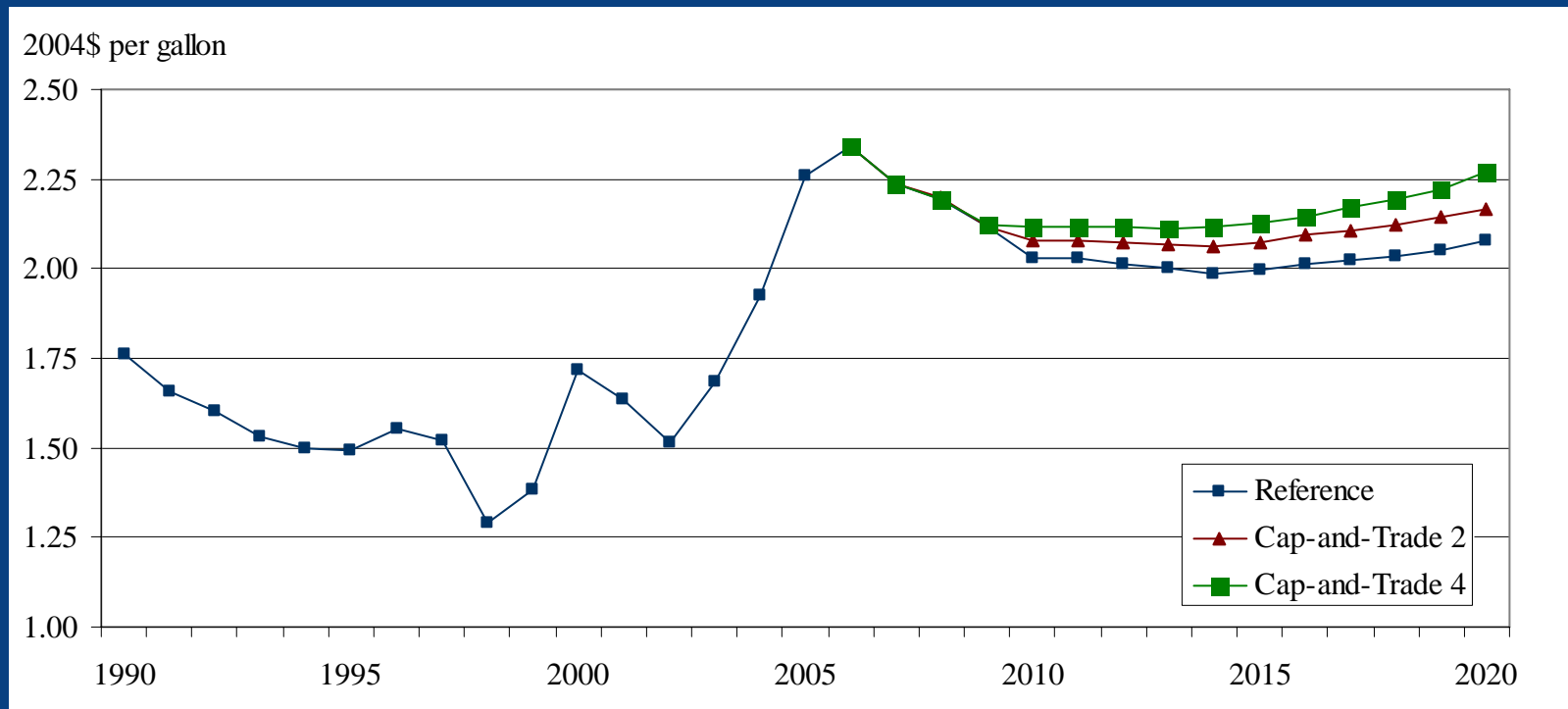
Source: Constructed from EIA. 2006. Energy Market Impacts of Alternative Greenhouse Gas Intensity Reduction Goals.

Gross Domestic Product, 2005-2030



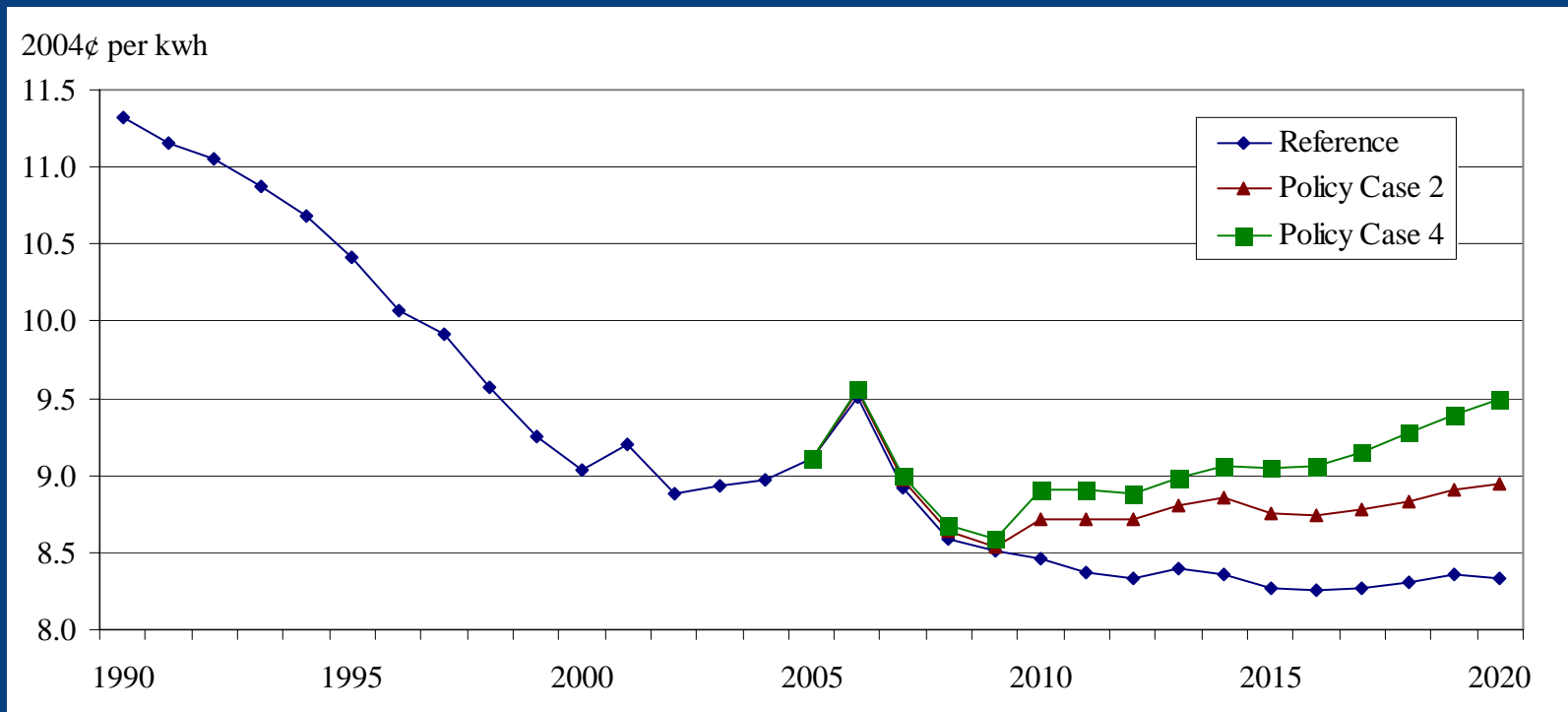
Source: Constructed from EIA. 2006. Energy Market Impacts of Alternative Greenhouse Gas Intensity Reduction Goals.

Gasoline Prices Under Reference and Two Climate Policy Cases, 1990-2020



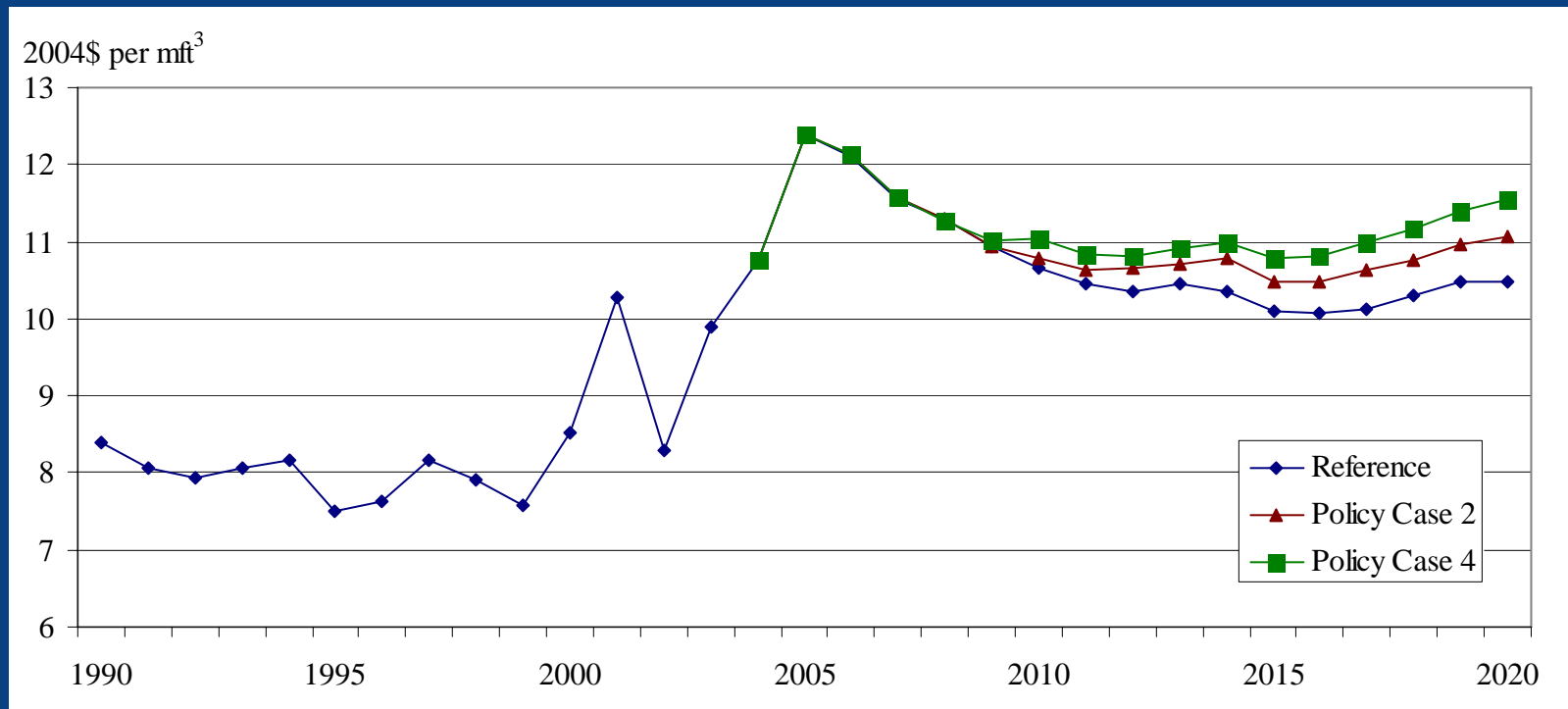
Source: Constructed from EIA. 2006. Energy Market Impacts of Alternative Greenhouse Gas Intensity Reduction Goals and EIA's Monthly Energy Review price series at www.eia.doe.gov/emeu/mer/prices.html.

Electricity Prices Under Reference and Two Climate Policy Cases, 1990-2020



Source: Constructed from EIA. 2006. Energy Market Impacts of Alternative Greenhouse Gas Intensity Reduction Goals and EIA's Monthly Energy Review price series at www.eia.doe.gov/emeu/mer/prices.html.

Natural Gas Prices Under Reference and Two Climate Policy Cases, 1990-2020



Source: Constructed from EIA. 2006. Energy Market Impacts of Alternative Greenhouse Gas Intensity Reduction Goals and EIA's Monthly Energy Review price series at www.eia.doe.gov/emeu/mer/prices.html.

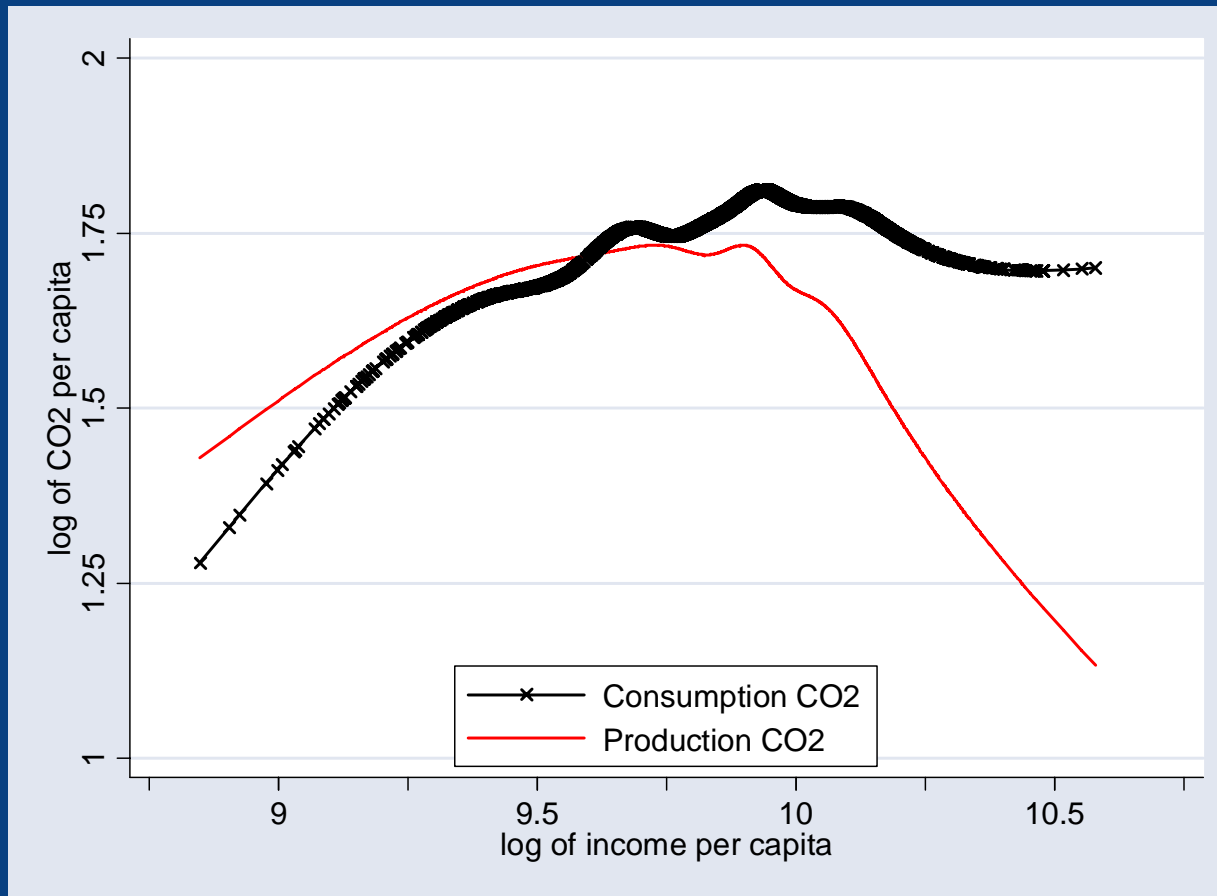
Further Issues Meriting Consideration

- What can be learned from other states' climate policy actions
- Non-climate policies with emissions impacts
- Ancillary benefits of greenhouse gas mitigation

What Can Be Learned from Other States

- Northeast states moving forward under RGGI
 - cap-and-trade on utility sector emissions
 - design issues: stringency of cap, allocation, offsets
 - possible concern: emissions leakage
- California climate change policies
 - tailpipe standards
 - utility sector policies
- Adaptation
 - Lessons from Katrina?

The Effects of Interstate Electricity Trade on Carbon Dioxide Emissions



Non-Climate Policies with Emissions Impacts

- Renewable Portfolio Standards
 - 20+ states mandate a share of electricity generation from renewable sources
- Biofuels mandate
 - 2005 Energy Policy Act: requires a minimum renewable fuels content in motor gasoline
 - emissions depend on ethanol production technology
- Can affect forecast emissions and incremental cost of carbon dioxide mitigation policies

Ancillary Benefits

- Reductions in local air pollutants associated with fossil fuel combustion
- Higher gasoline prices would reduce traffic congestion, reduce accidents
- Biological carbon sequestration activities could yield other ecosystem benefits
- Consistent with some views of “energy security”

Conclusions

- Climate change policy involves real resource costs (no free lunch), but it does not require a return to the 1970s
- Well-designed, cost-effective policies can send price signals that spur technology diffusion and development and lower emissions
- Recent energy price shocks larger than 15-year out energy price increases under some proposals
- Distributional impacts may present challenges

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