

Economic, Environmental, and Energy Security Consequences of a National Low Carbon Fuel Standard

The Congress has entertained setting a national standard to regulate the gasoline supply on the basis of carbon content to reduce greenhouse gas emissions and President Obama, a past sponsor of these congressional efforts, signaled his support during the 2008 presidential campaign. An early version of this approach already governs military fuel purchases and several states are taking steps to impose carbon limits on their fuel markets. A critical assessment of its effects on the U.S. economy, national and energy security, as well as its likely environmental effects has not been conducted. Before legislation is drafted and given serious consideration, Congress needs to understand the facts and understand the implication of a legislative mandate.

The Marshall Institute recently completed just such an analysis. We examined the economic implications of the imposition of a national low carbon fuel standard as well as its effects on national and energy security. Environmental and energy security concerns motivate proponents for policies to subsidize and promote low carbon fuel alternatives. If the nation's gasoline supply could have less carbon in it, advocates claim, U.S. emissions of greenhouse gas would fall as would imports of petroleum. Not surprisingly, reality is more complex. Our evaluation of the economic implications of a national standard and the fuel options available to meet it *concludes that there is "little justification" for a low carbon fuel standard and describes concerns about its effectiveness as well as its economic costs.* Our examination of the national security and energy security claims advanced by proponents of the standard *finds that their claims are largely overstated and identifies significant factors that mitigate the alleged contributions of a low carbon fuel standard to security and which may undermine those goals.*

What is a Low Carbon Fuel Standard?

A low carbon fuel standard (LCFS) sets a limit on the greenhouse gas (GHG) emissions allowed from the production and consumption of a transportation fuel. While proposals for an LCFS differ, the essence is to establish measures of life cycle¹ GHGs per unit of energy in fuel and set the standard to reduce these GHGs below those of current petroleum-based fuels. Most proposals have the standard decrease over time.

Often the proposals establish an average life cycle GHG per unit of energy for petroleum-derived fuels as of some particular time, and then specify reductions, such as 10%, that must be achieved by some later time. Before he became president, then-Senator Obama co-sponsored legislation (S. 1324) requiring that motor fuels sold in the U.S. market achieve a 5% reduction in carbon content relative to a 2005-2007 baseline by 2015, and a 10% reduction by 2020. Thus far, federal efforts to impose a national LCFS remain just proposals with the notable exception of a limit on purchases by the federal government. Several states are pushing the concept, creating the possibility of a patchwork of LCFS requirements throughout the country. California is leading the effort. The basic objective of California's proposal is to reduce the average carbon content of fuel sold in California by around 10% by 2020, relative to

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Economics of a National Low Carbon Fuel Standard

By Michael Canes and Edward Murphy

National Security, Energy Security, and a Low Carbon Fuel Standard

By Jeff Kueter, President, George C. Marshall Institute

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its presumed content in 2010, with the reduction gradually phasing in between 2011 and 2020. California is not the only state considering an LCFS. In early 2009, eleven states in the Northeast and Mid-Atlantic region announced plans to create a regional LCFS. In the Midwest, the Minnesota legislature is holding hearings on a bill to establish an LCFS in that state.

There are few viable low carbon alternatives and the likely result of a low carbon fuel standard is an expansion of biofuels. Our review of available alternatives finds that, with the exception of corn-based ethanol, none will be available for commercial consumption in the near-term. Corn-based ethanol is the only alternative fuel not requiring major infrastructure development or introduction of new vehicles. More advanced biofuels are decades away from commercial use and face significant scientific, technical, and commercialization obstacles before they will be available for widespread use.

Economic Effects

In *Economics of a National Low Carbon Fuel Standard* economists Michael Canes and Edward Murphy examine the likely impact of a national low carbon fuel standard and conclude it will be “prohibitively costly” before cheap low carbon fuel alternatives are developed. It is unclear whether there are practically available fuels which also have lifecycle GHGs below those of gasoline produced from crude oil. Considerable controversy surrounds fuels such as corn-based ethanol, where land use and nitrous oxide considerations raise the possibility that lifecycle emissions exceed those of gasoline. Even when

fuels with lifecycle GHGs below those of gasoline are practical and available, the impact of an LCFS will depend greatly on the exact difference in estimated emissions between the two. Yet there is considerable uncertainty surrounding lifecycle GHG emissions for alternative fuels, including those of ethanol.

Among the most notable effects are:

- *The costs of a national LCFS are likely to be very high.* Estimates in the open literature indicate that the costs of reaching a 90% LCFS via use of ethanol would range between \$80 billion and \$760 billion annually—that is, between \$695 and \$6520 per year per U.S. household. Canes and Murphy independently assess these annual costs for a hypothetical LCFS effective in 2020 and derived a similar, although slightly smaller magnitude of \$65.5 billion—equivalent to \$570 per household annually.
- *Because it redistributes income from consumers to the producers of the low carbon fuel, an LCFS would increase federal and state subsidies and cost taxpayers more as well.* For instance, tax revenue losses from ethanol subsidies vary between \$1 billion and \$17 billion among the scenarios we assessed. These losses are in addition to present state and federal subsidies to ethanol, which totaled about \$6 billion in 2006.
- If some other fuel (e.g., electricity) were used to meet an LCFS, the relative costs to fuel purchasers and to taxpayers would depend on what federal or state subsidies are offered to the fuel and what the costs of producing it would be.

- The principal winners under an LCFS are those who are subsidized—namely suppliers of the low carbon fuel, and raw material suppliers and processors of that fuel.
- Among the principal losers are consumers who will have to pay higher costs for transportation fuels while realizing little environmental or other benefits.
- To the extent ethanol is used to meet an LCFS, consumers of food products also are adversely affected. The diversion of land away from food production and towards fuel production will drive up the price of food. According to media sources, an unpublished World Bank study indicates that rising biofuel demand accounts for 75% of the rise in food prices over the past year.
- *An LCFS will cost motorists.* Canes and Murphy estimate that the 10% reduction in fuel GHG emissions mandated by the LCFS would have the following costs:
 - The price of ethanol would increase by 46%—from \$2.01 per gallon to \$2.93 per gallon due to the rise in U.S. ethanol demand.
 - The price of gasoline (both conventional gasoline and gasoline blended with 10% ethanol) would increase by \$0.61 per gallon from DOE's projected \$2.35 per gallon to reflect the higher price of ethanol used in E85 and E10, and to compensate E85 users for their lower MPG at the new, higher price of ethanol.
 - The net savings in GHG emissions, given the assumption of corn ethanol's 25% GHG savings relative to gasoline, would be 142 million metric tons per year—equal to 7% of transportation emissions and 2.2% of total projected U.S. GHG emissions in 2015.
 - The per ton cost of the 142 million metric ton reduction is \$457, which is enormous

compared to the costs of other possible reductions.

A state LCFS is even less effective than a national version. Canes and Murphy look at the impact of an LCFS on California and Minnesota. California's unique fuel market results in high costs likely with little GHG reduction. In Minnesota, ready access to ethanol means there will be a reshuffling, with reduced gasoline consumption and increased ethanol consumption, but consumers would see higher prices for fuel.

Environmental Effectiveness

A principal motivation for a national LCFS is attaining the environmental goal of reducing GHG emissions from the nation's fuel supply. Canes and Murphy consider these claims as does *National Security, Energy Security, and a Low Carbon Fuel Standard*, prepared by Jeff Kueter. Both conclude the environmental outcomes from an LCFS are overstated, tempered by the realities of trends in the demand for transportation fuel, offsetting effects on the national and international market, and the environmental implications of the likely alternatives.

The studies note:

- Consumption trends of petroleum for transportation worldwide are driven by the expanding automobile fleets in the developing world. The International Energy Agency recently concluded that global demand for oil will jump from 85 million barrels of petroleum products per day (MMbd) in 2007 to 106 MMbd in 2030 and “all the increase in world oil demand comes from non-OECD countries,” paced by India and China, who will have growth rates above 3.5% per year on average. *Regardless of actions taken by the United States through an LCFS or otherwise, world carbon dioxide emissions will be significantly higher in the decades ahead.*
- *The cost per ton of carbon removed by an LCFS is many times the estimated costs*

imposed by GHGs and also many times those of other measures that would reduce these gases. Costs per ton of reduction from an LCFS range from around \$300 per ton of carbon to over \$2200 per ton. For comparison, estimates of the damages due to GHGs are \$16 per ton of carbon with a 95% probability that the cost does not exceed \$62 per ton.

- Overall, under an LCFS it is likely that GHG emissions will fall in the gasoline market and rise in the ethanol market. The net effect depends on supply elasticities for the two fuels. The lower the supply elasticity of gasoline and the higher that of ethanol, the more likely that worldwide GHG emissions increase even if there is a decrease within the U.S. But even if the overall result is a net worldwide decrease, it is smaller than in the U.S. alone. *In short, U.S. consumers and taxpayers are asked to bear a burden that would have very little payoff, in part because of offsetting actions abroad.*
- Low-carbon alternatives have their own environmental concerns. Expansion of corn ethanol, the most ready replacement for petroleum gasoline, will have harmful effects on water and soil quality as a result of changing crop rotation practices and more intensive use of fertilizers to achieve the higher yields required to meet increased demand. The long-run environmental effects of cellulosic ethanol are not yet fully appreciated given its immaturity as a commercial undertaking.
- An LCFS imposed within the U.S. cannot be analyzed in isolation. There will be offsetting effects elsewhere, reducing whatever decrease in GHGs might be achieved in this country. *Decreasing U.S. demand for conventional gasoline and petroleum will reduce its price and increase demand for those products elsewhere in the world. The resulting consumption will offset reductions in GHG emissions expected from a U.S. LCFS.*

- A further response to the LCFS will be changing patterns of trade for North American petroleum products. *If confronted with an effective tax from a U.S.-imposed LCFS, Canadian oil sands producers will begin shipping crude to the Far East, thereby increasing GHG emissions generated by shipping it across the Pacific Ocean.*
- So long as the Canadians remain committed to producing and selling the oil sands crude and there is demand for it on the world market, the greenhouse gas contributions associated with its production will continue regardless of U.S. policy.

National and Energy Security Implications

Proponents of the LCFS also claim it will encourage the development and use of new kinds of transportation fuels and displace imported petroleum as a result. Reducing imports will improve U.S. national and energy security by decreasing dependence on volatile regions and hostile governments, the argument asserts. Interconnected world energy markets make it unlikely that the U.S. will significantly reduce its vulnerability to oil price and supply shocks. Furthermore, as a result of its diverse national interests in the Middle East, whose instability is the most commonly cited as justification for reducing oil imports, the U.S. will remain engaged in this volatile region for years to come. By placing barriers to the use of Canadian oil sands or further development of its own shale reserves, an LCFS may actually undermine U.S. energy security by limiting access to large, secure and available sources of energy.

Among the specific findings are:

- *The U.S. benefits from a diverse world market for petroleum.* Eleven of the top 15 suppliers to the United States are found outside of the Persian Gulf region. The changing share in the source of U.S. imports by region since the 1960s shows that the Persian Gulf states currently provide less

than 20% of U.S. imports and have never accounted for more than 30% of imports. At present Canada is the largest foreign supplier of oil imports to the U.S. and Mexico is the third largest. In the aggregate, the Department of Energy projects U.S. crude oil imports to decline 1.5% between 2007-2030. The International Energy Agency's forecasts for 2030 also project declining import dependence for the United States.

- A sharp rise in oil prices that erodes the economic health of Europe or China will harm the U.S. economy.
- Other important national security and foreign policy goals at stake in the Middle East suggest U.S. engagement in that region will remain high regardless of imports. Concerns about Israel, the Middle East peace process, terrorism, proliferation of missile technology and weapons of mass destruction, and maintenance of key military bases and facilities all remain important U.S. national security concerns. *Continued engagement in the Middle East will be the norm for the U.S. for years to come, regardless of oil import patterns.*
- *An LCFS weakens U.S. energy security by restricting U.S. use of oil sands from Canada* because of their high carbon life-cycle. Reserves of Canadian oil sands are equivalent to nearly one-quarter of projected U.S. transportation fuel needs in 2030. The U.S. consumes virtually all of Canada's petroleum exports today. An LCFS would force those exports other parts of the world, most likely China.
- *An LCFS also weakens energy security by further deterring exploitation of the oil shale resources* found in the western United States. Potentially recoverable reserves are greater than Saudi Arabia's oil reserves. Under an LCFS there is little incentive to invest in or develop the technologies needed to effectively remove and process the shale. The United

States possesses shale deposits estimated to hold enough oil to meet current U.S. import levels for the next 110 years.

- Shifting to ethanol as a principal transportation fuel will have significant effects on agriculture markets, including rising food prices, structural shifts in commodity prices, changed demand and supply for inputs, altering global patterns of trade, and shifting land use patterns. Research suggests biofuel production may push global corn prices up by 41% by 2020, oilseeds, including soybeans, rapeseeds, and sunflower seeds, are projected to increase 76% by 2020, and wheat prices by 30% by 2020, with deleterious effects on food security worldwide.
- The Congress enacted the first national low carbon fuel standard governing federal agencies, particularly the Department of Defense, in 2007. By restricting government purchases of fuel to only those that are "less than or equal to such emissions from the equivalent conventional fuel produced from conventional petroleum sources," the Congress limited the role the federal government can play in aiding the development of alternative fuels that otherwise meet military requirements and raises the cost of fuel purchases.

Conclusion

Champions of alternative fuel sources that remain economically uncompetitive with fossil fuels without government support have long argued that the externalities of petroleum fuels were very large and so negative that a full accounting would result in a positive assessment in favor of alternatives. The Low Carbon Fuel Standard is an attempt to account for those externalities and promote the emergence of alternatives to petroleum transportation fuel. Our works shows the LCFS to be prohibitively costly, a highly inefficient means to reduce GHG emissions, likely to produce reactions in the global market that offset its intended environmental benefits, and

weakens U.S. energy security by throwing barriers in the way of the exploitation of readily available and secure sources of energy. Simply stated, a national LCFS is bad public policy.

Note

1. The term “life cycle greenhouse gases” refers to all such gases created or emit-

ted in the production, distribution and use of a given fuel. In the case of a corn ethanol, for example, it would include greenhouse gases created in planting, fertilizing, watering, harvesting, transporting, storing and processing the corn, as well as gases emitted when the ethanol was burned.