

**Crystal Eth: America's Crippling  
Addiction to Taxpayer-Financed Ethanol**

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## I. Introduction

In 2011, rising oil prices and global unrest over escalating food prices highlighted the public policy questions surrounding government promotion of corn-based ethanol as a transportation fuel. Corn-based ethanol is unlikely to significantly reduce America's dependence on imported oil, has a negligible ability to reduce greenhouse gas emissions and contributes to environmental degradation in coastal waters. The public policies that promote or encourage ethanol production have significant impacts on America's future energy use, efforts to curb global warming and the global effort to reduce hunger. These transportation biofuel incentives will be tied to corn-based ethanol for the near future, as only corn-based ethanol is currently commercially viable in the United States.

This paper explores how the growth of corporate consolidation in the corn-based ethanol sector has been an unintended result of America's renewable transportation fuel politics, policies and subsidies. First, the paper examines the significant political contributions and lobbying efforts of some of the largest corporate ethanol refiners to garner ever-larger subsidies. While far from an exhaustive study of all contributions, these large firms provide case studies of corporate efforts to influence legislation and policy. Second, the paper estimates that ethanol refiners have received at least \$22.8 billion in total government financial support between 1999 and 2008. This includes the \$16.7 billion in the "blenders" tax credit, a \$3.6 billion in savings from buying artificially cheap corn, \$2 billion in effective subsidy from the first two years of the renewable fuel standard as well as at

least \$500 million in support from state governments. Third, the paper analyzes the negative effects of a rapidly consolidating ethanol refinery market in the hands a few large corporate operators. Last, the paper outlines key policy alternatives to corn-based ethanol like cellulosic ethanol and algae-based biodiesel, which could be more efficient, environmentally friendly and financially viable than corn-based ethanol. The paper examines the current level of government support for these technologies and whether more investment in these alternatives may be warranted.

Many of the subsidies provided by state and federal policy makers for ethanol production may not have had the intended effects of energy independence and the revival of America's rural areas. In fact, as the 2009 economic collapse undermined the ethanol industry, it sought a federal bailout. After decades of government support, in 2009 the ethanol industry requested \$1 billion in short-term credit and as much as \$50 billion in loan guarantees to expand the number of refineries in the United States.<sup>1</sup> Alternative biofuels may provide a better opportunity to accomplish these goals at a lower economic and environmental cost.

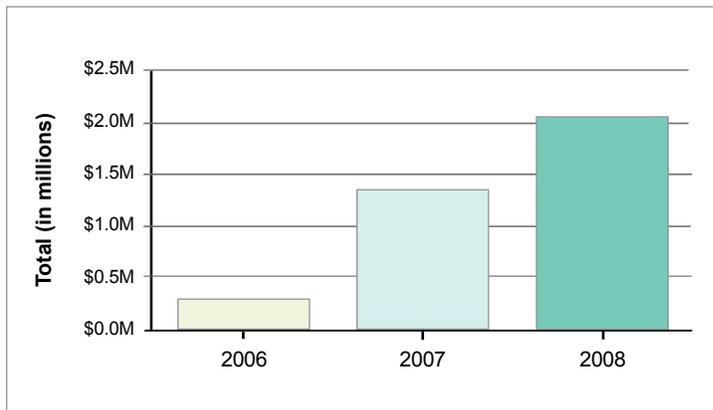
## **II. Power Politics: Corn Ethanol Campaign Cash and Lobbying Lucre**

Major refiners of corn-based ethanol have benefited from both the low cost of corn and the production subsidies for ethanol. For nearly forty years, the largest agribusinesses promoting corn-based ethanol have plied the Washington corridors of power in search of support for the industry. One early proponent of corn-based ethanol and government support for the industry was Archer Daniels Midland (ADM).<sup>2</sup> Dwayne Andreas was Chief Executive Officer of ADM from 1971 until 1999, and saw major changes in of the ethanol market through the 1980's and 1990's.<sup>3</sup> He contributed to the campaigns of Presidents George H. W. Bush, Clinton, and Carter, past presidential candidates Bob Dole, Michael Dukakis, Jack Kemp, and Jesse Jackson, and had close ties to congressional leaders like former Speaker of the House Tip O'Neill.<sup>4</sup> It is not debatable that he has friends in high places. His critics argue that his access has helped ADM secure significant taxpayer-financed support for the company's ethanol refineries. In fact, a study by the Cato Institute in 1997 revealed that ADM had received over \$10 billion in subsidies between 1980 and 1997, and each dollar of profit earned by ADM cost each American taxpayer \$30.<sup>5</sup>

National political candidates who fail to endorse ethanol do so at their peril because of the importance of corn-producing Iowa in the presidential primary process. During the early stages of the 2008 presidential campaign, each candidate who campaigned in Iowa praised ethanol and biofuels as practical energy alternatives to oil, except John McCain.<sup>6</sup> Senator McCain suffered during the Iowa caucuses for sticking to this position. During his primary campaign McCain compared ethanol subsidies to pork barrel spending and earmarks.<sup>7</sup> After winning the Republican primary, the presidential hopeful switched to supporting ethanol in his campaign speeches and rhetoric.<sup>8</sup> Perhaps McCain softened his ethanol critique to compete in the corn producing swing states of Indiana, Iowa, and Missouri. While his 2008 bout was unsuccessful, McCain's switch in rhetoric remains a good example of the political pressure to promote ethanol.

ADM's political action committee (PAC) and executives have contributed over \$8.2 million to political campaigns and soft money from 1990 to 2008, according to the Center for Responsive Politics (CRP). Although ADM generally supported Republicans from farming states, it gave generously to Democrats as well, with about

**Figure 1:** Annual Federal Lobbying by Archer Daniels Midland in Dollars. Data from Center for Responsive Politics.



\$4.6 million to the Republicans and \$3.6 million to the Democrats.<sup>9</sup> ADM's campaign contributions more than doubled from \$163,850 in the 2006 election cycle to over \$337,600 in the 2008 election cycle.<sup>10</sup> This, however, does not tell the complete story. Throughout these years, ADM has doled out campaign cash through agricultural trade groups — like the Corn Refiners Association, the Renewable Fuels Association, and the National Oilseed Processors Association — so they have been able to wield substantial influence without leaving fingerprints.<sup>11</sup>

ADM's affiliation with the Renewable Fuels Association brought them under fire in 2006 when the watchdog group Public Citizen revealed a \$1.2 million discrepancy in unreported third-party lobbying efforts since 1999.<sup>12</sup> ADM proclaimed its innocence but "conceded that it has begun an expanded presence in Washington and [is] taking incremental steps toward increased government relations activities."<sup>13</sup> It did not take long for these incremental steps to grow by leaps and bounds. ADM significantly increased its lobbying expenditures from 2006 to 2008.<sup>14</sup> According to the CRP, ADM's lobbying expenditures nearly quadrupled from \$300,000 in 2006<sup>15</sup> to over \$1.3 million in 2007.<sup>16</sup> In 2008, ADM again increased its lobbying budget by 54 percent to just over \$2 million.<sup>17</sup>

ADM is not alone in spending money in an attempt to gain political influence for the ethanol industry. Other ethanol refiners have significantly ramped up their campaign contributions and lobbying efforts. The third largest ethanol refining company in 2010 by volume, Poet Energy, increased its spending on lobbying over five-fold, from \$120,000 in 2006 to more than \$690,000 in 2009.<sup>18</sup> Valero Energy, the second largest ethanol company in 2010, has spent more than \$2.6 million in lobbying efforts between 2006 and 2009.<sup>19</sup> Additionally, Valero's PAC contributed more than \$2.5 million to campaigns during the 2008 election cycle alone.<sup>20</sup> Another large refiner, Verasun also spent more than \$400,000 in lobbying from 2005 until its bankruptcy in 2008.<sup>21</sup> These political donations and lobbying efforts have helped enact, protect and expand government support for corn-based ethanol.

### III. Taxpayer-Financed Fuel's Gold: Subsidizing the Corn Ethanol Industry

The federal and state governments provide significant policy and tax incentives to promote corn-based ethanol. Between 1999 and 2008, these total supports to the corn-based ethanol industry amounted to at least \$22.875 billion dollars. Most analysts believe the ethanol refining industry would not survive without the subsidies from both federal and state governments. One *Wall Street Journal* editorial noted that despite ethanol's dubious performance in the marketplace, "[i]n Washington, it's a lucrative business that provides jobs and votes."<sup>22</sup> Government support for the ethanol industry includes national transportation ethanol fuel mandates, access to low-priced corn over most of the past decade, a federal tax credit for ethanol blending, and state incentives to build refineries and produce ethanol.

## 1. Mandated Ethanol Use Under the Renewable Fuel Standard

The most fundamental ethanol incentive is the federal requirement to use a certain volume of ethanol in transportation fuel, known as the renewable fuel standard (RFS), which effectively increases demand for ethanol. In 2007, Congress significantly increased the minimum amount of renewable fuel that must be used domestically, either ethanol blended into gasoline or biodiesel. The 2007 Energy Bill raised the RFS from 5.4 billion gallons to 9.0 billion gallons in 2008, and annually increases the requirement until it reaches 36 billion gallons in 2022.<sup>23</sup> For the immediate future, most of this requirement would be filled with corn ethanol, but starting in 2016, all of the RFS increases must be met with cellulosic ethanol and other non-corn ethanol biofuels.<sup>24</sup> Friends of the Earth estimated that the renewable fuel standard mandate alone provided 14¢ for every gallon of corn ethanol.<sup>25</sup> The benefit to corn ethanol refiners will grow as the renewable mandate increases, but in the first two years this benefit amounted to \$2 billion.

## 2. Decade of Cheap Corn Effectively Subsidizes Corn Ethanol Refineries

Ethanol refiners saved an estimated \$3.6 billion between 1999 and 2008 by buying artificially low-priced corn, the most important input for ethanol refineries. Federal farm policies that encourage overproduction have kept corn prices artificially low for most of the past dozen years. These farm policies effectively subsidize all industries that rely on corn as a key input — feedlot and factory farm operators, the high-fructose corn syrup refiners, and the ethanol industry.

These pass through subsidies represent an important yet often overlooked subsidy to ethanol refiners.<sup>26</sup> Since corn remains the primary ingredient in U.S. ethanol production, any policy that lowers the price of corn below its cost of production effectively subsidizes the ethanol refiner. The market price of corn between 1999 and 2008 averaged \$2.57 per bushel, but the average cost of production was \$2.81 per bushel.<sup>27</sup> This represents a 24¢ windfall for each bushel of corn that government farm policy bestowed upon ethanol refiners.

During the decade 1999–2008, corn was priced 8.5 percent below average production costs.<sup>28</sup> Over this period, ethanol refiners saved approximately half a billion dollars a year over what might have been paid if market

**Table 1:** Corn Bushels and PassThrough Subsidies, 1999 – 2008.

Year	Ethanol Produced (millions of gallons)	Bushels (millions)	Price of Corn (\$/Bu)	Cost of Production (\$/Bu)	Subsidy Per Bushel	Total Subsidy Per Year
1999	1470	544	1.82	2.56	0.74	\$402,560,000
2000	1630	604	1.85	2.52	0.67	\$404,680,000
2001	1770	656	1.97	2.66	0.69	\$452,640,000
2002	2130	789	2.32	2.65	0.33	\$260,370,000
2003	2800	1039	2.42	2.51	0.09	\$93,510,000
2004	3400	1259	2.06	2.67	0.61	\$767,990,000
2005	3904	1446	2.00	2.87	0.87	\$1,258,020,000
2006	4855	1798	3.04	2.94	0	\$0
2007	6500	2407	4.20	3.10	0	\$0
2008	9000	3333	4.06	3.65	0	\$0
						\$3,639,770,000



prices for corn had equaled the cost of production.<sup>29</sup> The farm programs have allowed prices to fall below production costs and then reimburse farmers for some of their losses, effectively subsidizing ethanol refineries, meatpackers, factory farms and food processors.

As ethanol production increased between 1999 and 2005, the savings from artificially low-priced corn grew nearly every year. From 1999 to 2005 the price of corn averaged about \$2 a bushel. During this time, the pass through savings for ethanol refineries more than tripled from \$402.5 million in 1999 to almost \$1.3 billion in 2005. However, in 2006 corn prices began to rise. Between 2006 and 2008 the average price of corn was \$3.75 per bushel — higher than the cost of production for the first time in almost a decade — allowing farmers to earn profits with no pass through benefit to the ethanol refiners.

### **3. The Blenders' Credit Subsidy**

The ethanol industry has received an estimated \$16.74 billion between 1999 and 2008 in direct subsidies for mixing ethanol with gasoline. The “blenders credit” provided a tax credit to ethanol refineries — initially as an excise tax exemption and subsequently under the Volumetric Ethanol Excise Tax Credit (VEETC). These programs provided a 5.4¢ per gallon of combined gasoline and ethanol (or “gasohol”) tax exemption between 1998 and 2004 to companies that blend ethanol with gasoline (known as E-10 for 10 percent ethanol blends) before selling it to gas stations.<sup>30</sup> The VEETC gave a tax credit of 51¢ per gallon of ethanol between 2004 and 2008.<sup>31</sup> The 2008 Farm Bill decreased the 51¢ per gallon blender payment to gasoline refiners to 45¢ per gallon for corn ethanol.<sup>32</sup>

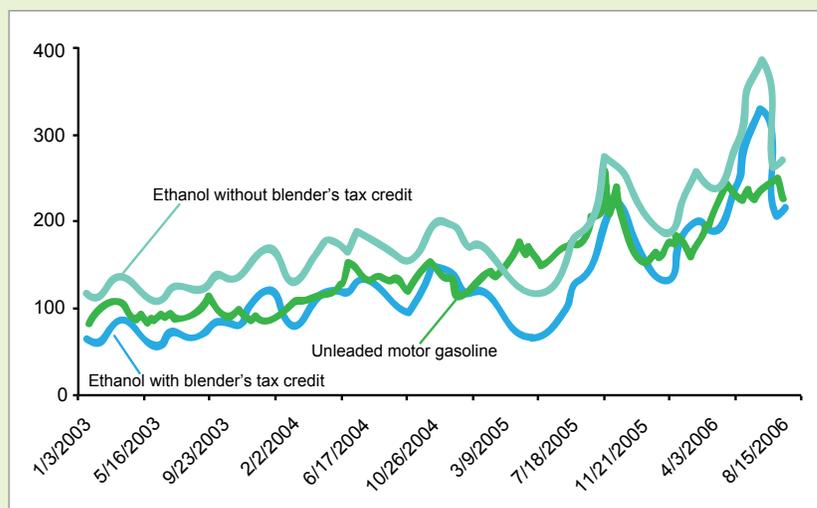
Though the VEETC is a “blenders'” credit, which is paid to the oil companies that mix ethanol with gasoline, in effect it only benefits ethanol refiners and consumers. Ethanol refiners benefit as long as the price of corn allows the refiners to keep the price of ethanol-blended fuel lower than gasoline alone. However, when the price of ethanol inputs like corn increase, ethanol-blended fuels can exceed the price of gasoline.

Between 1999 and 2008, the blenders credit cost American taxpayers \$16.74 billion to pay gasoline refiners for blending corn-based ethanol with gasoline.<sup>33</sup> The decrease in the VEETC in the 2008 Farm Bill shifted funding to a new cellulosic biofuels production credit for up to \$1.01 a gallon, available through 2012.<sup>34</sup> The credit is aimed

## How does the blenders credit interact with gasoline prices?

To understand how the blenders' credit works, imagine that ethanol and gasoline have the same cost of production at \$2.00 a gallon. In order to maximize their returns, ethanol refiners could increase their wholesale price of ethanol to \$2.45. At this price, blenders who have purchased ethanol can sell ethanol-blended fuel for \$2.00 a gallon (because of the 45¢ per gallon credit) since gasoline and ethanol cost the same to produce. The subsidy is essentially a profitable gain by the ethanol refiner because their customer, the blender, is receiving 45¢ per gallon to offset the higher price paid to the ethanol refiner. Between 2003

**Figure 2:** Average Price of U.S. Ethanol and Gasoline 2003 to 2006<sup>39</sup>



and 2006, changes in the price of ethanol have mirrored the price of gasoline.

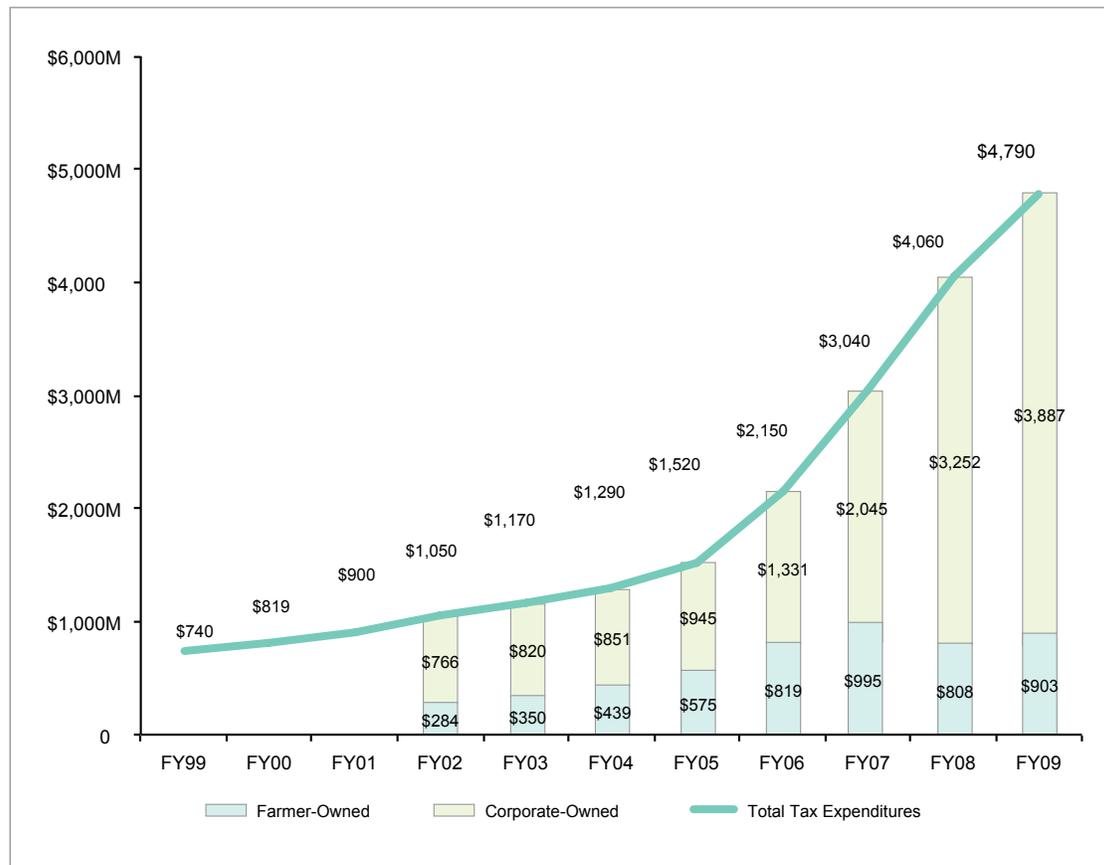
When the cost of producing ethanol is higher than the cost of producing gasoline, ethanol refiners can sell ethanol at a lower price and profit margin because of the blenders credit. For example, if the cost of producing a gallon of ethanol is \$3.00 as compared to \$2.00 for gasoline, ethanol refiners and blenders must sell the ethanol with as small a profit

margin as possible to stay competitive with the price of gasoline. As before, the blenders receive the 45¢ credit, which allows them to sell the ethanol at \$2.55 a gallon. Notice that in this case the consumer receives the benefit instead of the refiner, who needs to sell the ethanol at cost. Consumers benefit by only paying \$2.55 a gallon for a product that costs \$3.00 to produce.

Indeed, the tax credits can have a strange effect under the Renewable Fuel Standard requirement for vehicle fuels. Because the RFS mandates ethanol use, the blenders' credit is not needed to generate ethanol demand.<sup>40</sup> In 2010, the RFS called for 12.95 billion gallons of blended biofuel gasoline, with as much as 11.25 billion gallons in corn-based ethanol.<sup>41</sup> The RFS mandate absorbed 83 percent of the 13.5 billion gallon U.S. corn ethanol refinery capacity in 2010 without any tax incentive.<sup>42</sup>

The tax credit encourages ethanol consumption above the RFS mandate. According to Bruce Babcock, a University of Iowa researcher, blenders' credit proponents acknowledge that the tax credits primarily "push consumption beyond mandated volumes."<sup>43</sup> The blenders' credit stimulated ethanol refineries to produce 2.25 billion gallons in excess of the RFS mandate in 2010. The credit cost \$5.23 billion in 2010. That credit should be applied, not over the entire run of production, but only on the excess production induced by the tax credit. Calculated this way, the real cost was not the 45¢ per gallon subsidy, but an astounding \$2.32 per gallon.<sup>44</sup>

**Figure 3:** Millions of Dollars Paid by Capacity.<sup>32</sup>



at non-food (i.e. corn kernels and soybeans) biofuels feedstocks (primarily agricultural waste, wood chips, and perennial crops like switchgrass) and may reach \$400 million over the next decade.<sup>55</sup> Nonetheless, corn by-products like corn stover (corn cobs and stalks in the field) can and will likely remain the main feedstock for the cellulosic production credit, so any concerns over using food for fuel will not be alleviated.<sup>36</sup>

Corporate ethanol refiners received the lion’s share of the blenders’ credit benefits. Food & Water Watch analyzed the production of ethanol by farmer-owned and corporate-owned refineries based on annual reports from the Renewable Fuels Association (RFA), an industry trade group, and applied the total tax expenditures to the percentage of ethanol produced by farmer-owned and corporate-owned refineries for each year. For example, between 2002 and 2008, over \$10 billion in blenders’ credits — about 70 percent — went to corporate ethanol refiners and these payments are growing. Blenders’ credits to corporate ethanol refineries more than quadrupled between 2002 and 2008 to \$3.25 billion. Although farmer-owned ethanol plants provide more economic benefits to rural communities, farmer-owned refineries received about \$4.3 billion during the same period. In 2008, the four largest corporate ethanol refiners (Poet, ADM, VeraSun and U.S. Bioenergy) captured \$1.6 billion in blenders’ credits — almost twice the \$808 million that all farmer-owned plants received combined.<sup>38</sup>

#### 4. State Subsidies

While the federal government provides the largest share of government support through the renewable fuel

standard, tax production incentives and artificially low-priced inputs, state governments in the corn belt supplement federal programs with state-financed ethanol incentives. These incentives can take the form of production facility construction assistance, state production subsidies and transportation incentives. In total, these programs spent over \$564 million between 1998 and 2009. Below we explore how each of these programs has benefited ethanol refiners.

■ **State Construction Subsidies**

Some states have subsidized financing for new refineries by offering guaranteed grants and credits to refiners or investors constructing new facilities. For example, Ohio created its Alternative Fuel Transportation Grant Program which provides grants to fund the purchase of alternative fuels or alternative fuel infrastructure, up to 80 percent of the cost of the project.<sup>45</sup> Furthermore, Ohio law allows any taxpayer that invests in a state-certified ethanol facility to claim a tax credit.<sup>46</sup> Illinois created the Alternative Fuel Infrastructure Advisory Board which awards grants to ethanol refiners from the state’s Alternative Fuels Funds to help reduce the cost of producing ethanol and to increase the viability of the fuel in the state.<sup>47</sup> Twenty states have already approved tax credits or other incentives to build ethanol and biofuel production plants.<sup>48</sup>

■ **State Production Incentive Subsidies**

Some states also subsidize production directly via per gallon payments or tax credits, usually ranging between 5¢ to 20¢. Between 1998 and 2009, the production subsidies in only four states amounted to \$564 million – more than half a billion dollars. Kansas allows for a 5¢ to 7.5¢ per gallon subsidy depending on the date of production and availability of funds.<sup>49</sup> Minnesota and South Dakota both award ethanol manufacturers a 20¢ per gallon “producer incentive,” a policy that boosted the states’ annual ethanol output.<sup>50</sup> The Nebraska program provides between 7.5¢ to 18¢ tax credit per gallon depending on what percentage of production includes ethanol versus other fuels.<sup>51</sup>

**Table 2:** Production Subsidy Spent From 1998 to 2009 in KA, MN, NE, and SD.

State	Production Subsidy (¢/gallon)	Production Subsidy (millions spent 1998–2009)
Kansas	5 to 7.5	\$36.69*
Minnesota	13 to 20	\$276.27
Nebraska	7.5 to 18	\$196.35
South Dakota	20	\$55.07
Total		\$564.38

*The numbers are from the states’ fiscal years, which may begin and end on different dates. However, the numbers cover a time frame of eleven years except for Kansas.*

*\* Does not reflect 2009 values.*

While annual expenditures information from other states was not readily available, that does not mean that substantial state government funds have not been invested in promoting the ethanol. For example, Missouri grants ethanol refiners 20¢ per gallon from its Qualified Producer Incentive Fund for the first 12.5 million gallons of ethanol refined.<sup>52</sup> Similarly, Indiana gives refiners 12.5¢ per gallon refined.<sup>53</sup> Other types of incentive subsidies include alternative fuels or biofuels infrastructure tax credits. States such as Colorado, Florida, and Arkansas give tax credits for costs associated with infrastructure, capital investments, and operation.<sup>54</sup>

■ **State Transportation Incentives**

Some states offer benefits to ethanol refiners by providing for the costs of supplying the fuel to the public. For example, Indiana provides up to \$20,000 to fueling stations to install E85 fueling equipment.<sup>55</sup> Until January 1, 2009 Kansas offered fueling stations a tax credit worth up to 40 percent of the construction cost of the station, with a maximum of \$160,000.<sup>56</sup>

Some states also establish ethanol fuel requirements or encourage the purchase of ethanol-ready vehicles. In Missouri, 50 percent of newly purchased state government vehicles must be alternative fuel vehicles.<sup>57</sup> All educational institutions in Iowa must make at least 10 percent of their new vehicle purchases alternative fuel vehicles.<sup>58</sup> State-owned vehicles in Nebraska must purchase E85 gasoline whenever it is reasonably available.<sup>59</sup>

Minnesota requires that gasoline be at least 10 percent ethanol. By 2010, Minnesota cars were required to run on 20 percent ethanol in their gasoline.<sup>60</sup> Minnesota is not alone in this endeavor to promote ethanol to in-state consumers. Kansas funds up to 50 percent of the costs of converting traditional vehicles to ethanol use and up to 50 percent of construction costs for new ethanol fueling stations.<sup>61</sup> States like Iowa, Nebraska, Illinois and Missouri, among others, have adopted laws that establish state funds to promote the use and distribution of ethanol in their state.<sup>62</sup> Overall, state governments are trying to encourage the use of ethanol as a transportation fuel by either lowering the costs of supplying the fuel or by lowering the costs to consumers who use it.

## IV. Corporate Takeover of Local Ethanol Industry and Loss of Farmer-Owned Cooperatives

Ethanol has been heralded as an economic boon for rural communities. But to maximize the investment from ethanol refineries, the plants should be locally owned. Government subsidies have facilitated the consolidation of the ethanol industry into the hands of a few national companies. Although the agriculture sector is generally very consolidated, ethanol was the one sub-sector where small and medium-sized, locally-owned firms, and farmer-owned cooperatives represented a significant share of the market. In 2008 the largest five firms

**Table 3:** Plants and Capacity. Information gathered from the Renewable Fuels Association, Industry Outlooks, 2002-2009.

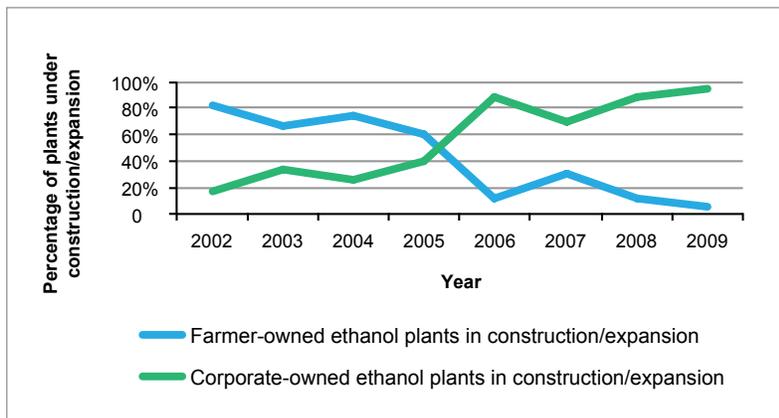
Year	Total Corn Based Ethanol Plants	Ethanol Production Capacity (mgy)	Farmer-Owned Corn-Based Plants	Farmer-Owned Capacity (mgy)
2002	52	2,333.3	30	624.0
2003	46	2,706.8	25	789.0
2004	51	3,100.8	30	1,033.5
2005	61	3,643.7	36	1,358.0
2006	73	4,336.4	42	1,625.5
2007	86	5,493.4	45	1,775.5
2008	87	7,888.4	35	1,556.0
2009	146	10,348.0	36	1,950.5

controlled over 24 percent of the market while the farmer-owned share of the market fell to 19.7 percent from a high of 38 percent in 2006.<sup>63</sup>

The ethanol industry has seen one of the most significant recent infusions of jobs, investment capital and economic opportunity for rural communities.<sup>64</sup> Most ethanol refineries are located in corn producing areas. These rural communities have faced declining populations and a scarcity of jobs.<sup>65</sup> The development of an ethanol refinery provides both jobs at the plant and in businesses that support the plant's operation. The new business can bolster state and local government revenues both from the plant and its employees.<sup>66</sup>

Locally-owned plants provide the largest economic engine for rural communities. Refineries that are owned by farmer cooperatives or owned by local investors generate stronger benefits for rural communities than corporate-owned and -operated refineries.<sup>67</sup> Corporate-owned plants are managed in absentia. The capital investments, planning, operational decisions and profits from the facility are made far away from the plant, largely indifferent to the local community.<sup>68</sup> Corporate refineries aim to maximize returns on investments for distant shareholders.

**Figure 4: Farmer- vs. Corporate-Owned Ethanol Facilities Under Construction.** Information gathered from the Renewable Fuels Association Annual Industry Outlooks, 2002-2009.



Locally-owned ethanol plants invest and buy locally, which leverages the economic impact beyond the jobs and revenues of the refinery alone. Farmers and farmer-owned cooperatives developed many of the early ethanol refineries to create new markets for their corn crop and to own a value-added step in the processing chain. The farmer-owned cooperative is a member of the community. The power to make decisions regarding the plant is kept within the community. Basic professional resources like legal, accounting and financial services tend to be utilized in the communities where local owners construct a facility.<sup>69</sup> In contrast, corporate-owned facilities centralize these services at their corporate headquarters. Most importantly, locally-owned plants allow farmers in the community to participate in the profits from their investment. This additional income adds to the economic base in the community and reverberates through the local economy. The local multiplier effect means that locally-owned ethanol refineries generate as much as 56 percent more local economic activity than corporate-owned plants.<sup>70</sup>

Despite the economic gains from local ownership, the largest investment in the ethanol industry in the past few years has come from large corporate operations. Between 2005 and 2010, the ethanol industry invested \$15.6 billion in new capacity.<sup>71</sup> Most of the investments during the ethanol boom have been by corporate refineries not farmer-owned plants. This corporate investment eroded local ownership and undercut the economic boon for rural areas. In 2005, half (50 percent) of ethanol refineries were locally owned, but by 2008, the share of locally-owned plants declined to just over one-third (36 percent).<sup>72</sup> The share of farmer-owned plants fell by

a quarter, from 39 percent of plants in 2006 to 28 percent in 2008. Most of the declining share of local ownership has occurred through corporate buyouts of farmer-owned plants and through the construction of new refineries.<sup>73</sup>

This trend is most likely going to continue as new ethanol refinery construction becomes almost exclusively driven by corporate investment (See Figure 4). Until 2005, farmer cooperatives were the driving force behind building new plants, but between 2005 and 2008, corporate investors have been the driving force behind new production capacity.



New construction combined with consolidation is cementing corporate control of the ethanol sector.

The economic meltdown accelerated mergers and acquisitions. As corn prices peaked in the first half of 2008, at least sixteen ethanol companies filed for bankruptcy.<sup>74</sup> Consolidation swept through the industry during 2009.<sup>75</sup> The rapid inversion of profitability allowed some corporate takeovers to snap up refineries for pennies on the dollar.<sup>76</sup> Larger firms mostly bought up the 2008 and 2009 bankruptcies, and as corn prices began to rise again in 2011, more local stand-alone ethanol facilities could be vulnerable to bankruptcy and takeover.<sup>77</sup>

Concentration of ethanol plants into fewer, larger corporate entities erodes the benefits of ethanol production to local communities. First, corn farmers will have fewer competitors for their crops, which can depress corn prices. Second, as larger, more distant corporations control larger market shares in ethanol production, state subsidy dollars will migrate over state lines. This concentration stymies the multiplier effect of dollars through local economies. Federal ethanol subsidies and farm programs meant to buoy family farms have facilitated the push for larger corporations to invest, purchase and consolidate ethanol production. Regrettably, those federal policies intended to help local communities could have unintentionally promoted disinvestment in rural communities as corporate concentration continues to escalate.

## V. Focusing on Second Generation Biofuels: Cellulosic Ethanol and Beyond

Currently, almost all domestically produced ethanol comes from corn. Many experts have identified this crop as a source of economic and environmental risk. The Renewable Fuel Standard set a nearly 13 billion gallon ethanol mandate for 2010, up from 5.4 billion in 2008.<sup>78</sup> There is a growing consensus that meeting this demand will require development of new plant-based fuel sources other than corn. “To a large extent in Washington, D.C., there’s the perception that corn-based ethanol is just a stepping-stone to cellulosic ethanol,” said Mark Lambert, spokesman for the Bloomington-based Illinois Corn Growers Association.<sup>79</sup> The renewable fuel standard is phasing in non-corn-based ethanol requirements with a 21 billion gallons non-corn-based ethanol requirement out of a total of 36 billion gallons of biofuels by 2022.<sup>80</sup>

Some alternative technologies are either currently becoming available or are being developed to meet America's energy needs. These other biofuel policy options have the potential to be more efficient, environmentally friendly and financially more feasible than corn-based ethanol. Furthermore, researchers are turning to these non-food plant options with the hope of meeting rising ethanol demands without putting undue stress on traditional food crops. Alternative energy crops that might fill this purpose include agricultural, forestry, and crop residues, wood waste, municipal solid waste, trees, and grasses.<sup>81</sup> Tall grasses such as switchgrass and fast-growing trees such as poplars appear to have particular promise.<sup>82</sup> Despite the promise of these next generation feedstocks, none are yet commercially viable. One observer quipped to the *New York Times* that solving the scientific puzzle of cellulosic ethanol has been "5 years away for the last 30 years."<sup>83</sup>

## 1. Cellulosic Ethanol: Barriers and Benefits

The corn-based ethanol lobby has drained taxpayers' pocketbooks and stifled the progress of the renewable energy industry over the past twenty years. Promising industries, like solar and wind, have fought for market share with minimal federal financial support, but the corn-based ethanol industry has raked in three-quarters of the available tax benefits and two-thirds of the subsidies available for the renewable energy sector.<sup>84</sup> A 2007 Energy Information Administration report detailed over \$3 billion in tax credits to the corn-based ethanol industry and \$690 million for wind, solar, geothermal, and other renewable companies.<sup>85</sup> As Paul Woods, CEO of Algenol Biofuels, which makes ethanol from algae, explained, "All we are asking is that policy be technology neutral — that lawmakers don't advantage one party. Right now, we have no support at all, which is ridiculous."<sup>86</sup>

Unlike corn-based ethanol, which is refined from starch, cellulosic ethanol is refined from the woody, fibrous portion of a plant. As a result, creating ethanol from cellulose is currently more complex and expensive than making it from corn. Cellulose must be pre-treated with enzymes to strip off cell-wall protections before yeast and other microorganisms can be applied to ferment those sugars into ethanol. Scientists generally extract these enzymes from microorganisms that produce them naturally because they are difficult to make from scratch. This cumbersome process makes utilizing enzymes the largest obstacle to producing cellulosic ethanol cheaply and quickly on an industrial scale.



Firms are investing in overcoming the barriers to cost effectively mass-produce cellulosic ethanol, in part, because of its energy potential. Cellulosic ethanol production shows higher energy ratios than corn-based ethanol and soy-based biodiesel.<sup>87</sup> Cellulosic ethanol generates 540 percent more energy than it takes to produce, but corn ethanol produces only 25 percent more energy than it takes to refine it.<sup>88</sup> This high energy gain means that refining cellulosic ethanol creates far more energy than it consumes.<sup>89</sup> And while the cellulosic energy gain will likely grow as the new technology matures, energy yields from corn and soy will likely hit their maximum capacity in the near future. This gives cellulose ethanol the potential to be far more efficient, cost-effective and environmentally sound than corn-based products.

## 2. The Promise of Biodiesel

Biodiesel is a diesel fuel replacement made from vegetable oil or animal fat. It can be used in any diesel engine with little or no modification to the engine's function. While biodiesel can be blended with petroleum diesel fuel in any proportion, the mix is typically 20 percent. This fuel blend is currently used primarily by vehicle fleets, but it is also available to individual consumers with diesel vehicles. As of July 2009 there were 675 fueling stations spread throughout every state (except Minnesota) providing a 20-80 blend of biodiesel.<sup>90</sup>

Biodiesel comes with both advantages and disadvantages. On the positive side, it has higher energy ratios than corn ethanol and releases less pollution per net energy gain, because it needs fewer raw materials and can be converted to fuel more efficiently. It has a low emissions profile, can be refined domestically, comes from renewable sources, is non-toxic and biodegradable, and is safer than petroleum products because of its high flash point.<sup>91</sup> On the other hand, biodiesel does not perform as well as petroleum products in cold weather, has a lower energy content than petroleum diesel (8 percent less energy per gallon), and is less oxidatively stable than petroleum. This instability causes biodiesel to break down into acidic compounds and sediments without the proper additives. Additionally, pressure from alternative uses for many biodiesel feed stocks, such as animal feed and human consumption, limits supply and creates scalability concerns.<sup>92</sup>

## VI. Conclusion

Corn-based ethanol is not a viable energy source for America. This analysis has looked at the limits of corn-based ethanol. First, we examined how some corporate ethanol refiners are large donors to political parties. Second, the paper found that the various ethanol subsidies being given to refiners, amounted to at least \$22.8 billion from federal and state subsidies between 1999 and 2008 — \$16.7 billion in the “blenders” tax credit, \$3.6 billion from pass through subsidies for corn, \$2 billion from the renewable fuel standard, and at least \$500 million from state coffers. Next, we looked at the recent market concentration of ethanol refiners and presented some of the potential negative effects if these trends continue. Finally, we explored biofuel alternatives that are more efficient, economically feasible, and environmentally friendly.

### Recommendations

Ultimately, policy changes need to strike a more balanced approach for sustainable energy independence. First, corn-based ethanol subsidies should be phased out completely over the next couple of years in favor of granting subsidies to cellulosic and algae biofuel refiners. Second, the renewable fuel standard should be amended to lower the amount of corn-based ethanol qualifying for government quotas. In the same vein, renewable fuel standards should be increased for second and third generation biofuels like cellulosic ethanol and algae-based biodiesel. Even these next generation biofuels should only receive support if they meet sustainability criteria to qualify for subsidies. These could include a net energy gain for cellulosic or other biodiesel fuels, reduced water utilization, limiting the indirect land use impact on food production, and eschewing emerging higher-risk technologies like nanotechnology and synthetic biology. Finally, farmers should be rewarded for taking steps that make their own operations energy independent. We propose that farmers who produce and consume their own biofuels on the farm should be rewarded by an energy tax credit for each gallon of ethanol, biodiesel or vegetable oil that they use instead of fossil fuels.

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