



Bio-Fooled

Why a Biodiesel Heating Mandate
Is Wrong for New York

by Jude Clemente

Public policy in recent years has promoted the increased use of renewable biofuels or biofuel additives as an energy source, particularly for transportation purposes. The blending of biofuel with petroleum-based heating oil has been mandated by some state and local governments—including New York City, which since November 2012 has required that heating oil sold in the city contain two percent biodiesel content, or B2.

A current proposal in the New York State Legislature would impose the B2 heating oil mandate on a statewide basis; meanwhile, a newly introduced bill in the New York City Council would boost the required biofuel content of heating oil sold in the city to 20 percent (B20).

Biofuel use is being promoted on the grounds that it will produce less pollution, improve energy efficiency and open new markets for New York farmers. In fact, as detailed in this paper:

- Biofuels produce significantly higher emissions of nitrous oxide, a particularly potent greenhouse gas.
- Biofuels are less efficient, requiring more fuel be burned to produce the same energy output.
- Biofuels drive up the costs of heating and food.

Instead of promoting an inefficient fuel supplement with its own added pollution component, New York should encourage homes and businesses to shift to more efficient furnaces. And it should promote development of the infrastructure needed to produce and deliver cleaner-burning natural gas as an alternative to oil.

INTRODUCTION

Biofuels are a renewable energy source derived from organic material—either directly from plants, or indirectly from agricultural, commercial, domestic, and industrial wastes. Over the past decade, public policy at the federal level, as well as in some states, has tilted in favor of requiring use of biofuels to displace petroleum-based fossil fuels as a way to reduce emissions of greenhouse gases and to enhance energy security by reducing dependence on foreign oil.

Policy support for biofuel mandates stems from the Renewable Fuel Standard established under the U.S. Energy Policy Act of 2005. The Energy Independence and Security Act of 2007 significantly expanded the biofuel mandate volumes, setting a national production goal of 36 billion gallons by 2022. The U.S. Environmen-

tal Protection Agency (EPA) is responsible for establishing and implementing regulations to ensure compliance.

America's most widely used biofuel is ethanol, an alcohol compound produced from the fermentation of sugars, which is commonly blended with gasoline. Another common type of biofuel is biodiesel, which can be used in oil-based heating plants as well as engines powered by petroleum-based diesel fuel.

Biodiesel feedstock can come from spent restaurant grease, used cooking oil and virgin vegetable oil, but is most commonly derived from soybeans. Biodiesel can be blended and used in a variety of concentrations commonly expressed as percentages – such as B2, which denotes a mix of two percent biodiesel and 98 percent petroleum diesel.

(The mixture of biodiesel and heating oil used in building furnaces is marketed as Bioheat®, a registered trademark.)

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Effective in 2012, New York City local law has required all heating oil dealers in the city to sell a B2 biodiesel blend in place of traditional heating oil. A bill imposing a similar B2 mandate on the entire state was passed by the New York State Legislature in 2013 but vetoed by Governor Andrew Cuomo.

The proposed B2 heating oil mandate has been revived in the 2015 New York State legislative session. If passed, the state mandate would take effect in October 2015 in Nassau, Suffolk, Westchester and Rockland counties, in addition to New York City, and in the rest of the state effective July 2016.¹

New York State currently supports biofuel use through tax credits. These include a production credit of 15 cents per gallon of biofuel produced at plants located in the state, after the first 40,000 gallons per year presented to market. The annual credit limit is \$2.5 million per entity, and can be claimed for four consecutive tax years per biofuel plant. Individual New York consumers can claim a tax credit of a penny a gallon for each percent of biodiesel blended with conventional home heating oil, up to a maximum of 20 cents per gallon.

The combined cost to the state of both credits is projected at just \$3 million in 2015. However, Cuomo's veto of the 2013 bill expressed concern over the "potential negative impact on the state's financial plan" of a B2 mandate, "because all consumers of heating oil would be able to claim a \$0.02 credit for each gallon of heating oil purchased."² He did not oppose the B2 mandate in principle, however, suggesting it be considered in the context of the budget. To address that issue by minimizing the revenue impact, the latest version of the proposed legislation raises the tax credit threshold to a 5 percent biodiesel mix.

But B2 mandates are just the beginning, and the

rush to significantly increase biofuels in heating is already underway. For example, a recently introduced local law now in committee in the New York City Council would increase the requirement in heating oil from B2 to B5 for all buildings in New York City by October 2016, and then scale up to B20 by 2030.³

Consumers will pay a heavy price for such mandates. Far from being cleaner, biofuels are worse for the environment, have higher greenhouse gas emissions, reduce energy efficiency, increase costs for both fuel and food, have eroding energy security benefits, and run counter to New York's State Energy Plan.

1. COST AND EFFICIENCY ISSUES

A major hurdle to commercialization of biofuels is their cost in comparison to petroleum-based fuels. Lower energy density and the rising price of raw materials due to mandates make biofuels more expensive than conventional petroleum-based fuels.

Heating oil with 2 percent biodiesel content, also known as B2, generally costs three to five cents more per gallon than conventional fuel.

Biofuels reduce energy efficiency because they require more fuel to produce the same amount of heat. Biodiesel, for instance, has 38 megajoules (MJ) of energy per kilogram (MJ/kg),

compared to 46 MJ/kg for petroleum-based heating oil (Figure 1).⁴ The greater the content of biofuels, the lower the energy density, defined as the amount of energy stored in a unit of volume. Lower energy density reduces energy efficiency, which in turn means higher costs and more frequent deliveries.

A biofuel mandate would therefore contradict New York's State Energy Plan, which identifies "the implementation of clean energy options and the increased adoption of energy efficiency across customer groups and sectors" as key environmental and public health goals.⁵

B2 mixtures generally cost around 3 to 5 cents per gallon more than traditional heating oil, ac-

According to Wesson Energy, an energy auditing firm that promotes the use of biodiesel. Costs generally rise by one to two cents for every percentage point of biodiesel in the mix, so a B20 mix costs 20 to 30 cents more per gallon.⁶

Several states have enacted or considered biodiesel mandates. However, closest to New York, Massachusetts suspended its two percent biodiesel heating mandate in 2010, with the state's Department of Energy Resources concluding that "implementing a minimum biofuel content requirement in...heating fuel is not feasible on the basis of unreasonable cost."⁷ Estimating that a mandated B2 blend would add three cents per gallon to heating fuel costs, the department settled on a voluntary B2 program.⁸

Even at the low-end estimate of a few pennies a gallon, the higher price of biodiesel heating adds up to several dollars a month for a home using 600 gallons of heating oil a year.

Biodiesel mandates are a particularly bad idea for New York State, where 33 percent of all families (2.7 million) and tens of thousands of businesses use heating oil, the largest such market in the country.⁹

New York already has the highest heating oil costs in the country, averaging \$3.30 a gallon for the month of March, compared to just \$2.77 in Pennsylvania.¹⁰ New Yorkers buy over 1.2 billion gallons of residential fuel a year.¹¹

Thus, including the existing New York City share, a statewide biofuels mandate adding three to five cents per gallon to the cost of heating oil would effectively amount to a \$36 million to \$60 million tax on residential customers alone.¹² Going to the B20 blend would push the premium closer to 40 cents per gallon, or \$240 in extra annual heating costs for a home using 600 gallons of the higher mixture.

A statewide B2 mandate would cost New York industrial and commercial users over \$6 million annually, according to one estimate.¹³ These firms, which are ineligible for the consumer tax credit, already pay an extra eight cents a gallon because of New York's existing state law requiring them to use ultra-low sulfur diesel fuel, at an estimated cost of \$24 million annually.¹⁴

Biodiesel mandates also would make New York even more dependent on higher cost energy imported from other states. Over 70 percent of U.S. biodiesel is produced in the Midwest.¹⁵ Due to small-scale production and the corrosive nature of biodiesel, the fuel is usually transported by trucks, which cost more, are less efficient, and less safe than the pipelines that

transport New York's heating oil, from petroleum production sites to refineries to distributors. Moving liquid fuels by truck can cost five times more than transport by pipeline, an extra \$7 per barrel (42 gallons) for a 240-mile trip.¹⁶ As of February 2015, the U.S. Energy Information

Administration (EIA) reports that New York has just one biodiesel producer, with no proven annual production capacity.¹⁷

Due to the biofuel mandate, demand is surging for used cooking oil from deep fryers ("yellow grease"), which is regarded as one of the more sustainable types of biodiesel. Restaurant owners used to have to pay someone to take their spent cooking oil away. Now, this unrefined, raw material alone is referred to as "liquid gold," fetching almost \$2.50 per gallon in New York by 2008, when it traded for just 45 cents in 2000.¹⁸

In contrast, the use of heating oil in the region is declining as more natural gas has entered the market, and heating oil prices are projected to drop 20 percent by 2016.¹⁹ But the Centre for Alternative Technology, a British think

The practical limitations of biodiesel include its more corrosive nature and a tendency to gel in cold weather, which must be prevented with costly additives and fuel heaters.

tank that favors practical solutions for energy sustainability, says that using cooking oils in place of heating oil is “not really an effective solution, for both financial and environmental reasons,”²⁰ mainly because of lower energy content, the small amount that can be produced sustainably, and higher costs.

Additional costs of biofuels often go unaccounted. A study released in January by the World Resources Institute found that biofuel mandates fail to consider their opportunity costs, and calls the world’s capacity to make biofuels from waste products “modest” since we “have much more cost-effective strategies for reducing greenhouse gas emissions and making more energy today.”²¹ Taken to extremes, biofuels can add extraordinary costs; for example, the Government Accountability Office last year found that the U.S. Department of Defense had been paying up to \$150 per gallon on alternative jet fuels made from algae when oil-based jet fuels cost just \$3 per gallon.²²

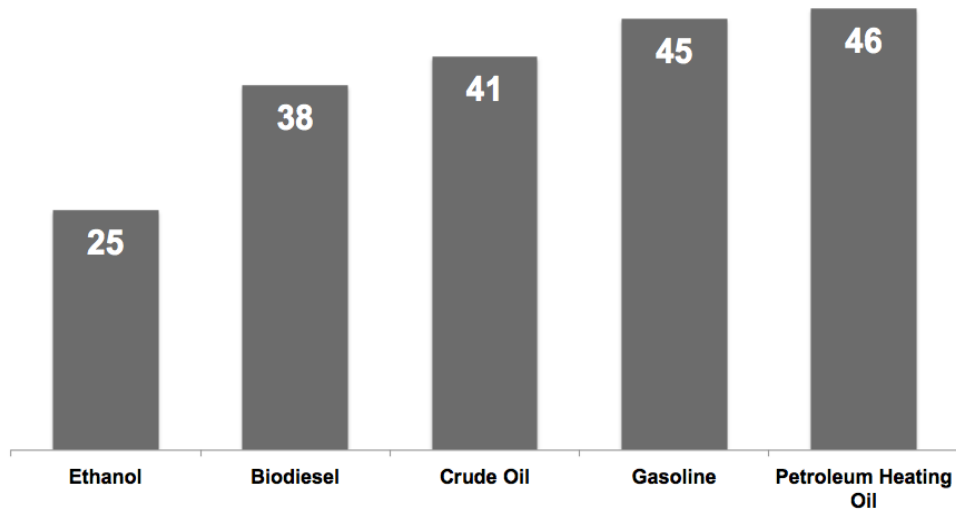
The inconsistency of biofuels and the varying strength of blends are highly problematic, particularly from an energy efficiency standpoint. The EPA, for instance, has delayed its 2014,

2015, and 2016 renewable fuel standard blending volumes for biofuels due to higher costs, equipment damage, costly repairs, and supply shortages. The federal Biodiesel Mixture Excise Tax Credit for biodiesel producers has been an on-again-off-again proposition, leading to unreliable supply and higher prices.

The practical shortcomings of biodiesel as an energy alternative manifest themselves in cold weather. The higher the concentration of biodiesel, for instance, the greater the chance of fuel “gelling” in low temperatures, which must be prevented with costly additives and fuel heaters. In addition, vegetable oil can damage fuel pumps because its viscosity (a measure of a fluid’s resistance to flow) is 10 to 20 times greater than that of heating oil.²³

Without significant government subsidies and mandates, there would be no appreciable market for biofuels—as evidenced by the substantial negative impact on the biodiesel market due to the EPA’s decision to delay the release of the Renewable Fuel Standard blending mandates.²⁴

Figure 1: Energy Density of Selected Fuels
Megajoules of energy per Kilogram (MJ/Kg)



Source: Author’s calculations, developed from U.S. Department of Energy

2. ENVIRONMENTAL ISSUES

Claims that biofuel mandates reduce greenhouse gas emissions and enhance energy security have no factual basis. If anything, when it comes to emissions, the opposite is true.

A vital concept when considering alternatives to petroleum is the energy return on investment (EROI), or how much net energy gain resides in the finished product compared to the total energy that was used in its production. EROI measures the net energy use in the complete process of producing, distributing, and consuming an energy source. A fuel's EROI directly impacts the price, rate of adoption, economic development rate, and the environmental benefits accrued to the society that consumes it. EROI and energy density are critical environmental concepts, which illustrate that even traditional petroleum products have a "green" side compared to some alternatives.

Petroleum has an EROI of 16, versus just 5.5 for biodiesel from soybeans.²⁵ Less potent non-petroleum alternatives, such as biodiesel, are less efficient and thus require greater levels of resource consumption.

The Assembly sponsor's memorandum in support of the proposed B2 biodiesel heating mandate in New York says that the "introduction of biodiesel will result in cleaner and healthier air by reducing...carbon dioxide, sulfur dioxide and nitrous oxide."

However, various studies have found that biodiesel actually produces higher emissions of nitrous oxide, a potent greenhouse gas. Nitrous oxide has almost 300 times greater impact on warming the atmosphere than does carbon dioxide (CO₂).²⁶

Meanwhile, nitrous oxide isn't the only nitrogen-oxygen compound produced in greater abundance by biofuels. As one peer-reviewed

academic study noted in 2013, "biodiesel produces higher NO_x emissions compared to ordinary diesel fuel."²⁷ Nitrogen oxide exposure concentrations near neighborhoods and roadways are of particular concern for susceptible individuals, including people with asthma, children, and the elderly.

In fact, total life-cycle greenhouse gas emissions from biofuels can be virtually impossible to measure. According to the authors of another recent academic study:

Significant disagreement and controversies exist regarding the actual energy and greenhouse gas savings of biofuels displacing fossil fuels. A large number of publications that analyze the life-cycle of biofuel systems present varying and sometimes contradictory conclusions, even for the same biofuel type.²⁸

While "direct" emissions can be lower for biofuels, their more abstract "indirect" releases can equate to higher life-cycle emissions. In other words, greenhouse gases are emitted throughout the various stages in the production and use of biofuels: in producing the fertilizers, pesticides, and fuel used in farming; during chemical processing, transport and distribution; and inclusive of final use. This process involves a significant amount of fossil energy along the entire supply chain that often makes biofuels less environmentally friendly than petroleum-based fuels.

From bean-crushing through transport, 18 MJ of fossil energy are needed to make only one liter of soybean-based biodiesel, which equates to about half a liter of gasoline, according to one best-case analysis cited in a scholarly journal.²⁹

The unaccounted environmental problems that indirectly arise from biofuel use are significant too. They include: 1) direct conflicts between

Burning biodiesel fuel produces higher emissions of nitrous oxide, a potent greenhouse gas with nearly 300 times the atmospheric warming impact of carbon dioxide.

land for fuels and land for food, 2) other land-use changes, 3) water scarcity, 4) loss of biodiversity, and 5) nitrogen pollution through the excessive use of fertilizers.

Other counts in the indictment of biofuels include:

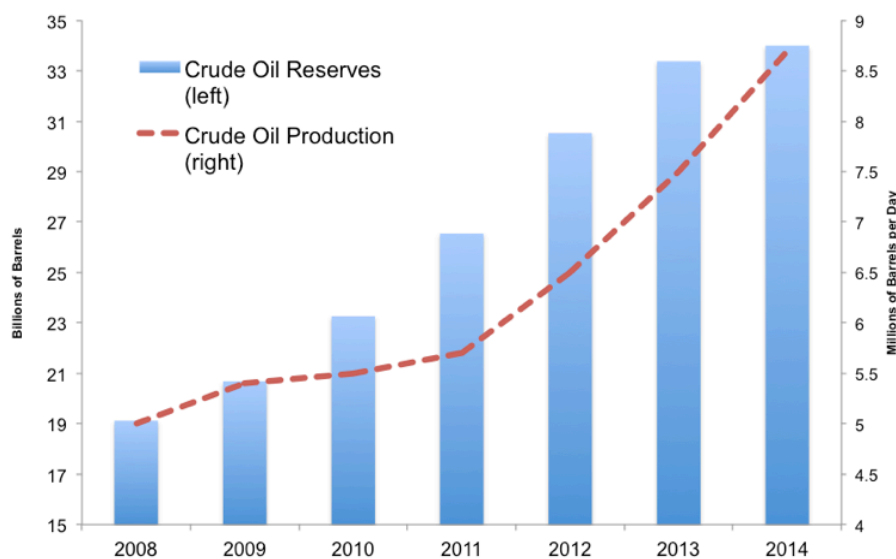
- Soy-based biodiesel, which accounts for about 60 percent of U.S. biodiesel production,³⁰ is especially land-intensive—taking five times the acreage of ethanol crops to produce the equivalent amount of biofuel energy.³¹
- The Union of Concerned Scientists found that “biofuels have serious secondary impacts that undermine their climate benefits and pose a threat to water resources.”³²
- The Intergovernmental Panel on Climate Change reported in 2014 that indirect emissions from biofuels “can lead to greater total emissions than when using petroleum products.”³³
- A 2010 study commissioned by the European Union focused on indirect emissions and found that CO₂ emissions from biofuels are four times higher than those of petroleum-based products.³⁴ Thus, soybeans

grown in America would have an indirect carbon footprint of 340kg of CO₂ per gigajoule, compared to just 85kg for petroleum products.³⁵ The International Institute for Sustainable Development has also estimated that the climate benefits from replacing petroleum fuels with biofuels are basically zero.³⁶

- The environmental group Greenpeace says that Western biofuel policy “threatens the climate.”³⁷
- A 2013 study by Chatham House, a British think tank, was even more blunt: “Biodiesel from vegetable oils is found to be worse for the climate than fossil diesel.”³⁸

The energy security benefits of “getting off oil” at all costs continue to be eroded. Neighboring Mexico and Canada account for nearly half of America’s oil imports, prompting a Citigroup analysis to suggest that North America could be the “New Middle East.”³⁹ America’s energy revolution is in full swing thanks to the deployment of horizontal drilling and hydraulic fracturing (“fracking”) that release and extract oil and natural gas from dense shale rock formations.

Figure 2: The Rising Production and Availability of U.S. Oil



Source: U.S. Energy Information Administration

“North America is at the forefront of a sweeping transformation in oil and gas production.”

Maria van der Hoeven
Executive Director
International Energy Agency

While U.S. biodiesel production is expected to peak in 2020, the EIA's Annual Energy Outlook 2015 has gas production increasing by nearly 50 percent from 2013 to 2040, led by the Marcellus shale play. The Marcellus shale underlies 18,700 square miles in New York State alone,⁴⁰ although shale gas production in the state has been temporarily prevented by a state government ban on fracking.

The outlook for U.S. oil production and domestic availability of petroleum is now as good as it has been in decades. For example, last year U.S. crude oil production reached nearly 9 million barrels per day, compared to 5 million in 2008.⁴¹

The EIA notes that about 27 percent of the petroleum consumed by the United States in 2014 was imported from foreign countries, "the lowest level since 1985."⁴² Persian Gulf countries now supply less than 10 percent of the oil consumed in the U.S.⁴³

And while the demand trend for spent cooking oil is up considerably, the domestic use of crude oil is declining. By 2025, the International Energy Agency projects that total U.S. oil production will increase by over 20 percent, while

demand will drop by about eight percent, as new vehicle efficiency standards will cut usage.⁴⁴

And the U.S. is hardly running out of oil (Figure 2). Proven U.S. oil reserves stand at 34 billion barrels, compared to 20 billion in 1945, despite the extraction of 185 billion barrels over the period.⁴⁵ Experts at Rice University conclude that the nation could have 2 trillion barrels at its disposal, enough to fully cover our current needs for 285 years.⁴⁶

3. FOOD FOR FUEL?

Biofuels increase food prices and therefore do not have the positive benefits for humanity claimed by proponents. In 2012, a top United Nations official called upon the U.S. to suspend its biofuels mandates to help avert a looming global food shortage.⁴⁷

The use of biofuels increases the level and volatility of food prices, in the United States and around the world. Consider ethanol: FarmEcon, a consultancy, found that with mounting ethanol mandates and production since 2006, food prices have sharply risen. The typical Ameri-



can family of four has been paying \$2,055 more in annual food bills than would have been the case if costs had kept to the 1950-2005 trend.⁴⁸

The government-incentivized use of spent cooking oil as a fuel competes with other uses of the commodity; this can increase its price as a fuel and increase its cost as an input (such as for livestock farmers, who spray it on feed to fatten their animals) to other food uses.

Biodiesel demand alone has been blamed for an increase of 74 cents per bushel, or roughly 8 percent, in the price of soybeans. Higher-cost soybeans have large ripple effects throughout the economy, because of their use in hundreds of other products ranging from crayons to animal feeds. (Ninety-eight percent of U.S. soybean meal byproduct goes to feed pigs, chickens and cows.⁴⁹)

Energy markets now regularly compete with the food sector for vegetable oil; soybean prices and energy prices have been statistically linked, creating a floor price for the soy oil used as a biofuel feedstock. Rising food and energy prices are already dangerously expanding the problem of “food insecurity.”

The U.S. food price index is now approaching 250, compared with 100 in the mid-1980s.⁵⁰ Higher food and energy costs also function like a regressive tax on the most vulnerable segments of the population, notably minorities and the elderly.

New York’s senior citizens, most of whom live on fixed incomes, are particularly susceptible to health problems in cold weather. “People do die from extreme cold. It’s not a secret. The elderly turn down the heat...it happens all the time,” notes Mark Wolfe, executive director of the National Energy Assistance Directors’ Association.⁵¹ Although Americans keep hearing about the dangers of a warming planet, the Centers for Disease Control and Prevention reports that cold kills twice as many Americans as extreme heat.⁵²

CONCLUSION

“There is growing concern about the role of bio-fuels in rising food prices...and doubts about the climate benefits. This has led to serious questions about their sustainability.”

—Renewable Fuels Agency⁵³

Biofuel mandates are a bad idea. Biofuel mandates undermine the state’s energy plan by reducing energy efficiency and generating higher greenhouse gas emissions. Biofuels inevitably would cost more and would contribute to higher food prices. With a disproportionate impact on poor people at home and abroad, biofuel mandates do not improve the environment but will surely add costs to New York’s businesses and families.

A better approach to improving the efficiency of residential, commercial and industrial heating plants is summarized in consumer advice from Britain’s Centre for Alternative Technology: “think about replacing an oil boiler with a different heating system, rather than replacing the fuel with a bio-oil alternative.”⁵⁴ To this end, New York State’s tax incentives could be revised to encourage more efficient systems rather than less efficient fuels.

Indeed, natural gas is increasingly replacing oil as the preferred heating fuel in the Northeast. Instead of mandating biofuels, New York would be much better served to reconsider its ban on shale gas production and continue to support an expansion of gas infrastructure, especially more pipeline capacity. This would give more residents access to the cheaper, and cleaner natural gas that is rising in abundance in surrounding states.

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