

United States Biofuel Policies: Overview and Discussion¹

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Introduction

Governments at different levels in the United States have introduced various support policies to promote alternative and renewable energies. These policies aim to reduce greenhouse gas emissions and to improve energy security (Khanna, Dhungana, and Clifton-Brown 2008). Major policy initiatives include biofuel mandates and tax credits. It is widely expected that these policies will significantly affect both the environment and the economy of the United States. For example, biofuel production has effectively changed the role of agriculture by creating a linkage between the agricultural and energy sectors. Economic research indicates that the biofuel mandate has significantly affected agricultural commodity prices, which has caused a structural shift in land use and crop production (Wu, Guan, and Myers 2011; Wu et al. 2013). Given the broad environmental and economic implications of biofuel policies, it is of interest to have a more in-depth understanding of the policies, their evolution, and their potential effects. This article reviews and discusses US biofuel policies.

Biofuel Policies

Evolution in Legislation

According to the US Department of Energy, Energy Information Administration (DOE/EIA), domestic renewable energy use grew by 32% from 2006 to 2012 and accounted for about 9% of total primary energy consumption in 2012



(EIA 2013). These advances in renewable energy use were the result of a long history of policy development dating back to 1970 when the Clean Air Act of 1970 created initiatives to reduce pollutants from mobile sources. Also, the 1973 energy crisis arising from the Arab oil embargo illustrated America's dependence on imported oil, directly influencing subsequent legislation regarding fuel economy standards and the support of alternative fuels. As a result, the Energy Policy and Conservation Act of 1975 regulated Corporate Average Fuel Economy (CAFE) standards and required the dissemination of fuel economy information to consumers. In 1988, the Alternative Motor Fuels Act established the CAFE credits for automakers.

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The US government's support of alternative fuels started with the Energy Tax Act of 1978, which provided a tax exemption of US\$0.40 per gallon of ethanol (US\$0.04 gasoline excise tax for gas mixed with 10% ethanol). The tax exemption was later increased to US\$0.50 per gallon of ethanol in the Surface Transportation Assistance Act of 1982, and to US\$0.60 in the Tax Reform Act of 1984. In 1990, the Omnibus Budget Reconciliation Act extended the ethanol tax exemption through 2000 (but decreased it to US\$0.54 per gallon). It was again extended through 2007 (reduced to US\$0.51 per gallon by 2005) by the 1998 Transportation Efficiency Act of the Twenty-First Century. The 2004 Jobs Creation Act extended the exemption to 2010 but changed it from an excise tax exemption to a blender tax credit. The tax credit was later decreased to US\$0.45 per gallon.

Besides tax policy, the Energy Policy Act of 1992 introduced a comprehensive policy aimed at reducing dependence on imported oil and improving air quality. It addressed alternative fuels, renewable energy, and energy efficiency. The Energy Policy Act of 2005 called for tax incentives for alternative fuels as well as other policy initiatives. It established the Renewable Fuel Standards (RFS) aimed at increasing ethanol production from 4 billion gallons in 2006 to 7.5 billion gallons by 2012 (Schnepf and Yacobucci 2013). The Energy Independence and Security Act (EISA) of 2007 greatly expanded the biofuel blending mandates, requiring transportation fuels sold in the United States to contain a minimum of 36 billion gallons of renewable fuels by 2022. This act covered four types of biofuels: renewable fuels (including corn-based ethanol), advanced biofuels, biomass-based diesel, and cellulosic biofuels. The 2007 EISA encouraged research and development of the next generation of biofuels, such as cellulosic fuels. The cellulosic biofuels mandate was set at 16.9 billion gallons by 2022. The expanded RFS created a market for biofuels by requiring biofuel blenders to have minimum volumes of biofuels in their annual transportation fuel sales. In addition, the biofuels under each category are required to achieve certain minimum thresholds of lifecycle greenhouse-gas-emission performance.

Apart from these legislative efforts, market factors also played an important role in the production of biofuels. Before the 2008/09 recession, energy prices remained high for an extended period of time, and crude oil prices reached a record of US\$140 per barrel, which effectively accelerated the pace of alternative energies development. Due to government support and these market factors, ethanol production in the United States reached 13.3 billion gallons at 211 ethanol refineries in 2012. The growth in the US

ethanol industry was estimated to have contributed approximately US\$43.4 billion to the Gross Domestic Product and US\$29.9 billion to household income in 2012 (REA 2012; Urbanchuk 2013).

Administration of the Renewable Fuel Standards

The Environmental Protection Agency (EPA) currently administers the RFS to impose an annual minimum volume of biofuels based on the estimated total volume of transportation fuels. Since the RFS indirectly subsidizes capital investment in the construction of biofuels plants, the RFS is expected to continue to stimulate growth in the biofuels industry. Over the long term, this mandate will likely be a more significant policy measure than tax incentives in promoting the use of biofuels (Schnepf and Yacobucci 2013).

To determine the annual blending requirement for renewable fuels, the EPA first estimates the total volume of fuel that is expected to be used for transportation during the upcoming year (EPA 2007), and then computes the blending requirement to satisfy the total amount of renewable fuels mandated to be used in a given year. The EPA has the right to waive the RFS requirements if the biofuel mandate negatively affects the US economy or environment. As part of the biofuel mandate, all companies blending biofuels must satisfy the renewable volume obligation (RVO) which specifies the EPA's standards for the four biofuel categories. Companies blending biofuels are required to include a quantity of biofuels equal to a percentage of their total annual volume of fuel sales. To monitor the blenders' RVO, the EPA issues unique renewable identification numbers (RINs) for each renewable fuel. In effect, each blender must have enough RINs to show that they meet the four mandated standards. The RINs are transferrable, so that the blender can sell its RINs to another blender who cannot meet the minimum mandate.

Discussion

There are different opinions regarding biofuel policy and the associated RFS practices. Those who support the policy believe that the RFS can decrease the refineries' investment risk in renewable biofuels by ensuring their demand (Schnepf and Yacobucci 2013). Renewable fuel standards are also expected to improve US energy security by decreasing the country's reliance on imported fossil fuels (EIA 2012). In addition, renewable biofuels have significant economic benefits for both agricultural and rural sectors because they provide an additional source of farm income

(Urbanchuk 2013). However, critics of the RFS argue that expanding the mandate has negative effects on other areas, including petroleum production, overall pollutant and greenhouse gas emissions, agricultural commodity and food markets, land use patterns, soil and water quality, conservation, etc. (Abbott, Hurt, and Tyner 2011; Schnepf and Yacobucci 2013). In particular, many studies conclude that ethanol is technically, economically, and environmentally an inefficient form of energy (Pimentel 2003; Schmitz, Moss, and Schmitz 2007; Koplow and Steenblik 2008; Searchinger et al. 2008).

Along with these potential negative effects of ethanol policy, many welfare analyses also suggest that the benefits of an ethanol policy could be less than its costs. That is, the policy measures can distort markets and generate economic “dead-weight” losses. This means that the benefits may be offset by the large costs that the government and consumers will pay as a result of implementation (Tyner and Qear 2006; Gardner and Tyner 2007; Schmitz, Moss, and Schmitz 2007; Babcock 2008; Hahn and Cecot 2008; Taheripour, 2008; Du, Hayes, and Mallory 2009). Moreover, the expansion of biofuels affects the agricultural sector because corn is the main feedstock for ethanol production. The ethanol boom has caused food to become more expensive. Higher food costs result from a structural change in the demand for corn that has pushed up corn prices, and wheat and soybean prices along with them, as a result of the spillover effects due to the substitutability between these food crops.

In essence, biofuel demand has changed the role of agriculture by altering agricultural commodity market prices and agricultural land use. Wu et al. (2013) indicate that corn expansion could distort the production of other crops so that land formerly used for food crops will be used for more lucrative fuel crops instead. Another effect of biofuel demand has been that lands enrolled in the Conservation Reserve Program (CRP) have decreased rapidly (Oh and Guan 2015). These less productive and environmentally sensitive lands are being returned to agricultural production because the agricultural returns for biofuel crops are higher than the incentives the CRP can offer. Thus, many biofuel opponents support investment in domestic oil-and-gas production over increasing biofuel use. They argue that increasing domestic oil-and-gas production may be cheaper and will decrease crude-oil prices by expanding supply. Although clean energy alternatives can reduce the dependency on fossil fuels in the long run, decreased crude-oil prices may provide greater economic benefit.

Conclusions

The US government has made multiple efforts to promote renewable fuels as alternative sources of energy. As biofuel policies have evolved from subsidization to mandate, the production of biofuels has dramatically increased. The expansion of the mandate may contribute to reducing greenhouse gas emissions. However, the public should also be aware that biofuels may be technically, economically, and environmentally inefficient. Further research is needed for an accurate scientific assessment of biofuel policies. We recommend a comprehensive systems approach be used to study all aspects related to biofuel production and consumption, with particular emphasis on the associated environmental, climate, economic, and land-use effects.

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