



Massachusetts Bioenergy Initiative Requires Restructuring to Ensure Energy Market Neutrality and Cost Efficiency

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Provided to the
Massachusetts Advanced Biofuels Task Force

February 28, 2008

It's hard to argue with the goals behind Governor Deval Patrick's recent push for biofuels: reduced oil imports, improved environmental quality, and new jobs. But it is at least five years into the biofuels boom and the governor's "nation leading" initiative does not seem to have learned the lessons from the more than 200 biofuel subsidy programs already in existence in nearly every state of the country. Of particular concern:

- **Costs of program will be high, and have been poorly estimated.** The proposal is costly, especially when measured per gallon produced or CO₂-equivalent emissions reduced. Other strategies could achieve these goals more effectively.
- **Policies lack neutrality across potential energy solutions.** The proposal is not neutral across all potential ways to reduce our carbon footprint, but rather exacerbates a skewed policy structure that already exists at the federal level to pre-select ethanol and methyl ester biodiesel as the market winners. As a result, it inhibits, rather than supports, a dynamic marketplace for improvements in the transport and home heating sectors.
- **Policies are a poor fit with the structure of the state's agricultural and biotech industries.** Supplying biofuel feedstocks requires very large land areas of monocultural crops, not small landholdings focused on premium crops such as dominates in New England. On the biotech side, the government intervention acts to skew biotech research towards a handful of products, rather than letting the firms focus on which of the thousands of problems their industry can take on are most important and remunerative.
- **Poor integration of conservation.** Unlike gas and electricity users who have been served by demand-side management programs for many years, oil consumers have been largely ignored. Current legislative trends do not correct this problem, even though improved oil-heat equipment and insulation can likely save far more oil (and associated emissions) than mandated use of biodiesel can.

¹ Mr. Koplow has written on government subsidies to energy for national and international organizations for nearly 20 years. Since 2006, he has analyzed and quantified subsidies to biofuels around the country, publishing two major studies on the topic (full citations in references section).

- **Inadequate analysis.** The State is too reliant on analysis conducted by a biofuels trade association in structuring its approach. Were the supporting materials provided by the coal, nuclear, or oil lobbies, it is unlikely that the State would be so accepting of the approach and recommendations of an outside party without doing its own comprehensive internal research.

These issues are discussed in greater detail below.

1. Policy Neutrality

Neutrality across potential energy options should be the State's most important guiding principle as it moves forward with its energy plans. While cellulosic ethanol and biodiesel are all the rage today as solutions to our reliance on oil within the transport sector, they are not the only solutions. Their environmental profile is also coming under increasing scrutiny. As more complex interactions within ecosystems are appropriately being integrated into the lifecycle modeling of the fuels, we are seeing major downward revisions in the environmental benefits attributed to particular fuels. This revision, while less acute, also applies to cellulosic feedstocks. Searchinger *et al.* (2008), for example, estimates that producing cellulosic ethanol from switchgrass that is grown on corn lands will actually *increase* greenhouse gases (GHG) by 50 percent.

Although the legislative language suggests the state will ensure fuels from sustainable feedstocks, state officials are unlikely to have the expertise to do so. Deferring to a federal standard would also be problematic. Modeling issues remain contentious. Given the sums of money involved (some fuels may be excluded from eligibility in the federal Renewable Fuel Standard), the technical decisions on which model to use and how to integrate critical impacts such land use change or nitrous oxide emissions, will likely be as much political as scientific. Current federal language, for example, grandfathers in any sources that pass the standard initially even if the modeling that allowed it to pass is later determined to have been wrong.

There are multiple levels of policy neutrality that the State should be taking into account. This challenge exists even within the biofuel sector itself. While blend rates of 10% are generally considered the cap for conventional ethanol to avoid vehicle damage, "second generation" biofuels such as butanol can be used in higher blend ratios with existing motors and fueling systems. It can also be shipped through existing pipeline infrastructures. Both of these characteristics are enormously beneficial in reducing the need to scrap or replace vehicle or pipeline infrastructure, investments worth many tens of billions of dollars. Some biodiesel formulations made through thermal coprocessing with petroleum have better performance in cold weather than does standard biodiesel. In theory, such attributes should be encouraged to improve the reliability of the alternative fuel, and its ability to be used across a wider variety of weather conditions. Policies should not disadvantage these, or other, emerging resources; current state proposals will.

Even more importantly, this neutrality must extend beyond biofuels and into the many other emerging options that can reduce our reliance on oil per passenger- or freight-mile travelled. High efficiency clean diesels, better fleet maintenance, more efficient internal combustion engines (cylinder deactivation is one example), and alternative drive-trains such as plug-in hybrids may turn out to be lower cost ways to reduce our reliance on imported oil. The point is not to predict which technologies or set of technologies will win, but to ensure that government policy plays a neutral role in allocating resources and establishing policies, forcing all of the alternatives to compete.

This issue is also central in the home heating oil sector. With little visible debate, the Patrick administration seems to have decided that the most effective way to improve the sustainability of oil heat is to force consumers to buy biodiesel blends at higher prices. The short-sightedness of this approach is stunning, especially given the increasing evidence of wholesale environmental destruction in Brazil and Indonesia that has triggered by biodiesel demand in the US and Europe. Fargione *et al.*(2008), for example, estimate that the carbon debt triggered by conversion of Indonesian peatlands to produce biodiesel from palm oil will take *over 840 years* to repay. A more refined strategy would be better:

- **Demand-side options have not been evaluated.** The key metric in the heating sector should be the gallons of oil required per year or per square foot of space. Given that the oil heat sector has not participated in demand-side management programs to nearly the degree that homes using natural gas or electricity have, it is likely that there are many low cost options to improve efficiency still available. Whether they include equipment upgrades or better insulation, if they reduce the need for oil, the administration should be indifferent to the mode.
- **Split-incentive problem in rental housing should be addressed.** Where oil heat exists in rental housing, the problem is even more acute. The tenants have no incentive to upgrade the capital equipment, as they are not there long enough to recoup the investment. The landlords have no incentive to insulate or upgrade capital as they do not pay the utility bills. Solving this split incentive problem would likely provide enormous benefits to state residents, both environmentally and in terms of reduced cost of living for lower-income renters.²

These types of changes would generate year-on-year cost reductions and clear environmental benefits. In contrast, the biodiesel mandate will generate instead year-on-year cost increases to homeowners and tenants, adding to the already steep increase in energy prices.

² The "[Pay as You Save](#)" Program is one possible way to address the split incentive program, and their chair of their board (Nancy Brockway) is actually located in Boston. The State should explore programs such as this as it moves to build a more balanced energy strategy.

2. Biofuels as a future growth industry for Massachusetts

House Speaker Salvatore DiMasi is quoted in a press release from Congressman Bill Delahunt as saying that the biofuels initiative is "not just the right thing to do for our environment and our energy independence, it is the right thing to do for our economy." (Delahunt, 11/5/07). Proponents of the legislation point out the state could produce cellulosic ethanol feedstocks (primarily wood waste); and that it could become a national leader in the associated technologies. They point out that the state already has a number of cellulosic and algal-ethanol firms operating. (Northeast Biofuels Collaborative, 2007). Governor Deval Patrick believes the subsidies will enable the state to "capitalize on clean-fuel research for economic growth and jobs." (Patrick, 11/5/07).

While any government spending will generate some jobs (though sometimes at the expense of others), this doesn't make the current proposals the proper building blocks for creating strategic new industries. The arguments put forth by proponents of subsidies to cellulosic ethanol and biodiesel are mistaken in a number of important respects:

- **Cellulosic feedstocks are price sensitive.** The costs to harvest and store cellulosic feedstocks are important factors in the industry's competitiveness. This suggests that large acreage, monoculture production of these feedstocks will have an advantage in the initial years of the industry. Such production does not exist in Massachusetts. Trying to build a capacity for bulk commodities would go counter the state's advantages in producing high value crops for local markets. While there is some residual woody biomass, heavily subsidizing conversion of these to transport fuels would need to be weighed against existing or new-build uses for the biomass for direct heat or electricity. Furthermore, while cellulosic ethanol production facilities may at some point handle mixed feedstocks, entrepreneurs in the sector with whom I've spoken suggest their will not happen for many years.
- **Cellulosic production technology is a global industry, unaffected by whether the fuels are consumed locally.** As with development of a blockbuster drug, the successful creation of enzymes to produce cellulosic ethanol on a competitive basis will be highly lucrative for the inventing firms. The products are portable, and the innovation will serve a national or global market. Firms will be able to capitalize on these discoveries regardless of whether the state of Massachusetts subsidizes cellulosic ethanol through exemptions from motor fuel taxes. The key characteristics driving cellulosic ethanol and other clean energy firms to locate within the state is not our auto fleet, but our universities and huge installed base of a variety of biotechnology firms.
- **Biofuels are one possible application of biotechnology expertise, but there are hundreds of others.** As with skewing the market towards one particular fuel, the Patrick administration risks skewing biotech research towards biofuels under the mistaken assumption that this will grow the sector and its associated jobs. Biotech firms are doing all sorts of important work, in a huge variety of areas.

They can make their own decisions as to whether biofuels will generate a better return than alternative applications of their skills. The Patrick administration should focus on ensuring that local biotech firms can operate easily and efficiently in the state no matter what their product is. The administration should steer clear of trying to direct the firms' research agenda towards the items that the political leadership believes to hold the most promise. The firms themselves are likely to do a far better job assessing this.

- **Job creation may be higher through demand-side management programs than through biodiesel mandates.** Simply believing that new incentives to ethanol and biodiesel will bring jobs to the state is simplistic and incomplete. Net jobs matter, and government policies that cut revenues in one area, or that drive up heating costs, can have negative impacts on employment elsewhere. DSM programs may actually offer more jobs than would earmarked subsidies to a handful of favored groups. This would come not only through the likely higher labor intensity of the industries upgrading residential or commercial energy efficiency infrastructure, but also through the potential increased disposable income these upgrades could provide through reduced heating costs. The Patrick blending mandate, in contrast, is expected to increase prices by nearly 10% (Ferrante, 2008), reducing disposal income and generating negative local economic multipliers.

3. Cost of the Biofuels Bill

Costs matter. They matter not only in terms of the financial burden on taxpayers, but also on how efficiently they achieve key policy goals, such as reducing our reliance on imported oil. Biofuels perform poorly on both counts. This section discusses the public cost of the Massachusetts initiative, and total public subsidies from both the planned Massachusetts initiative and existing federal biofuel subsidies. A variety of metrics to assess the efficacy of the programs are presented.

3.1 State biodiesel mandate

Governor Patrick proposes mandated blending of biodiesel in both home heating oil and diesel transport uses. Contrary to arguments put forth by the state, and in a report provided to the state by a biofuels trade association,³ there is no reason to expect that a mandate will be cost decreasing or cost neutral. Standard market pressures encourage suppliers to minimize costs. Mandates generally force market behaviors that would not happen without government intervention, and these choices are usually cost-increasing. This is already evident in federal biofuel mandates (see Koplou, 2007), and in the current price premium for B10 heating oil within the state (noted in Ferrante, 2008). Currently, B10 must remain relatively price competitive with standard heating oil to have some

³ Northeast Biofuels Collaborative, *A Proposed Strategy to Promote Biofuels Production and Use in Massachusetts*, November 2007.

market share. As mandates require all producers to blend in biodiesel, this competitive constraint disappears and higher premiums as a percent of price should be expected.

According to federal data, Massachusetts used just over 1 billion gallons of number 2 distillate in 2006, roughly 60% for heating and 40% for transport. (EIA, 1/30/08). B10 blends for home heating oil are selling at a 10% premium over standard home heating oil, equivalent to roughly 90 cents per gallon of B100 (Ferrante, 2008). Assuming even that the price premium does not rise as the mandate takes effect state-wide, consumers of #2 oil would pay \$20 million per year more for heating and transport under the 2% mandate, rising to more than \$45 million in extra charges under the 5% mandate.

State subsidies are not acting alone, however, but rather are layered on top of a number of large federal biodiesel subsidies that total between \$1.80 and \$2.20 per gallon of B100 (see Koplow, 2007). This adds another \$37-\$45 million per year in subsidies for the B2 mandate, rising to \$92-\$112 million/year under the B5 mandate. Combined state and federal subsidies to biodiesel under the B5 mandate will reach \$138-\$158 million per year. Even if not paid by the state taxpayer, this integrated view is appropriate when evaluating the efficacy of biofuels against alternative energy solutions.

Biodiesel Subsidy Metrics	Low	High
Total State and Federal subsidies, \$/gal B100	2.7	3.1
Total subsidies per household under B5 mandate (\$/yr)	120	170
Total subsidies, (\$/mt CO2-eq)	237	(722)
Comparable reductions: ECX prices (mt CO2-eq)	8	(29)
Comparable reductions: CCX prices (mt CO2-eq)	60	(307)

Source: Earth Track calculations based on Koplow (2007), Ferrante (2008), EIA (12/07) and (1/30/08)

Massachusetts subsidies to biodiesel compound existing federal supports to generate very high subsidies of roughly \$3 per gallon produced, or roughly \$120-\$170 per household per year in supports to biodiesel producers.

According to the Patrick administration, a key goal of their biodiesel strategy is to reduce our emissions of greenhouse gases. Yet, this subsidy translates to public support of more than \$200 per metric ton of CO2 equivalent reduced, even under the most favorable scenarios (of lower bound subsidy and upper bound GHG displacement). Using less favorable assumptions, we are actually paying more than \$700 per mt of *extra* CO2-equivalent that we release through subsidizing biodiesel production and use. This huge range illustrates the tremendous difficulty and uncertainty with properly modeling the lifecycle impacts of biofuel production chains.

It is instructive to note that if the public support now applied to subsidize each gallon of biodiesel were instead used to purchase carbon reductions in the most efficient manner possible, much greater environmental gains would be possible. Based on prices

on the European Climate Exchange, these state and federal subsidies could buy 8 to 30 times the reductions as we will get under the Massachusetts program; and 60 to more than 300 times the reductions based on prices on the Chicago Climate Exchange.

3.2 Tax exemption for cellulosic ethanol

Governor Patrick proposes a pro-rata exemption from the states 23 cpg motor fuels tax for cellulosic ethanol that "is produced from feedstocks that are grown in a sustainable manner." The ethanol need not be produced within the state. While it is difficult to assess how much cellulosic ethanol might make its way to the state to take advantage of this subsidy, some lessons from state biodiesel subsidies are instructive.

Interviews I conducted in work for the Global Subsidies Initiative (Koplow, 2007) indicated that 25 percent or more of domestic biodiesel production ended up in a single state -- Illinois. Biodiesel blends of 11 percent or more in that state are exempt from the state's 6.25 percent sales tax on blends. Another 20 million gallons is believed to supply Minnesota, which already mandates biodiesel blends. An additional 50-70 million gallons of domestic production is believed to go into export markets, most likely to Europe to take advantage of additional downstream subsidies there.

The lesson is clear: biodiesel distribution is being driven primarily by market arbitrage, with limited production following the subsidies. Large chunks of production move to the places with the highest subsidies; places with no incremental subsidization or mandates may get little or no supply. While this scenario was probably not the goal of the state biodiesel incentives discussed above, it is nonetheless a probable outcome for cellulosic ethanol in Massachusetts. Rather than spurring large increases in production capacity (technical problems remain at the forefront here), the Massachusetts plan could simply result in a re-direction of whatever cellulosic production does originate to the state in order to capture our incremental subsidy.

The cost of this proposal can be bounded by assuming that a full 10 percent of the state's gasoline blend is met using cellulosic ethanol as soon as it is available. This amounts to roughly 270 million gallons per year of E100, for a state tax loss of roughly \$60 million per year. The likelihood of cellulosic reaching the state's fuel stocks depends partly on the rate of production around the country (there is currently no commercial cellulosic production) and on the relative magnitude of cellulosic incentives within Massachusetts versus other states. If production were low and other states (New York, perhaps) offered even higher cellulosic subsidies, they would "win" the contest. If Massachusetts had relatively high cellulosic subsidies, we might quickly fill our 10% capacity with cellulosic once production begins.

As with biodiesel, the state subsidies merely compound high federal ethanol subsidies of \$1.00 to \$1.20 per gallon of E100. (Koplow, 2007). These estimates pre-date the quintupling of the federal renewable fuels mandate in December 2007, which is expected to drive up prices of ethanol blends to consumers substantially, providing a

large incremental subsidy to ethanol producers. A number of incremental subsidies to cellulosic producers have also been proposed at the federal level that would further boost subsidization levels.

However, even with the much more favorable greenhouse gas emissions profile of cellulosic fuels relative to those from corn, and ignoring rising subsidies from recent legislation, the cost per mt of CO₂-equivalent avoided remains high -- in excess of \$100. This is 4-8 times the cost of reductions in other sectors based on offset prices on the European Climate Exchange and roughly 30-80 times the cost of offsets on the Chicago Exchange.

Cellulosic Ethanol Subsidy Metrics	Low	High
Total State and Federal subsidies based on MA ethanol consumption, \$mils/yr	328	381
Total subsidies, (\$/gallon of E100)	\$ 1.23	\$ 1.43
Total subsidies, (\$/mt CO ₂ -eq)	109	197
Comparable reductions: ECX prices (mt CO ₂ -eq)	4	8
Comparable reductions: CCX prices (mt CO ₂ -eq)	28	84
Total subsidies/vehicle year (\$/vehicle year)	95	110

Source: Earth Track calculations based on Koplow (2007), DOT (2006), EPA (2006), EIA (1/30/08).

4. Massachusetts needs to analyze policy options in a more rigorous manner, and using a disinterested party

A press release issued by the Governor's office on November 5, 2007 to announce the new biofuel subsidy plan referenced findings from a report prepared for Congressman Bill Delahunt by the Northeast Biofuels Collaborative (NBC) (Patrick, 11/5/07). Delahunt's own press release goes even further, noting that:

The report served as the framework for legislation that Governor Patrick, Senate President Murray, and Speaker of the House DiMasi announced today..." (Delahunt, 11/5/07).

With no disrespect meant to NBC's research team, their effort was not paid for by Delahunt, but financed instead by NBC's members in the biofuels industry. Were lawmakers to roll out hundreds of millions of dollars in new subsidies to oil based on a report by the American Petroleum Institute; or to nuclear based on crack analysis by the Nuclear Energy Institute, they would have been pilloried from all sides. Independent analysis of all of our energy options is just as important for alternative fuels (which now includes coal gasification, by the way, according to Section 20 of House Bill 4373 on Green Communities that passed the MA House on 15 November) as for conventional fuels. This is a critical step for the state to take if their proposals are to have any credibility going forward.

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