Mitigating Climate Change Through Energy Efficiency: A Multi-Model Perspective

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Today's Discussion

- **Motivation for Analyzing Energy Efficiency**
- **Aggregate CO2 Trends**
- **Comparison: Process-Economic versus Economic Equilibrium Models**
- **Sectoral Energy Intensity Trends**
- **Decomposing CO2 Trends**
  - Role for energy-efficient improvements
- **Current Trends in Energy-Economy Modeling**
- **Some Preliminary Perspectives**

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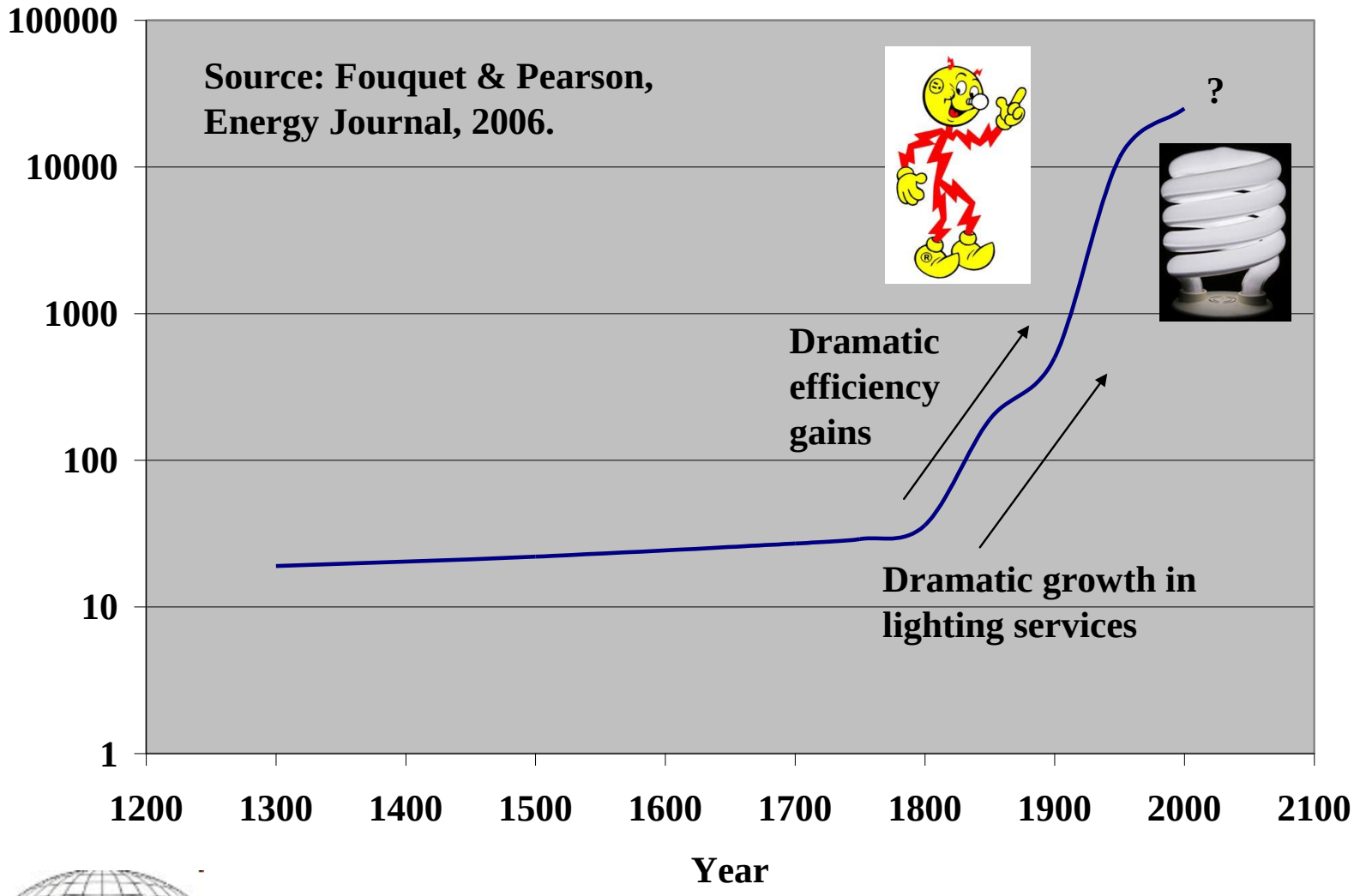
Lumen-Hours per Kilowatt Hours



EMF Climate Change Studies

- **Technology Strategies for Climate Change Mitigation**
- **Broad international participation**
  - North America, Europe, Asia
  - Increasing participation from emerging economies (Asia, South America).
- **Will focus today on EMF 25**
  - Emphasizes energy efficiency
  - US centric but also includes France, Japan and Switzerland

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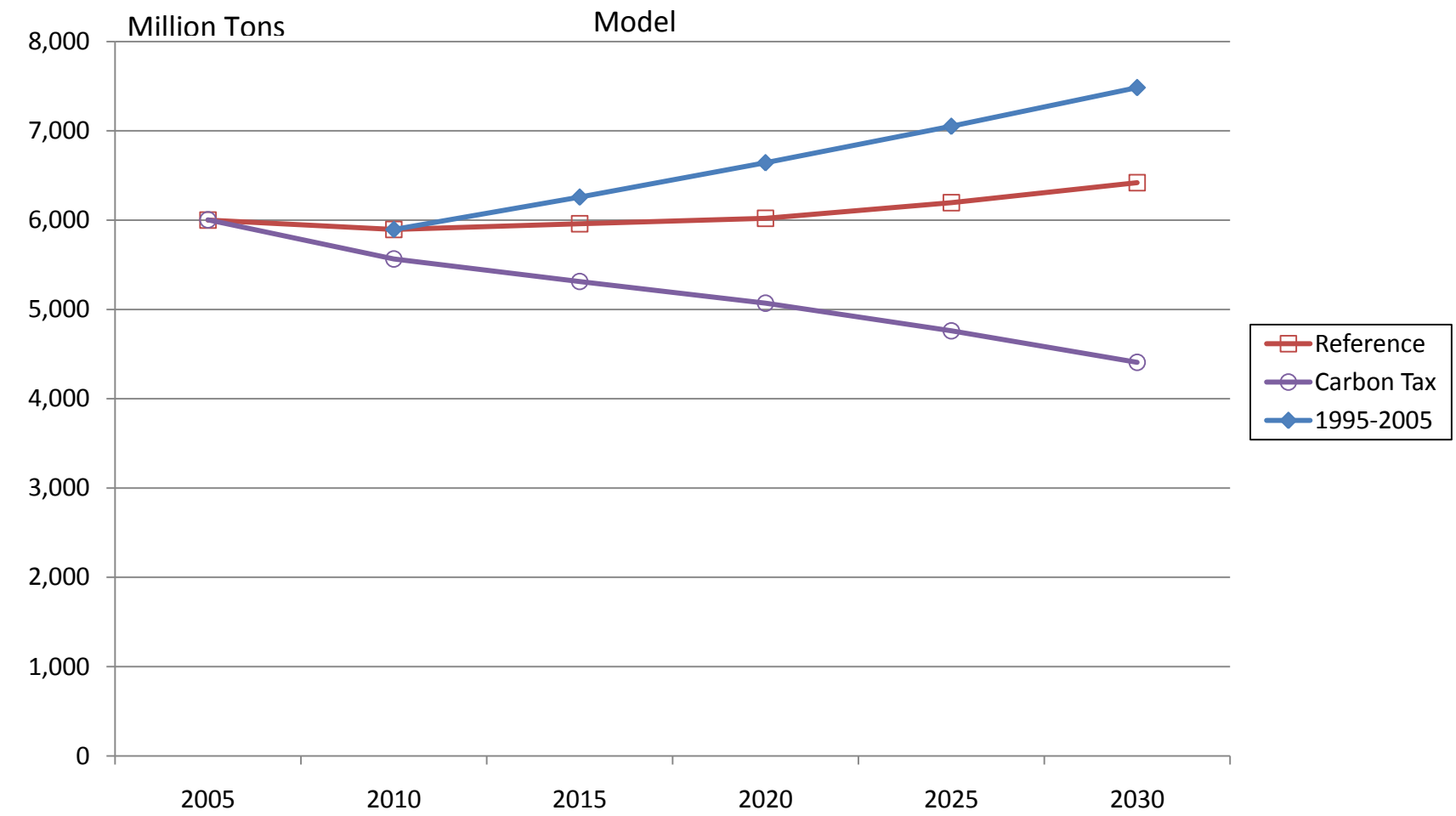
CO2 Emissions, Pre- and Post-CO2 Tax



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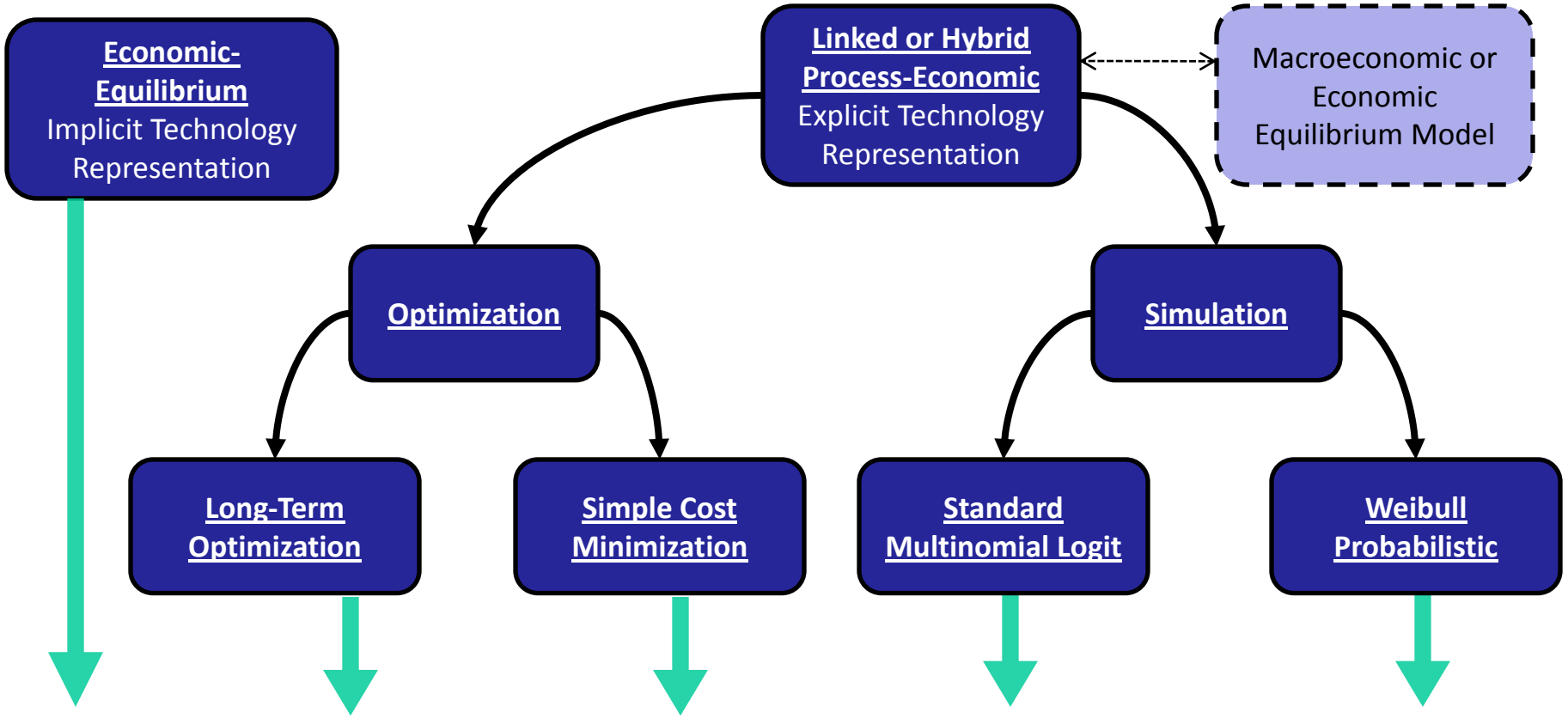
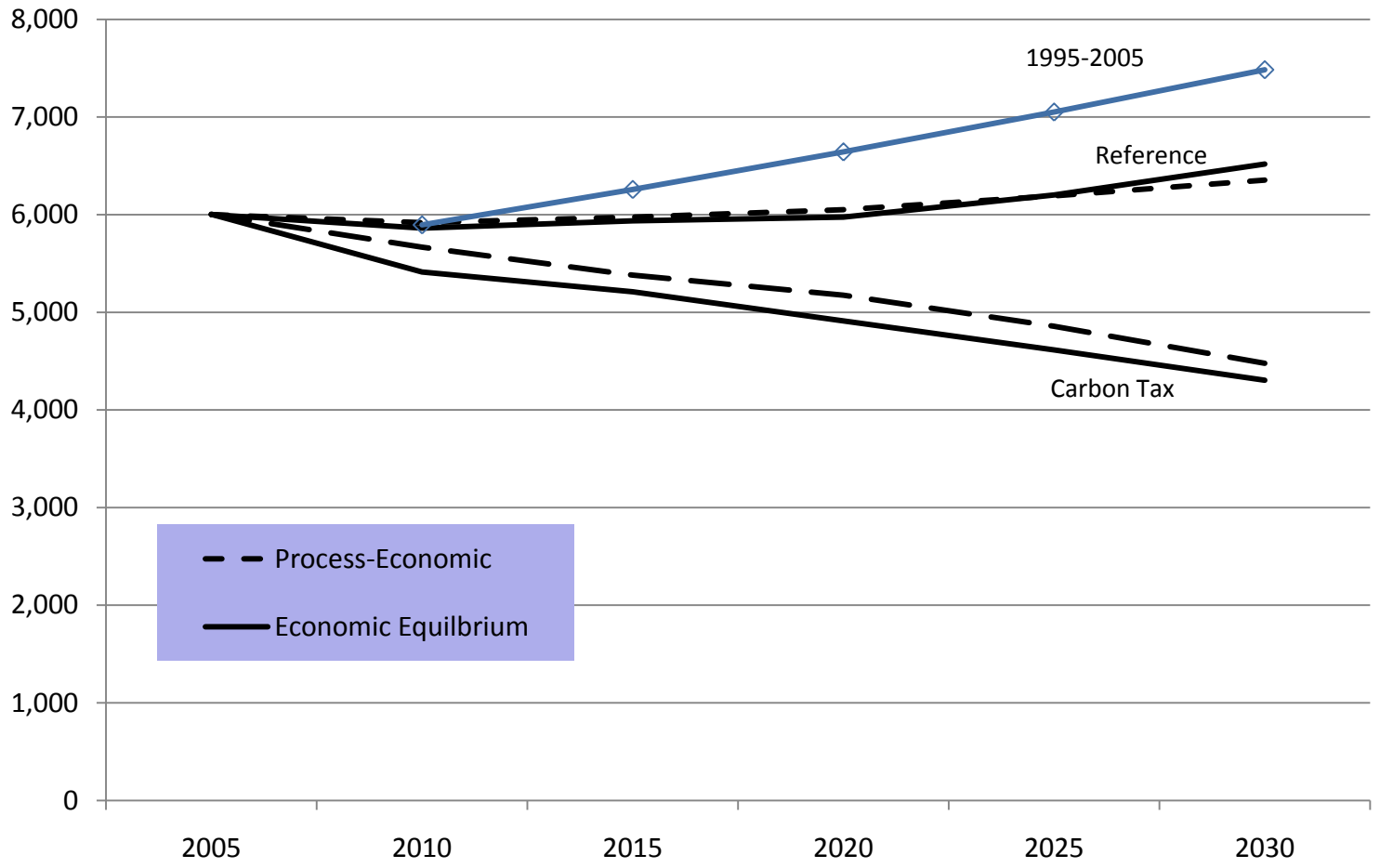
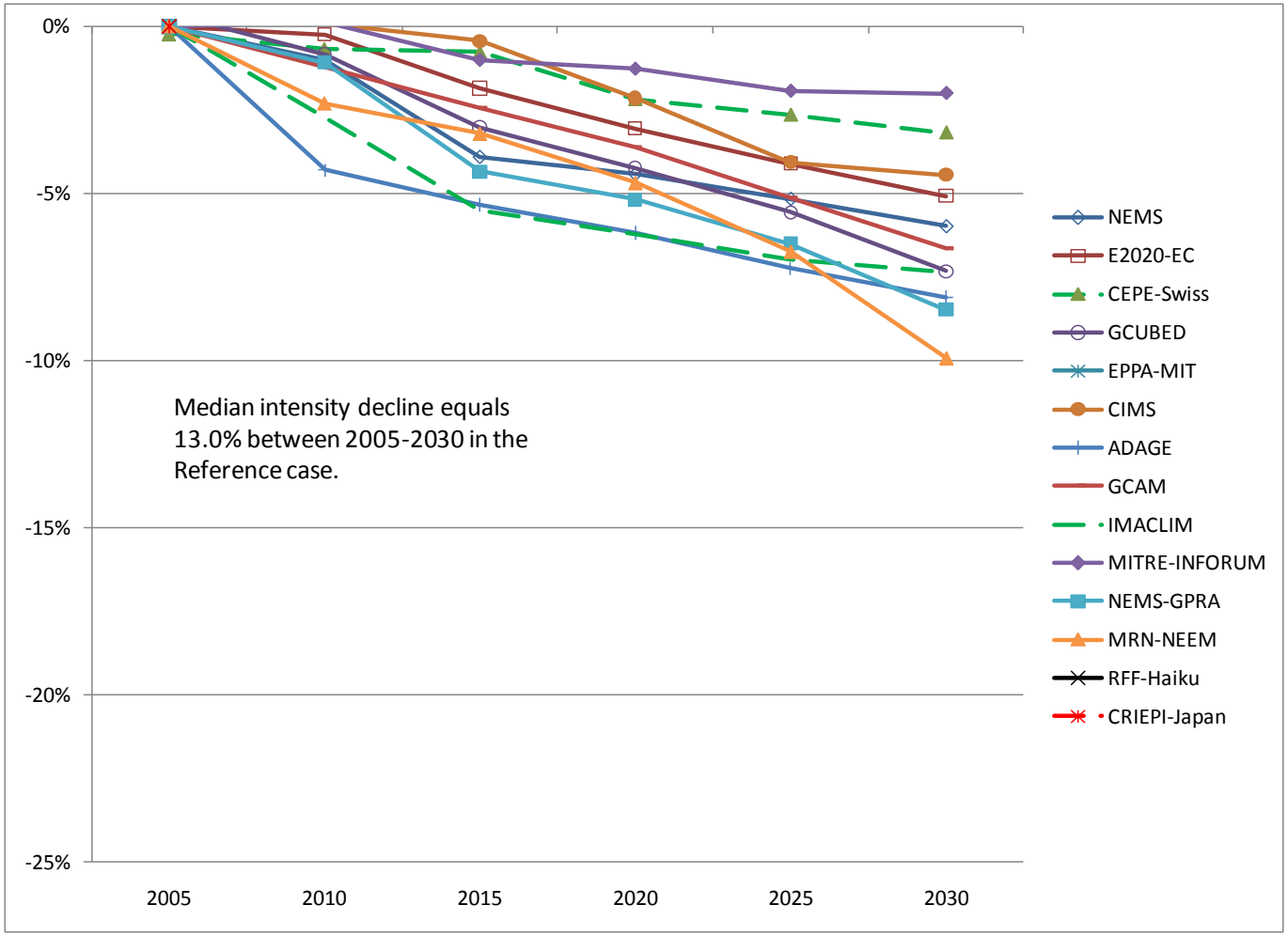
Taxonomies of Energy-Economy Models



Process-Economic vs Economic Equilibrium



Carbon Tax Effect on Residential Energy Intensity (%)



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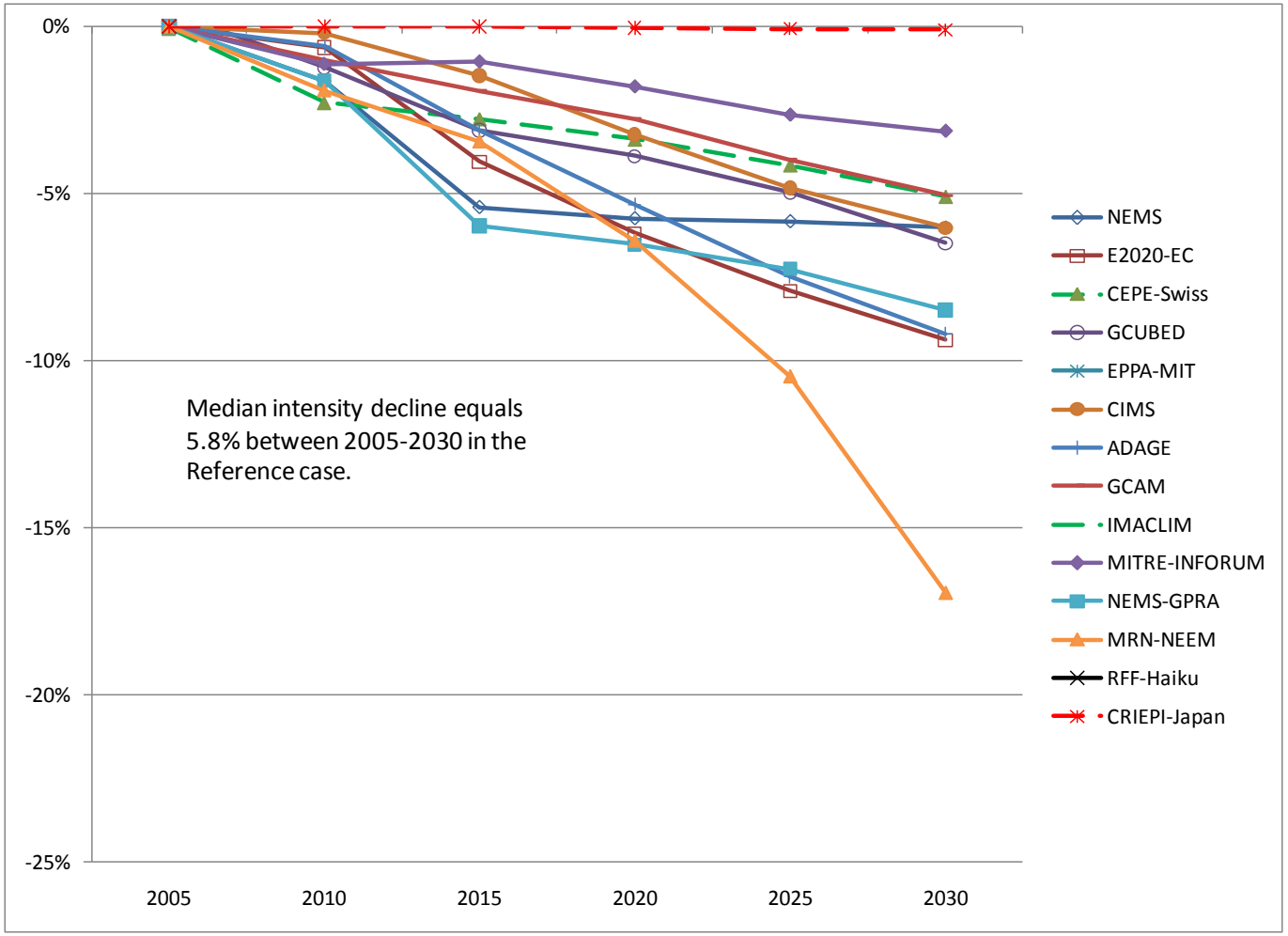
Carbon Tax Effect on Commercial Energy Intensity (%)



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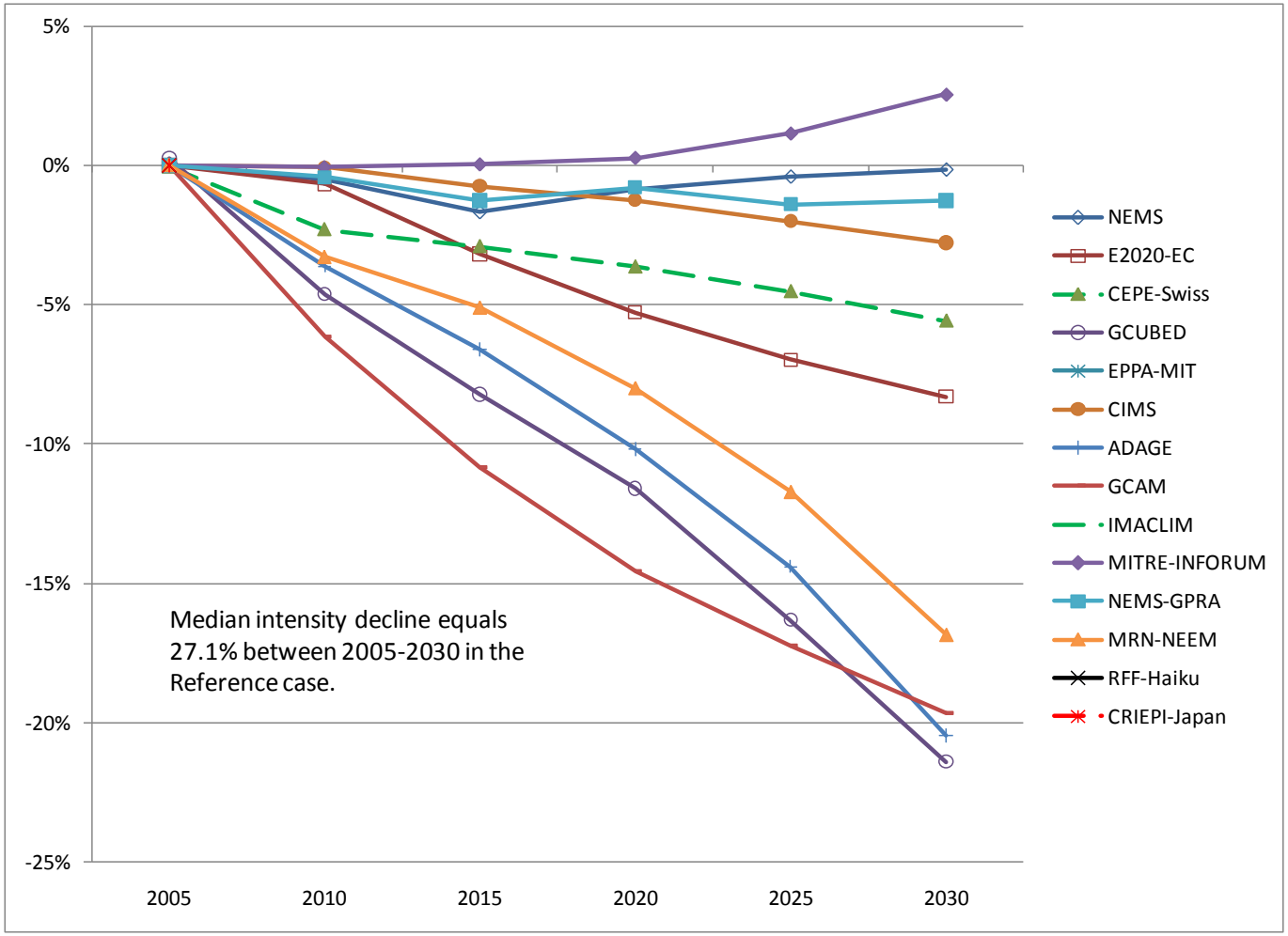
Carbon Tax Effect on Industrial Energy Intensity (%)



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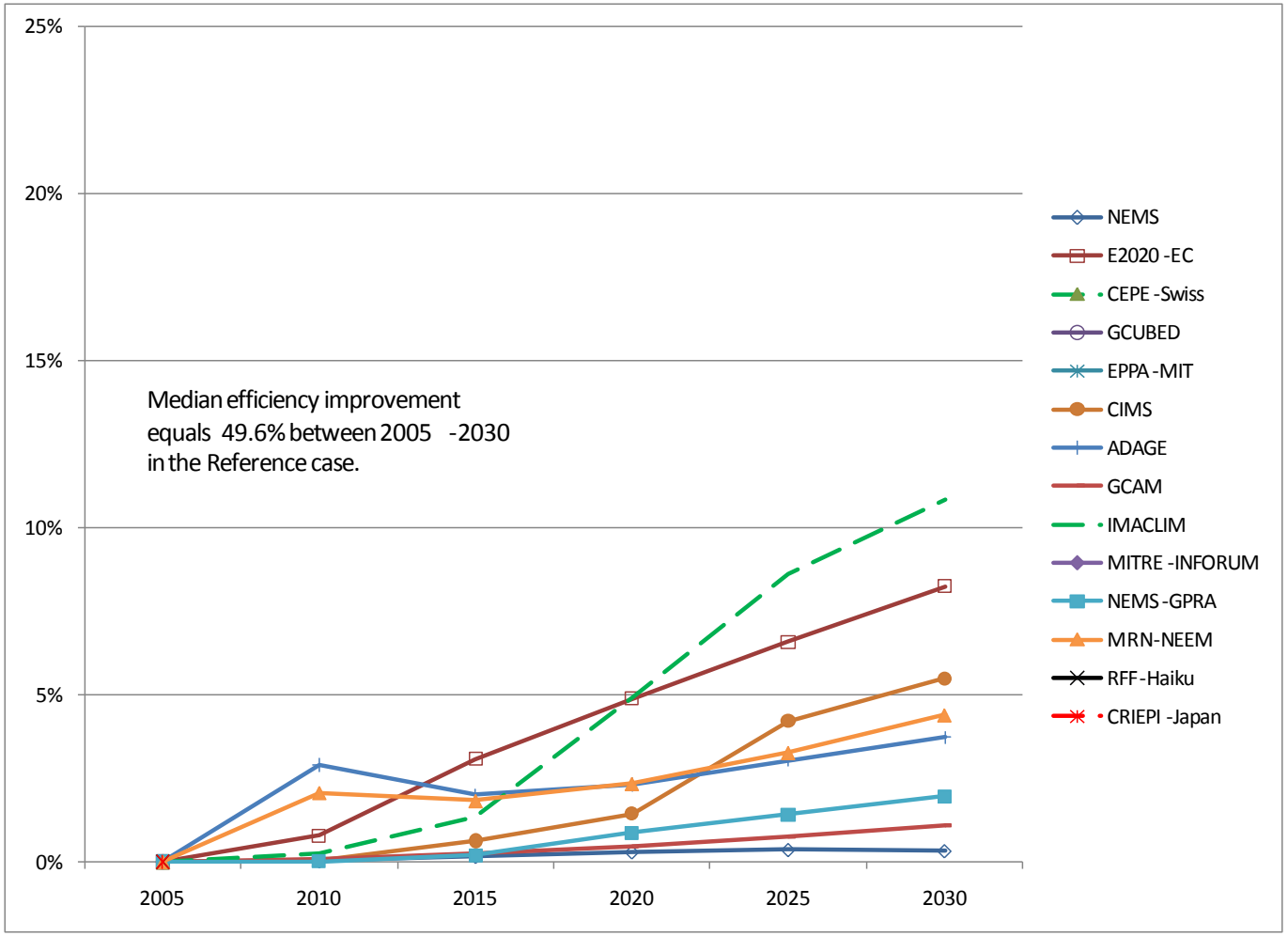
Carbon Tax Effect on Transportation On-road LDV Efficiency (%)



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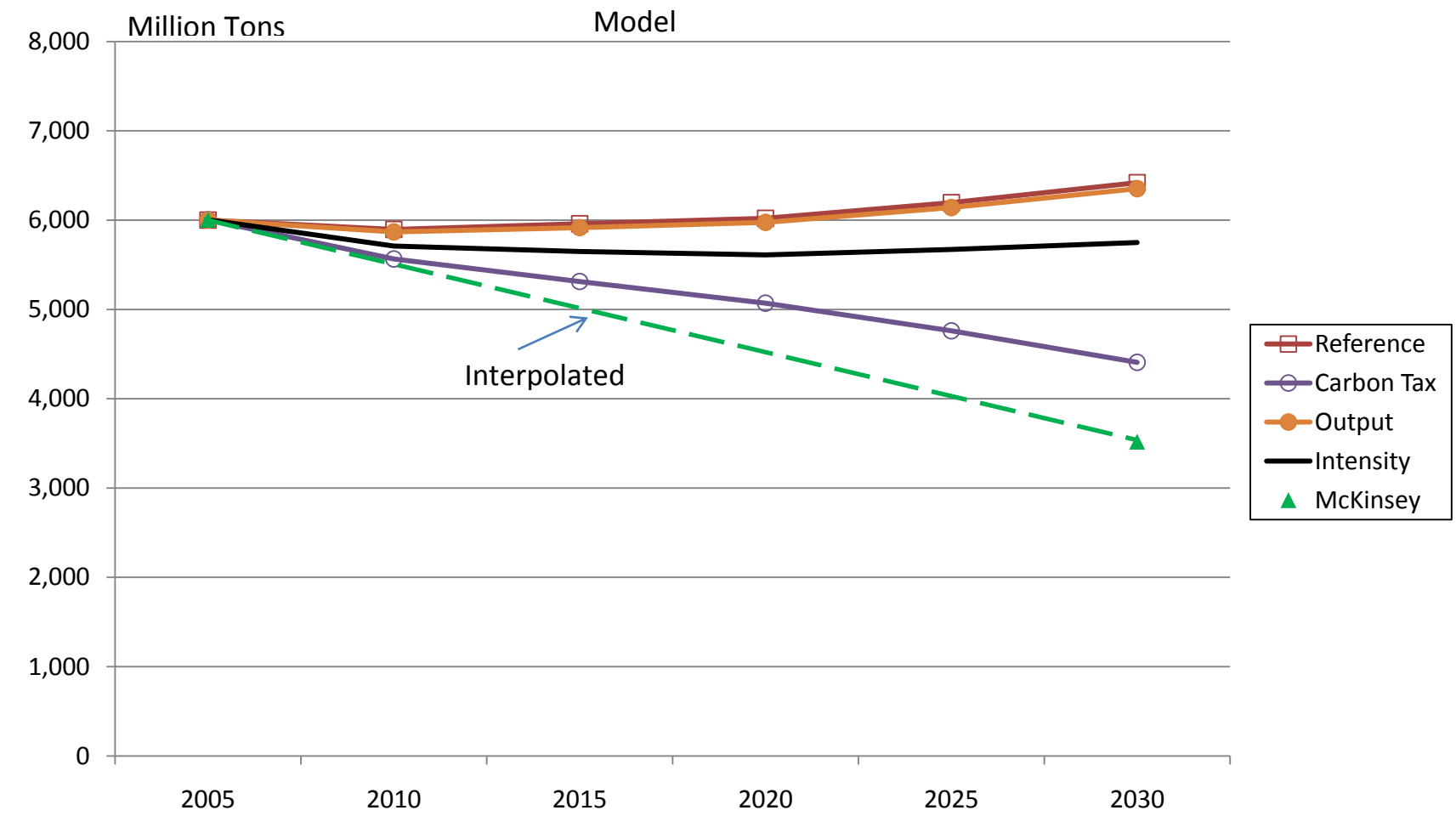
Decomposing Aggregate CO2 Trends



Out-of-Pocket versus Opportunity Costs

- **High-cost adopters do not use average costs.**
- **Adoption is seldom universal.**
  - What if only 80% adopt over the next 10 years?
- **Efficiency changes cost/quality of services.**
  - What if rebound effect is 20% (estimated at 10-30% for OECD).
- **Fallacy of composition may reduce profits.**
  - Aggregate behavior can change prices.
  - Example, energy savings can reduce energy prices.
- **Policies/programs can be costly.**
  - Gillingham *et al* (2006) average utility program costs = 3.4 cent/kWh.
  - Nadel & Geller (1996) suggest policy costs vary widely.

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Current Directions for Improving Energy-Economy Modeling

- **Link explicit technology costs and performances to economic relationships:**
  - Linked or hybrid systems
  - Suites of models where satellite analyses are coupled with integrating systems.
- **What do we mean by costs?**
  - Is there a common metric for costs?
  - Taxes reveal costs directly
  - What are the costs of standards and utility DSM programs?
    - Out-of-pocket expenses
    - Opportunity costs

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Current Directions for Improving Modeling and Analysis

- **Publicly available data on technology costs and performances**
  - Policymakers should be critical of proprietary data
  - ACEEE/LBNL data sets in EMF study
- **Research experiments to determine behavior on who adopts new processes and under what conditions**
- **Better information on program costs (implementation, monitoring, free riders/drivers, etc.)**

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Some Preliminary Perspectives

- **US energy intensity will decline sharply even without any new policies.**
  - No-policy trends already incorporate some promising options.
- **EMF energy savings < economic potential estimates.**
  - More behavioral than technical reasons.
  - Out-of-pocket costs are not opportunity costs.
- **Assumptions dominate selection of model type.**
- **Standards and carbon prices are not perfect substitutes for each other on the policy front.**
  - But we need more research on this topic.
- **Far from perfect, models provide consistent frame-work for evaluating supply-demand options.**

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