RENEWABLE FUELS ASSOCIATION

Analysis of CBO Study:
Using Biofuel Tax Credits to Achieve Energy and Environmental Policy Goals

The Congressional Budget Office (CBO) on July 14 published a report examining the ability of biofuel tax credits to achieve energy and environmental policy goals. The scope of the report was narrowly focused on analyzing the impact of biofuel tax credits on two major policy goals: 1.) reduction of petroleum consumption, and 2.) reduction of greenhouse gas emissions. Other biofuels benefits were not examined in detail, though CBO acknowledges that "…increased production of ethanol has probably resulted in some reduction in the price of gasoline, an increase in farm incomes, and some impact on the quality of the nation's air and water resources."

The CBO report confirmed that biofuels like ethanol have indeed reduced both petroleum consumption and GHG emissions. However, using highly pessimistic and debatable assumptions, CBO suggests those benefits have come at a significant cost to taxpayers. This analysis examines the assumptions used by CBO in calculating the costs to taxpayers of displacing petroleum fuels and reducing GHG emissions with ethanol. We compare key CBO assumptions to more reasonable and accepted assumptions and examine the sensitivity of CBO's results to changes in those key parameters. *We find that CBO likely overestimated the cost to taxpayers of displacing petroleum with ethanol by a factor of 3-4 and overestimated the cost to taxpayers of reducing GHG emissions by a factor of 6-8.*

<u>Cost to Taxpayers of Displacing Petroleum Fuels Through Use of the Ethanol Tax Credit</u>
CBO suggests the cost to taxpayers to displace one gallon of petroleum with an energy-equivalent amount of ethanol (1.5 gallons) is $1.78. This calculation hinges on two key assumptions: 1.) the value of the tax credit adjusted for energy content, and 2.) the share of total ethanol consumption attributable to the tax credit.

CBO notes that ethanol has roughly 30% lower energy content per gallon than petroleum. However, by adjusting the value of the tax credit based solely on energy content, CBO is assuming ethanol has value *only* as a BTU replacement for gasoline. This ignores the fact that ethanol has significant value as an additive to gasoline. Ethanol is the only viable oxygenate on the market today for use in reformulated gasoline, and it has considerable value as a source of octane. Oil refiners and blenders use ethanol to upgrade otherwise unmarketable lower octane sources of gasoline (called sub-octane) to the octane level needed to meet specifications for regular grade. This practice reduces the refiner's cost of producing gasoline. Refiners also use ethanol to upgrade regular grade gasoline to mid and premium grades. The "additive value" of ethanol has been estimated at $0.25 per gallon and higher.[1] If ethanol were not available to refiners, demand for certain additives likely would be unmet or would have to be met with other higher-cost sources. Thus, it is not legitimate to simply adjust the value of the tax credit by its energy content, which implies that *all* ethanol only has value as BTU replacement for gasoline.

It is true that some portion of ethanol consumption is used exclusively for BTU replacement or volume extension, but a large share of ethanol consumption is due to its unique additive properties. Therefore, it would have been more appropriate for CBO to adjust the tax credit for energy content *only for the volume of ethanol that is used strictly as BTU replacement*. We conservatively assume that the primary use for 60% of 2009 U.S. ethanol production was as an oxygen or octane additive,

[1] Hurt, Tyner & Doering. "Economics of Ethanol." (ID-339) Purdue University Cooperative Extension Service (2007).

meaning the primary use for remaining 40% was as BTU replacement.[2] Thus, the energy content adjustment in our analysis is applied to 40% of 2009 production. This results in a weighted average adjusted tax credit value of $0.54, compared to CBO's estimate of $0.67.

CBO rightly recognizes that very little petroleum is used to produce ethanol. Yet, it uses an overly conservative estimate of the amount of petroleum required. The report states that production of 125,000 BTU of ethanol "…requires close to 11,000 Btus of energy from petroleum fuels." In other words, only 1 BTU of petroleum energy is needed to produce 11.4 BTUs of ethanol energy, according to CBO. A widely cited report by authors at the University of California at Berkeley found the ethanol-to-petroleum input/output ratio to be 1:16.7, meaning only 7,500 BTUs of petroleum are required to produce 125,000 BTU of ethanol.[3]

The second key assumption affecting CBO's estimate of the cost to taxpayers of displacing petroleum fuels with ethanol is the share of total ethanol consumption attributable to the tax credit. CBO estimates only 32% of current consumption is attributable to the tax credit, but readily acknowledges that the estimate may be understated and that the results are highly sensitive to this assumption. CBO writes, "…32 percent might be too low..." because previous tax credits built a strong and lasting foundation for the ethanol industry. Indeed, a strong argument can be made that today's ethanol industry would be a fraction of its current size *or may not exist at all* if not for the federal tax credits and incentives that gave the industry a strong foothold in the early 1980s and fostered steady growth in subsequent decades.

Additionally, as CBO points out, the Renewable Fuels Standard (RFS) has not ever been binding and RIN credits have had negligible value. This is further evidence that while the RFS has provided investment certainty, tax credits have continued to be a main driver of growth in ethanol production and consumption. Further, 8 billion gallons of ethanol capacity (75% of 2009 production) was already in production by December 2007, when the Energy Independence and Security Act (EISA) containing the expanded RFS was signed into law. Thus, we believe it is appropriate to assume 75-100% of current consumption is attributable to past and present tax credits.

Elements of Table 4 from CBO's study are compared to the more reasonable assumptions discussed in this paper in Table 1 below.

Table 1. *CBO Assumptions on Petroleum Displacement Costs Compared to Alternative Assumptions*

	CBO Report	Alternative Assumptions
Federal Tax Credit	$0.45	$0.45
Adjusted Tax Credit (per 125,000 BTU)	$0.67	$0.54
Change in Excise Tax Receipts	$(0.09)	$(0.09)
Net Cost of Ethanol Tax Credit	$0.58	$0.45
Share of Total Ethanol Consumption Attributable to Tax Credit	32%	75-100%
Cost to Taxpayers of Displacing 1 Gallon Petroleum with 1.5 Gallons Ethanol	**$1.78**	**$0.45-$0.61**

[2] Assumes 6.5 billion gallons primarily used for oxygenation of RFG and octane enhancement. It is not possible to estimate the amount of sub-octane gasoline that is upgraded by blending with ethanol given available sources, meaning our estimate may be conservative.
[3] Farrell et al. (2006). "Ethanol Can Contribute to Energy and Environmental Goals." *Science*. Vol. 311: 507-509.

The results obtained through using more reasonable assumptions about ethanol's utility in the fuel market (i.e., additive value vs. BTU replacement) and the share of ethanol consumption attributable to past and present tax incentives are equivalent to just 26-34% of the CBO estimate. Notably, based on our assumptions, we find that the cost of displacing one gallon of petroleum with 1.5 gallons of ethanol is likely roughly equivalent to the value of the $0.45/gallon tax credit itself.

Cost to Taxpayers of Reducing GHG Emissions Through Use of the Ethanol Tax Credit

CBO estimated that the cost to taxpayers of reducing GHG emissions through the use of ethanol is $754 per metric ton of GHG reduced. This calculation stems from two key assumptions: 1.) the cost to taxpayers of displacing petroleum with ethanol (as discussed in the previous section), and 2.) the units of petroleum that would need to be displaced to reduce GHG emissions by one metric ton.

CBO's review of the literature found that the use of ethanol reduces GHG emissions relative to gasoline. Unfortunately, CBO adopted an overly conservative estimate of the magnitude of GHG reductions resulting from substituting corn ethanol for gasoline. CBO assumes corn ethanol reduced GHG emissions by 20% compared to petroleum, citing a 2007 study by Argonne National Laboratory based on the GREET model. It is important to note that the GREET model used by Argonne is currently in the process of being updated to include more recent data that better reflects current industry practices.[4] Once completed, the updates to GREET are likely to show that average corn ethanol reduces GHGs by approximately 40% compared to gasoline. This result would be more consistent with a number of other recent ethanol lifecycle analysis studies that have found corn ethanol average GHG reductions in the range of 35-50%.[5] Further, lifecycle analysis conducted recently by U.S. EPA for the RFS final rule showed that corn ethanol reduces GHGs by 50%, when highly uncertain land use change emissions are not included. Therefore, it would have been more appropriate for CBO to assume corn ethanol reduces GHGs by 40%.

Elements of Table 5 of the CBO study are recreated in Table 2 below and compared to more reasonable assumptions on GHG reductions resulting from corn ethanol use.

Table 2. *CBO Report Assumptions on Costs for GHG Reductions Compared to Alternative Assumptions*

	CBO Report	Alternative Assumptions
Cost to Taxpayers of Displacing Petroleum with Ethanol	$1.78	$0.45-0.61
GHG reduction compared to gasoline per 125,000 BTU of ethanol consumed	2.4 kg CO2e. (20%)	4.8 kg CO2e. (40%)
Units of petroleum fuel (@125,000 BTU) that would need to be displaced to reduce GHG emissions by 1 metric ton	424	208
Cost to Taxpayers of Reducing GHG Emissions by 1 metric ton through Ethanol Tax Credit	**$754**	**$94-$127**

[4] The update to GREET that is currently under way will integrate data published by Mueller, Steffen. See "2008 National Dry Mill Corn Ethanol Survey", Biotechnology Letters, 10.1007 (2010)

[5] See for example: Liska, A.J., et al. (2009). Improvements in Life Cycle Energy Efficiency and Greenhouse Gas Emissions of Corn-Ethanol. *Journal of Industrial Ecology*. 13(1): 58-74.; Mueller, S. (2008). *The Global Warming and Land Use Impact of Corn Ethanol Produced at the Illinois River Energy Center*. University of Illinois-Chicago; and International Energy Agency (O'Connor, D.) (2009). *An examination of the potential for improving carbon/energy balance of bioethanol.* IEA Task 39 Report T39-TR1, 72 pp.

The result of using more reasonable assumptions on the GHG reductions associated with using corn ethanol is that the cost to taxpayers of reducing one ton of GHG emissions is just 13-17% of the CBO estimate. Incidentally, the range of $94-$127 per metric ton of reduced GHG emissions is similar to projected abatement costs and the estimated value of avoided carbon emissions in a number of carbon cap-and-trade analyses (though, as CBO notes, these costs are not directly comparable).

Context is Key

Any examination of the cost to taxpayers of using certain technologies to achieve energy and environmental policy goals must include proper context and comparisons to other options, including "business as usual" (status quo) scenarios. CBO failed to compare the tax incentives available to biofuels to the myriad of tax breaks and other government support that is afforded petroleum. Specifically, the cost to taxpayers of the gallon of gasoline that is replaced by ethanol should have presented for context and comparison. CBO's report does not acknowledge that the tax credits and other assistance provided to petroleum producers does absolutely nothing to reduce GHG emissions or decrease the nation's consumption of oil (in fact, it could be argued that some programs, such as tax credits for deep-water drilling and tar sands extraction, actually use taxpayer dollars to *increase* GHG emissions).

Currently, no commercial-scale options other than biofuels exist to reduce U.S. petroleum consumption and GHG emissions from the transportation sector. Had CBO conducted a fair comparison of biofuel tax provisions to the tax benefits and other government support provided to oil producers, there would have been no question that continued investment in biofuels is prudent if the nation truly wishes to reduce oil consumption and GHG emissions.