



ENERGY TECHNOLOGY INNOVATION POLICY RESEARCH GROUP

# Reducing the U.S. Transportation Sector's Oil Consumption and Greenhouse Gas Emissions

## BOTTOM LINES

- **Harder Than it Looks.** Reducing oil consumption and carbon emissions from transportation is a much greater challenge than conventional wisdom assumes. It will require substantially higher fuel prices, ideally in combination with more stringent regulation.
- **Higher Gasoline Prices Essential.** Reducing carbon dioxide (CO<sup>2</sup>) emissions from the transportation sector 14% below 2005 levels by 2020 may require gas prices greater than \$7/gallon by 2020.
- **Tax Credits Expensive.** While relying on subsidies for electric or hybrid vehicles is politically seductive, it is extremely expensive and an ineffective way to significantly reduce greenhouse gas emissions in the near term.
- **Climate and Economy Not a Zero Sum Game.** Aggressive climate change policy need not bring the economy to a halt. Even under high-fuels-tax, high-carbon price scenarios, losses in annual GDP, relative to business-as-usual, are less than 1%, and the economy is still projected to grow at 2.1-3.7% per year assuming a portion of the revenues collected are recycled to taxpayers.

By W. Ross Morrow, Henry Lee, Kelly Sims Gallagher, and Gustavo Collantes

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Oil security and the threat of climate disruption have focused attention on the transportation sector, which consumes 70% of the oil used in the United States.

This study explores several policy scenarios for reducing oil imports and greenhouse gas emissions from transportation.

1. Business as usual (based on the Department of Energy's 2009 Annual Energy Outlook).
2. An economy-wide CO<sup>2</sup> tax, with prices starting at \$30/t of CO<sup>2</sup> in 2010 and escalating to \$60/t in 2030. (This tax serves as a surrogate for a cap-and-

trade system like that proposed in the pending American Clean Energy and Security Act.) Tax revenue is returned to consumers through income tax reductions.

3. The economy-wide CO<sup>2</sup> tax, plus a strong gasoline and diesel tax. (\$0.50/gal in 2010 and increasing 10% per year, relative to the previous year and in real terms, resulting in a \$3.36/gal tax in 2030.)
4. The economy-wide CO<sup>2</sup> tax, plus improved Corporate Average Fuel Economy (CAFE) standards during 2020-2030, reaching a new standard of 43.7 mpg in 2030.
5. The economy-wide CO<sup>2</sup> tax plus aggressive performance-based tax credits for alternative motor vehicles.
6. The United States adopts all of these policies.

These scenarios were analyzed using the National Energy Modeling System (NEMS), an energy-economic equilibrium model of energy markets in the United States, maintained by the Department of Energy's Energy Information Administration (EIA). As with any modeling exercise, the results rely on the assumptions built into the model and thus should be interpreted as an indication of the direction and magnitude of potential policy impacts rather than an exact prediction.

## RESULTS

Present efforts to keep fuel prices low while simultaneously trying to significantly reduce oil imports and greenhouse gas emissions are inconsistent. Taxing transportation fuels stimulates the greatest reductions in oil consumption and CO<sub>2</sub> emissions and is a necessary complement to strong vehicle efficiency standards. Fuel efficiency standards affect only new vehicles and are subject to the rebound effect, in which some of the efficiency gain is offset by the increased use due to lower operating costs. Higher fuel costs are the only policy option modeled that curtails the growth in vehicle-miles traveled.

An economy-wide carbon price of \$30-\$60/tCO<sub>2</sub> alone would do little to curb emissions from cars, trucks, and the rest of the transportation sector. Instead, most of the emission reductions would occur in the electric utilities – specifically, those that rely heavily on coal. Note that prices in the range of \$30-\$60/t CO<sub>2</sub> are higher than the levels considered in Congress in the summer of 2009.

While increasing CAFE standards will reduce CO<sub>2</sub> emissions, the benefits of this approach take time to accrue and decrease as people increase the number of miles they drive. This phenomenon becomes most pronounced in the 2020-2030 time period as population and incomes rise. Tax credits for hybrid and alternative vehicles are expensive and not particularly effective at reducing CO<sub>2</sub> emissions, at least in the near term. Moreover, artificially increasing the popularity of alternative motor vehicles under

the Corporate Average Fuel Economy (CAFE) standards has the unintended effect of decreasing new conventional vehicle fuel economy. Because of these issues, the combined scenario does not achieve the greatest reductions in CO<sub>2</sub> emissions and oil imports, and is the most expensive scenario in terms of GDP loss relative to business-as-usual.

The macroeconomic impacts of reducing greenhouse gas emissions are small, even with our relatively aggressive policy scenarios. GDP is projected to grow at 2.1-3.7% per year through 2030 under all of our scenarios, with losses in annual GDP, relative to business-as-usual, less than 1% for all scenarios. For the purpose of this report, we assumed that economy-wide CO<sub>2</sub> tax revenue was fully returned to U.S. consumers as reduced income taxes, an assumption that certainly contributes to the low economic impacts. Revenue from the fuel taxes was not recycled directly to consumers, though it could be in reality. Note that the American Clean Energy and Security Act does not recycle the revenues to consumers in the early years.

## INSIGHTS FOR POLICYMAKERS

- Even individual policies that seem radical in the present U.S. political context do not meet targets set by the Obama administration or proposed in the American Clean Energy and Security Act without significant use of offsets. This is a challenge, since there is no agreement on the structure of a workable offset policy.
- A fundamental insight from this study is that if one wishes to reduce U.S. CO<sub>2</sub> emissions or net petroleum imports from the transportation sector during 2010-2030, consumers cannot continue to drive more and more each year. The EIA currently projects that vehicle-miles traveled will grow more than 30% between 2010 and 2030 as a result of the increase in household incomes and population. In this study, higher fuel prices are the mechanism to reduce vehicle-miles traveled. Higher transportation costs are also closely linked to land-use policy and development of mass-transit systems.

- The strengthened Energy Independence and Security Act CAFE standards, or continued increases in new vehicle fuel economy past 2020, are also unlikely to prevent significant growth in U.S. transportation-sector greenhouse gas emissions and oil imports by 2030. These policies will, however, prevent even larger growth from occurring. The reason is that the U.S. economy will continue to grow over this period increasing personal incomes and consumption, including increased vehicle purchases and increased driving.
- The impact of energy and climate policies depends on the underlying world oil prices from now to 2030. If oil prices are \$198 per barrel by 2030, reductions in net oil imports on the order of 5.7 million barrels per day in 2030 are projected for business-as-usual. With high fuels taxes this can be reduced another 1.1 million barrels per day, though gasoline prices are above \$8 per gallon. If, however, the underlying world oil prices are below \$90 per barrel during the next two decades, then none of the policy scenarios modeled achieves the desired targets for annual U.S. CO<sub>2</sub> emissions.

## CONCLUSION

An economy-wide CO<sub>2</sub> price combined with transportation sector-specific policies can reduce total U.S. greenhouse gas emissions below 2005 levels — a significant reduction from business-as-usual projections. However, options now being discussed in Congress cannot by themselves achieve the significant reductions in the transportation sector needed to meet the Obama administration's targets for total U.S. greenhouse gas emissions by 2020. The most effective policy for reducing CO<sub>2</sub> emissions and oil imports from transportation is to spur the development and sale of more efficient vehicles with strict efficiency standards while increasing the cost of driving with strong fuel taxes. Without addressing both, CO<sub>2</sub> emissions from the U.S. transportation sector will continue to grow.

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*Statements and views expressed in this memo are solely those of the authors and do not imply endorsement by Harvard University, the John F. Kennedy School of Government or the Belfer Center for Science and International Affairs.*

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## RELATED RESOURCES

Morrow, W. Ross, Kelly Sims Gallagher, Gustavo Collantes, and Henry Lee. "Analysis of Policies to Reduce Oil Consumption and Greenhouse-Gas Emissions from the U.S. Transportation Sector." *Energy Policy* 38, no. 3 (March 2010): 1305-1320.

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