

# The Potential of Fuels and Vehicle Technologies: Getting the Incentives Right

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# Main Points

- We don't care about automotive fuel economy for its own sake, we care about it because we want reduced greenhouse-gas emissions and/or reduced oil consumption for energy security
- Technology development and deployment (including technology transfer) is strongly dependent on the type and nature of the incentive structure.
- Government policies and consumer demand are the two most important incentives, and they must be aligned to be effective.
- In general, we tend to be too “supply-side” in our thinking, and we don't focus sufficiently on demand. How do we get consumers to care about which car they purchase, and how much they drive? Demand is essential for technology deployment.
- There are “limits to leapfrogging” in non-OECD countries, and those are caused by failing to get incentives right.

# Consumer Behavior—Rationality?



# Why do Americans buy hybrid vehicles?

Kelly Sims Gallagher and Erich Muehlegger 2008, “Giving Green to Get Green? Incentives and Consumer Adoption of Hybrid Vehicle Technology,” 2008, *American Economic Journal: Economic Policy* (under review). Also available as a faculty working paper at [www.energytechnologypolicy.org](http://www.energytechnologypolicy.org).

- Results

- 33 percent of hybrid sales due to consumer social preferences, 28 percent due to rising gasoline prices, and 12 due to sales tax incentives. Federal income tax deductions not statistically significant.

- Policy implications

- Consumer social preferences matter the most - education about climate change and energy security matters
- Fuel prices also strongly drive consumer purchase behavior - can we get beyond the aversion to fuel taxation?
- Design of tax incentives important - sales tax deductions much more powerful than income tax deductions
- HOV access to HEV, statistically significant, but only in Virginia

# ***Analysis of Transport-Specific Carbon Policies***

*Source:* Kelly Sims Gallagher and Gustavo Collantes 2008, “Analysis of Policies to Reduce Oil Consumption and Greenhouse-Gas Emissions from the U.S. Transportation Sector,” *Energy Policy* (under review).

# Assumptions I

- The time period is **2010-2030**
- **AEO2007 version of National Energy Modeling System (NEMS)** used as updated for Congressional service requests
- All policies are in terms of **carbon dioxide**, not carbon
- **Covered gases** include energy-related CO<sub>2</sub>, nitrous oxide (excluding agriculture and mobile combustion emissions), and hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulfur hexafluoride (SF<sub>6</sub>)
- The carbon content of transportation fuels is **not assessed on a lifecycle basis** but rather in terms of the carbon content of the fuel
- **Revenue of carbon taxes is recycled** to consumers.
- **Revenue of motor fuel taxes is not recycled** to consumers

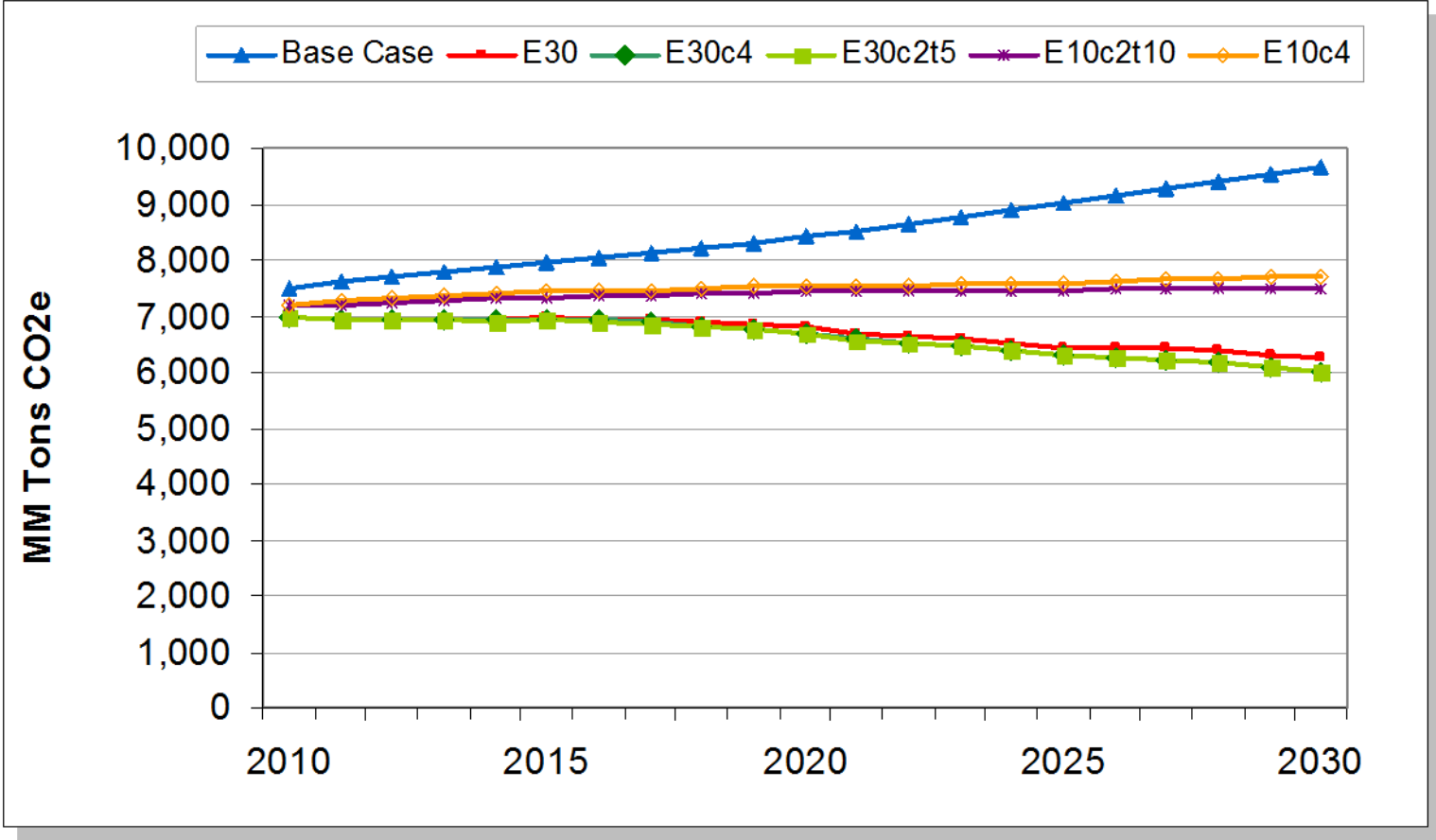
# Assumptions II

- **World oil prices** are predicted to rise only from \$49/barrel in 2007 to \$51/barrel by 2030 in the reference case
- **Taxes** on transportation fuels are assessed at the exit gates of refineries.
- No “**offsets**” are allowed
- There are **13 vehicle technology options**
- NEMS was modified to allow **greater penetration of high-efficiency vehicle technologies** (including hybrids and diesels) than the EIA reference case for passenger vehicles (but not freight trucks).
- **CAFE increases** take effect in 2010 and last for ten years

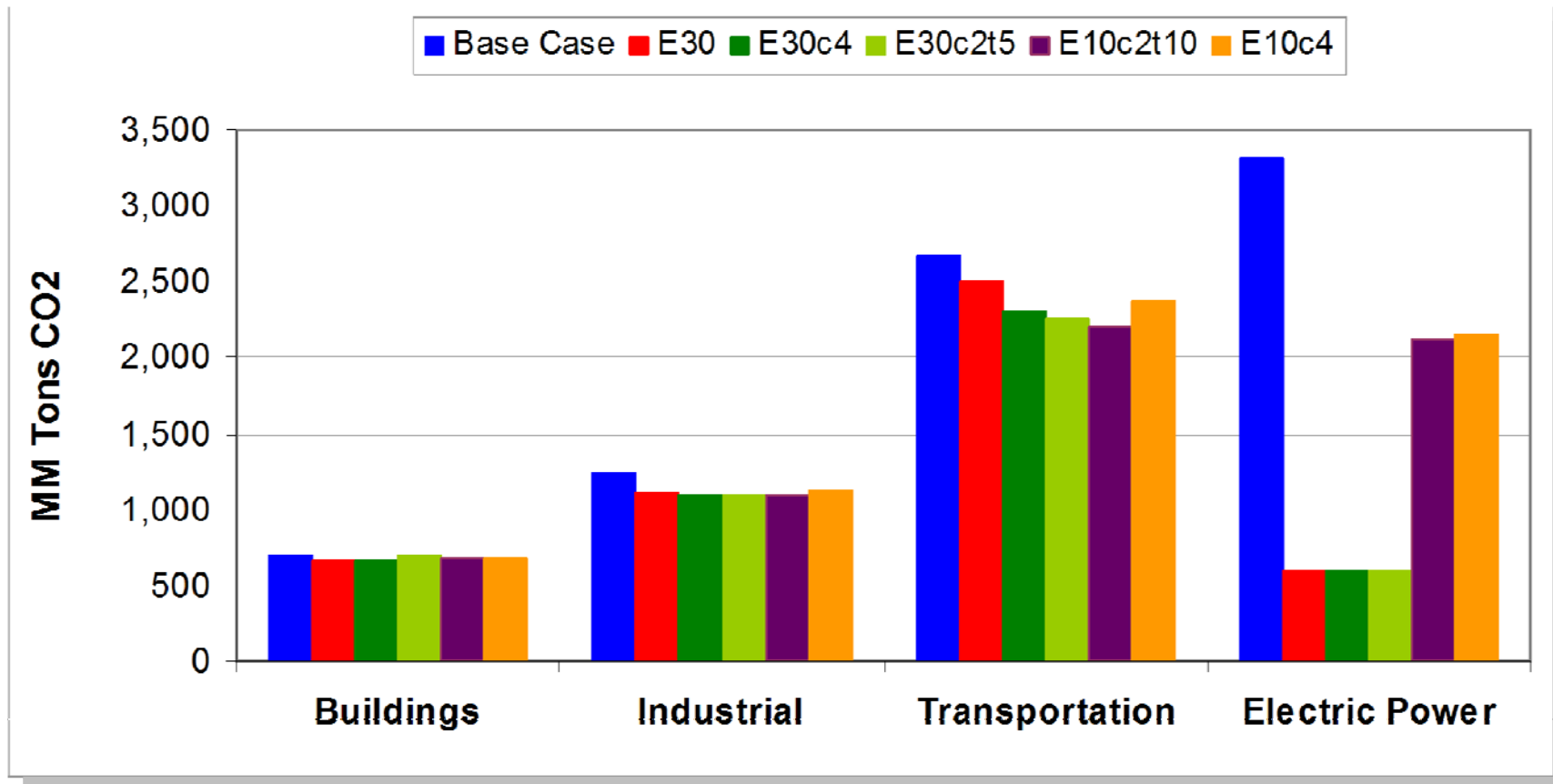
# Policy Scenarios

<i>Policy Scenarios</i>		
<i>Scenario</i>	<i>Abbreviation</i>	<i>Description</i>
A	<b>Base Case</b>	Reference case for NEMS model
B	<b>E30</b>	Economy-wide carbon price of \$30/ton CO <sub>2</sub>
C	<b>E30c2t5</b>	Economy-wide carbon price of \$30/ton CO <sub>2</sub> , plus 2% annual improvement in CAFE for cars and light trucks, plus an additional transportation carbon tax starting at 50 cents increasing at 5% per year in real terms
D	<b>E30c4</b>	Economy-wide carbon price of \$30/ton CO <sub>2</sub> , plus 4% annual improvement in CAFE for cars and light trucks
E	<b>E10c4</b>	Economy-wide carbon price of \$10/ton CO <sub>2</sub> , plus 4% annual improvement in CAFE for cars and light trucks
F	<b>E10c2t10</b>	Economy-wide carbon price of \$10/ton CO <sub>2</sub> , plus 2% annual improvement in CAFE for cars and light trucks, plus a gasoline and diesel tax increasing at 10% per year in real terms
G	<b>E10c2gf</b>	Economy-wide carbon price of \$10/ton CO <sub>2</sub> , plus 2% annual improvement in CAFE for cars and light trucks, plus flat gas tax that stays constant at 50 cents per gallon

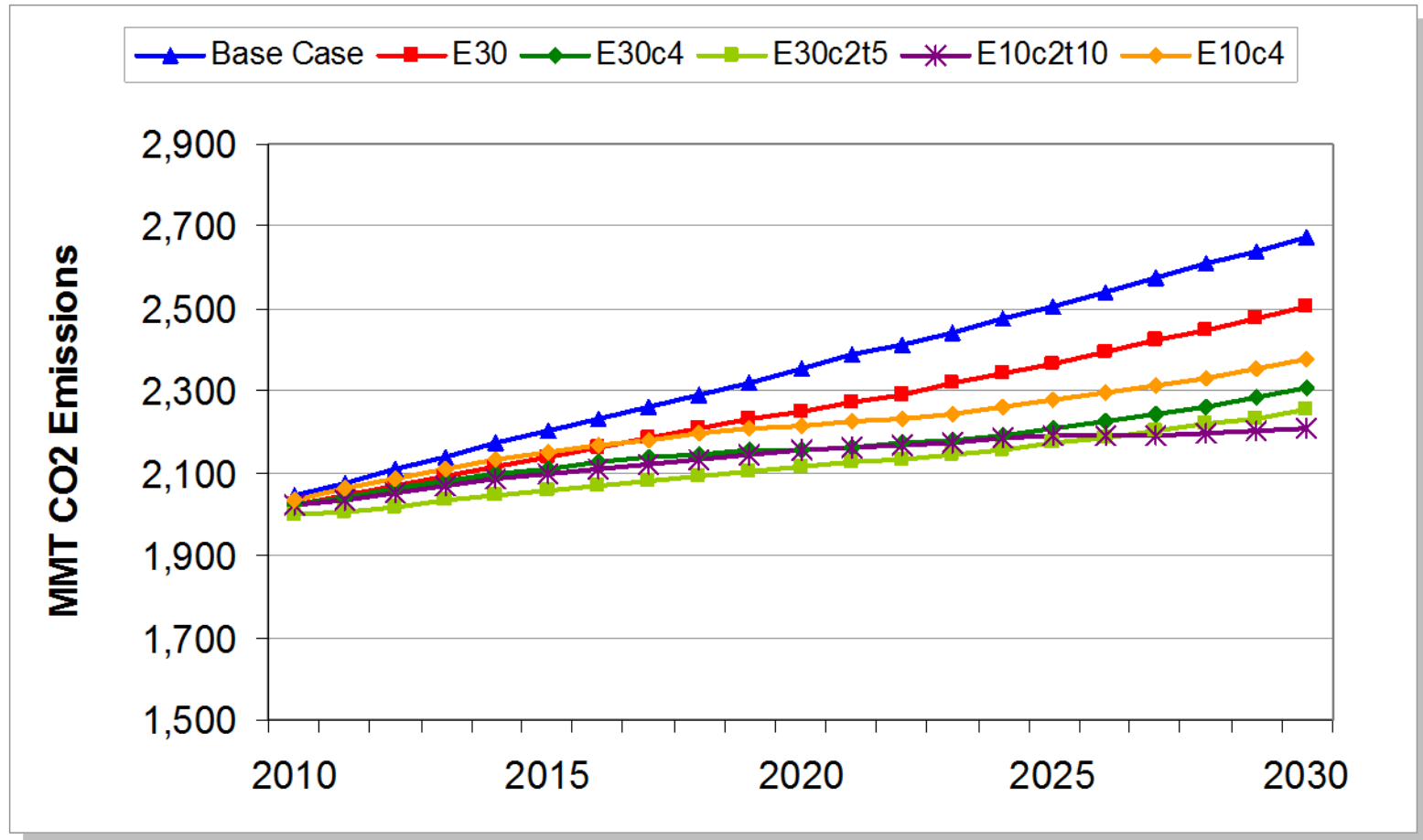
# Total GHG Emissions



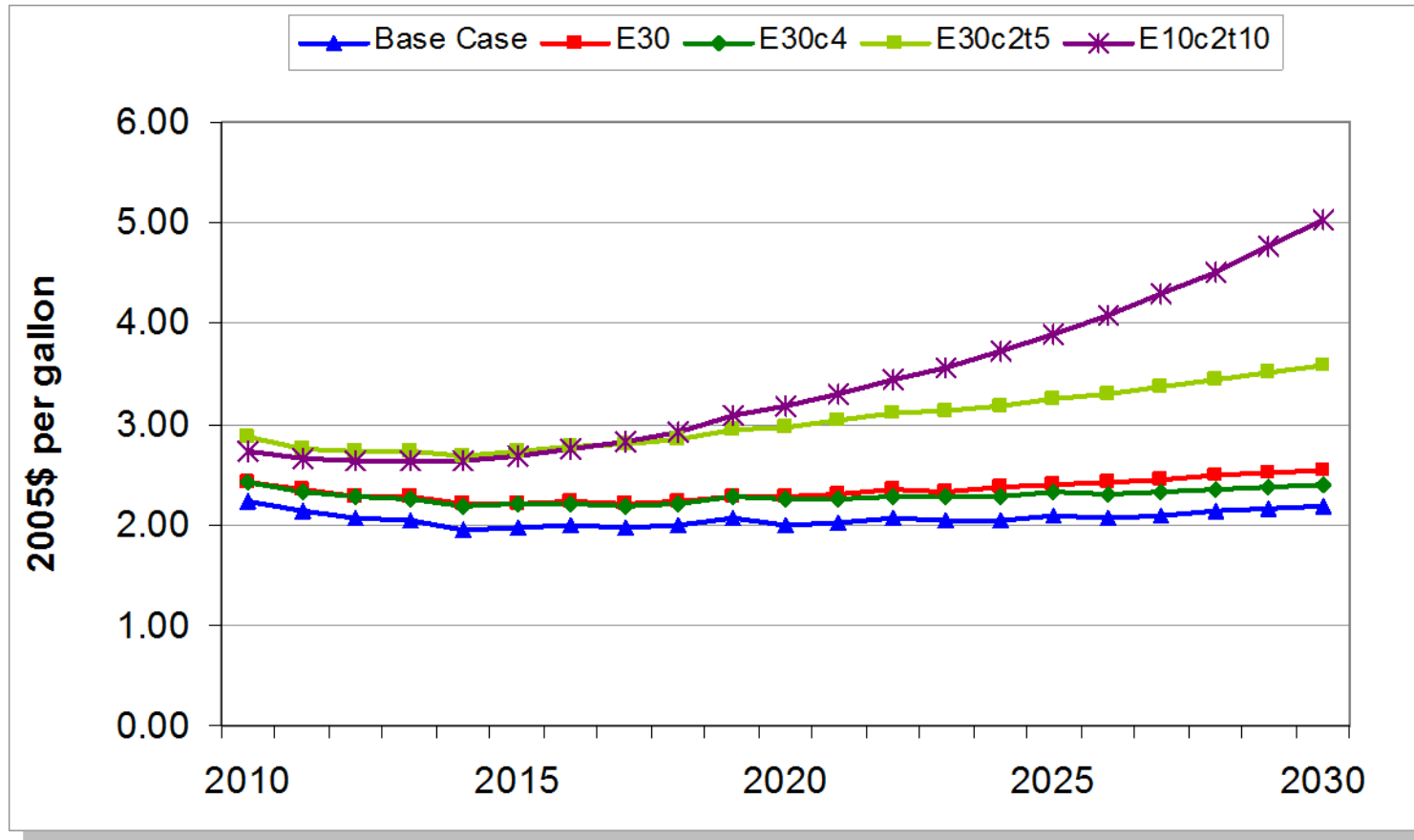
# GHG Emissions by Sector (2030)



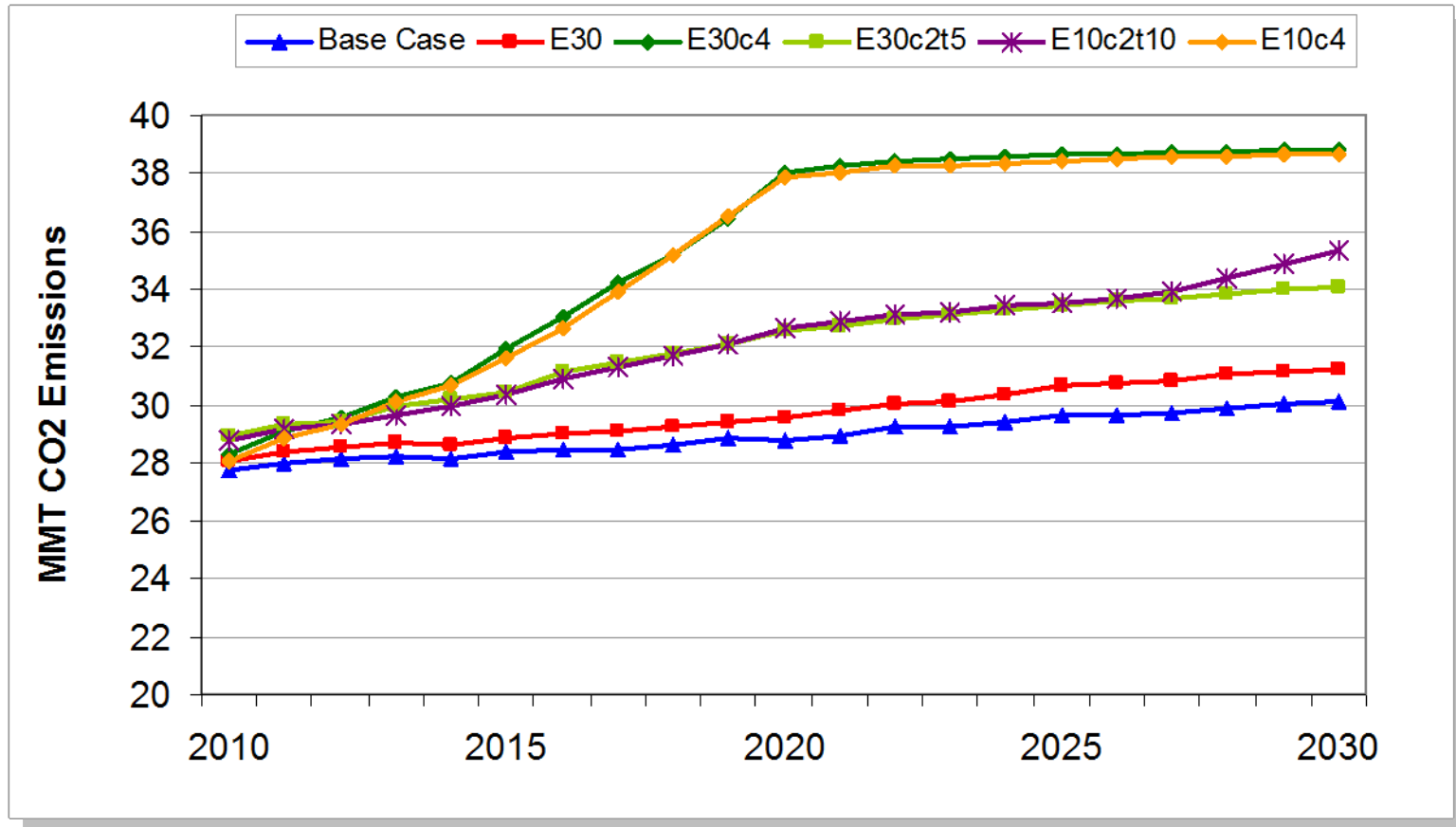
# GHG Emissions from Transportation



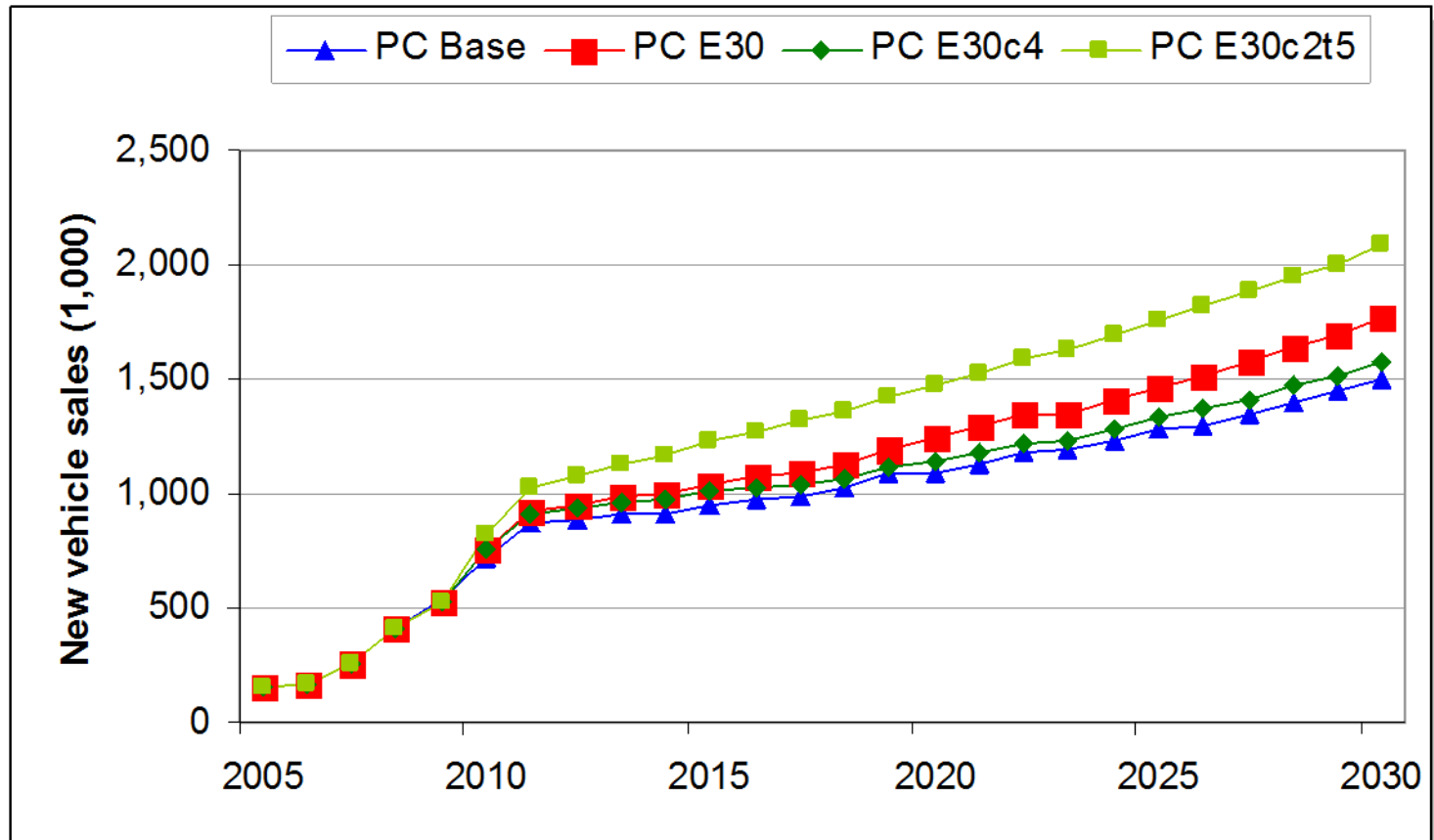
# Gasoline Prices



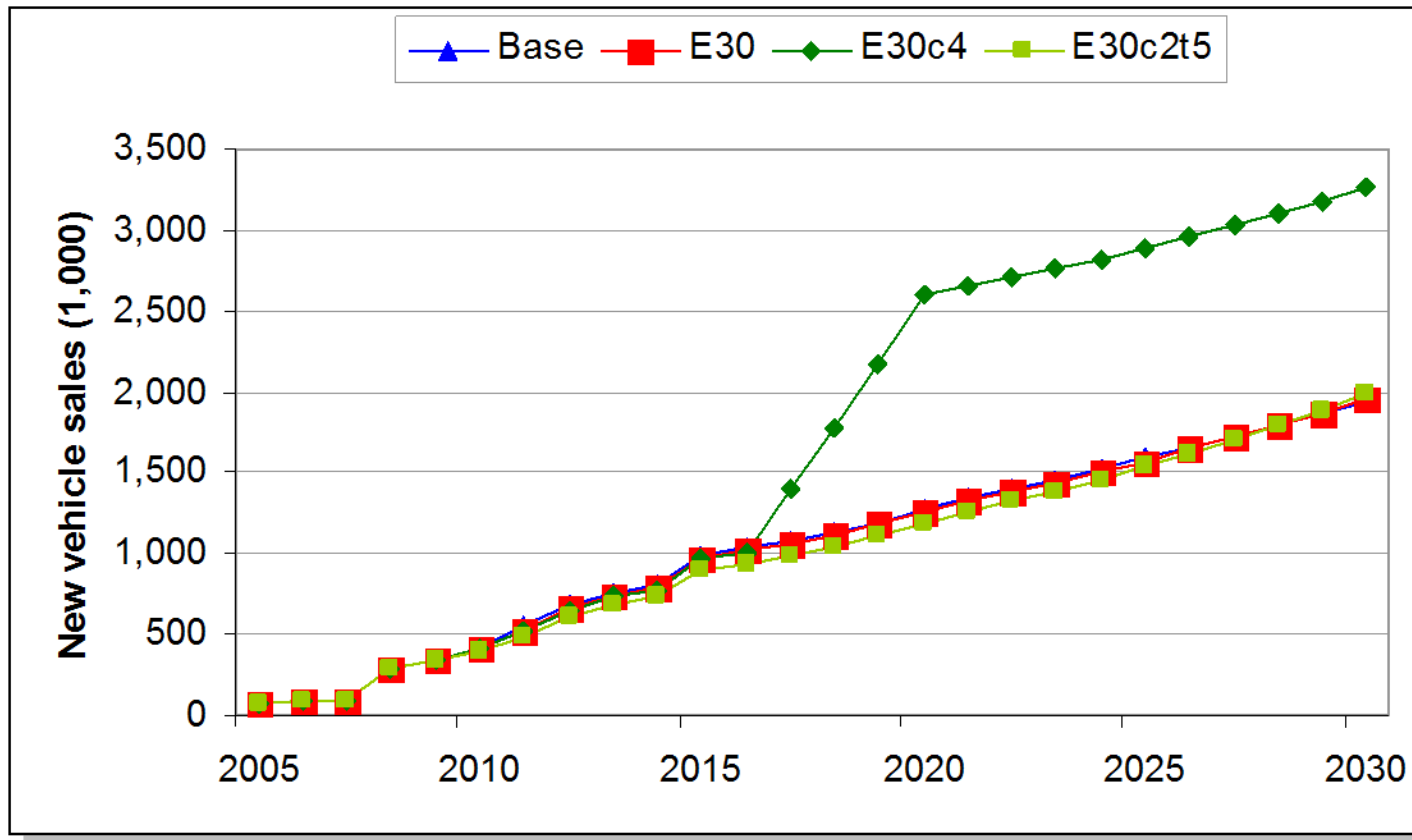
# New LDV Fuel Economy



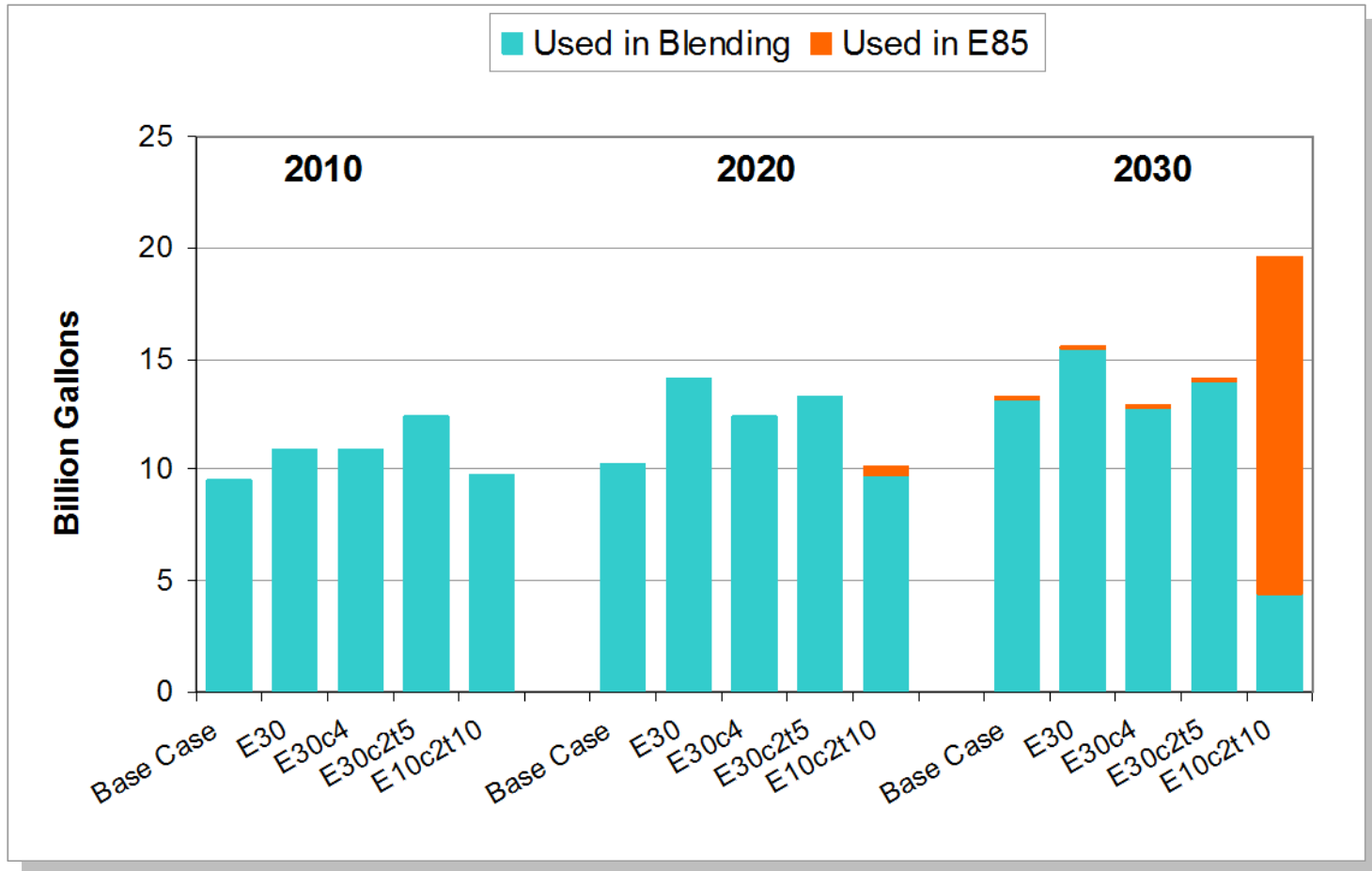
# Hybrid Electric Vehicle Sales—Passenger Cars



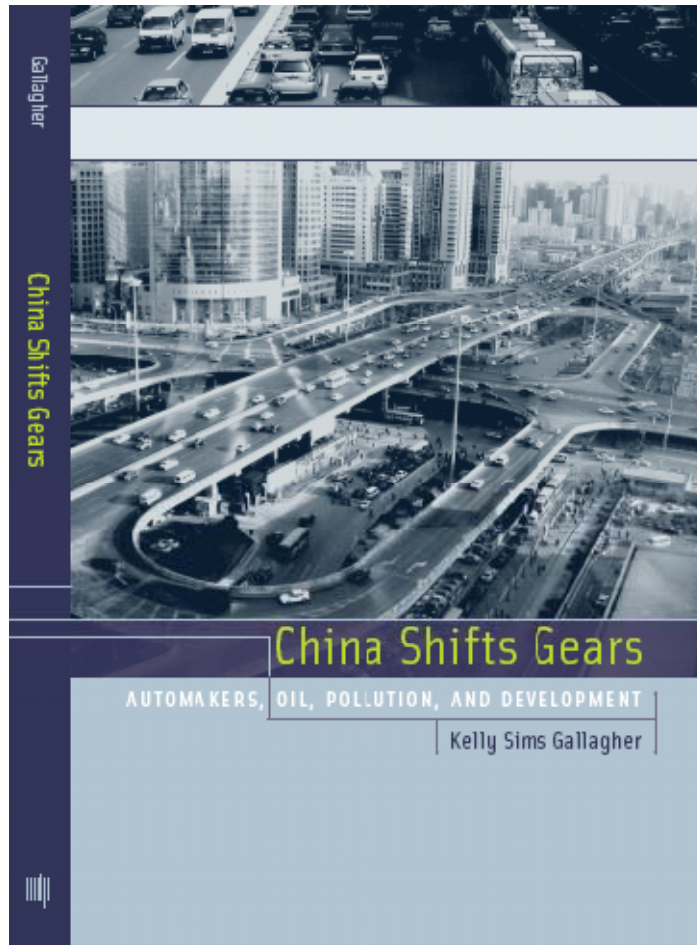
# Hybrid Electric Vehicle Sales—Light Duty Trucks



# Ethanol Use



# Technology Transfer to China: Leapfrogging and Lack of Leapfrogging



- Emission standards and pollution-control technology
- Fuel-efficiency standards and fuel-efficiency technology
- Weak bargaining
- The vicious circle
- Consumer acceptance and the “good enough” phenomenon
- Development goals vs. environment or energy security goals

# Concluding Thoughts

- Alignment of manufacturer and consumer incentives critical
- Fuel-economy standards alone will not be sufficient to meet policy goals, though they are important
- Need packages of complementary policies that all create the same incentives for the development and deployment of cleaner and more efficient vehicle and fuel technologies
- Long-term signal particularly important to setting expectations
- International harmonization is likely to help with all of the above

# Thank You!

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[www.energytechnologypolicy.org](http://www.energytechnologypolicy.org)