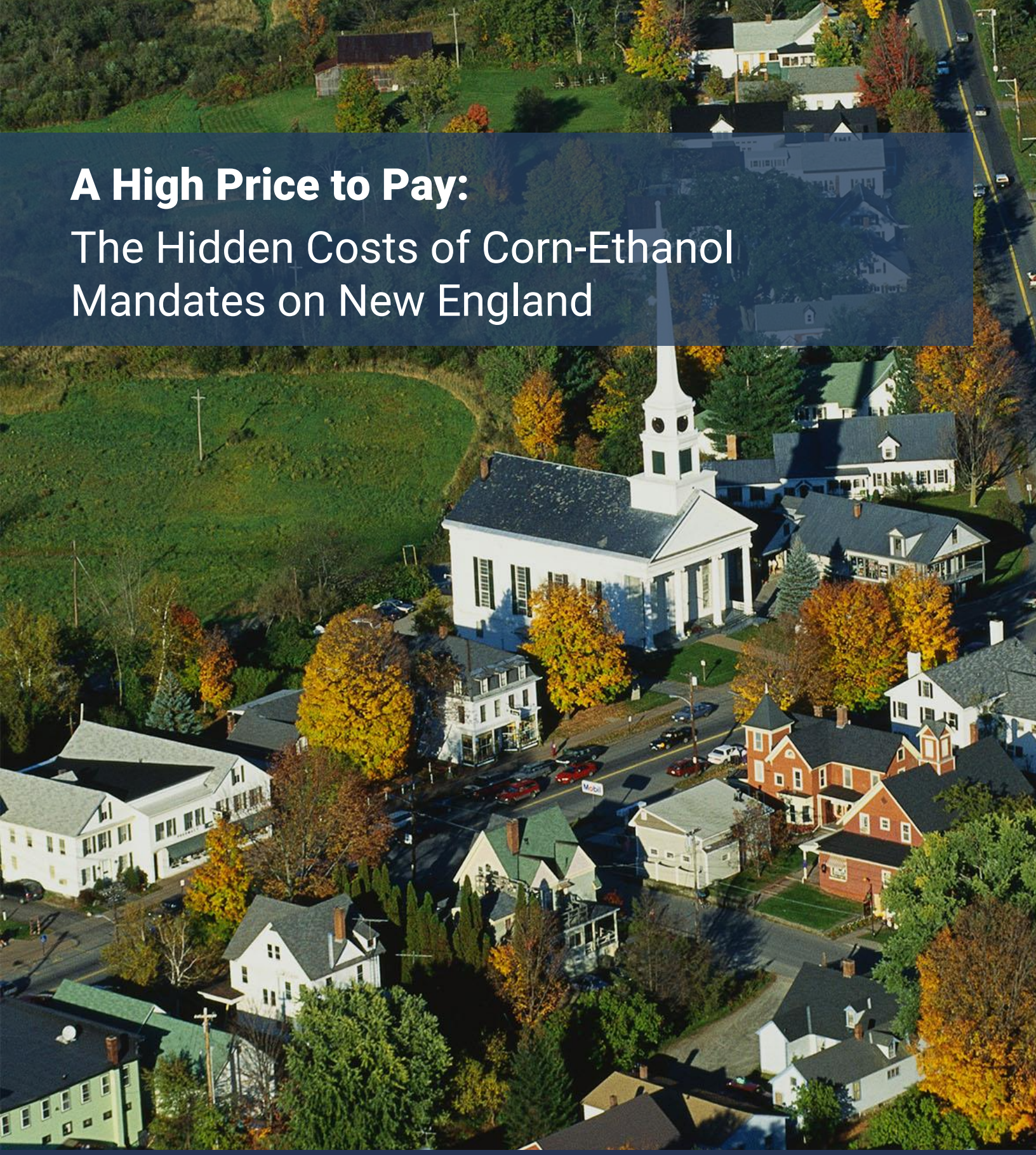

A High Price to Pay:

The Hidden Costs of Corn-Ethanol Mandates on New England

The Center For
Regulatory Solutions

SBE COUNCIL
Small Business & Entrepreneurship Council

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EXECUTIVE SUMMARY

On November 30, 2015, the United Nations (U.N.) will convene its annual Conference of the Parties meeting in Paris to discuss solutions for addressing climate change and reducing greenhouse gas (GHG) emissions. That same day, the Environmental Protection Agency (EPA) is expected to issue updated rules mandating that greater volumes of biofuels such as corn ethanol be added to the nation's fuel supply, a mandate that proponents say creates jobs, spurs economic growth and reduces GHGs.

Ten years removed from when the Renewable Fuel Standard (RFS) was first implemented, the science has never been clearer on whether forcing billions of gallons of corn-derived ethanol into our fuel tanks is an environmental winner: It is not. In fact, a **study[1] published** in the *Proceedings of the National Academy of Sciences* last year found that ethanol-fueled vehicles damage air quality up to 80 percent more than vehicles fueled by gasoline.

Increasingly challenged on environmental grounds, proponents of the RFS often attempt to make the case that increased corn production, driven by the RFS mandate, has benefited the country economically. Indeed, **one recent study**[2] commissioned by the Renewable Fuels Association, a leading ethanol industry group, found that more than 86,000 direct jobs were created thanks to the RFS, with an additional 300,000 jobs created indirectly, or "induced." All told, the study found that the ethanol industry contributed $44 billion to the country's gross domestic product (GDP) in the year 2013 alone.

But while some[3] have questioned the methodology behind the ethanol industry's jobs reports, empirical evidence supports the general contention that the RFS, which forces motorists to consume ever-increasing volumes of ethanol in their fuel, has likely contributed to positive economic outcomes for the six or seven states that produce **between 60 and 70 percent** of the nation's corn crop.[4]

But what about everyone else? How have the RFS and federal corn consumption mandates impacted non-corn states, and the small businesses struggling to stay competitive in the global economy? According to a new study commissioned by the Center for Regulatory Solutions (CRS), a project of the Small Business and Entrepreneurship Council (SBE Council), the RFS's increasingly aggressive ethanol

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[1] Christopher Tessum, Jason Hill, and Julian Marshall, "Life cycle air quality impacts of conventional and alternative light-duty transportation in the United States," Proceedings of the National Academy of Sciences of the United States of America 111 (2014), http://www.pnas.org/content/111/52/18490.full.

[2] Renewable Fuels Association, "New Study Shows Powerful Impact of Ethanol Industry on Jobs & Energy Independence," February 18, 2014, http://www.ethanolrfa.org/2014/02/new-study-shows-powerful-impact-of-ethanol-industry-on-jobs-energy-independence/.

[3] Nathanael Greene. "Corn ethanol tax credit: most expensive way to create jobs ever?" *Switchboard* (Natural Resources Defense Council Staff Blog). April 7, 2010. http://switchboard.nrdc.org/blogs/ngreene/corn_ethanol_tax_credit_most_e.html.

[4] Rob Cook, "States That Produce The Most Corn," Beef2Live, September 21, 2015, http://beef2live.com/story-states-produce-corn-0-107129.

mandates are hurting New England's economy, particularly small businesses, and driving up transportation costs for millions of people who live in Massachusetts, Connecticut, Vermont, Rhode Island, Maine and New Hampshire.

To quantify the drag on the New England economy created by the RFS, SBE Council commissioned an analysis of the costs that have already been imposed on New England residents since the RFS mandate began in 2005. It also took a look at what future costs might be over the next decade based on projected ethanol consumption in the six states.

At its core, the analysis finds that New Englanders were shortchanged nearly $ 6.29 billion in GPD opportunity from 2005 to 2014 due to the RFS, and should expect to to be deprived of $13.67 billion in future lost opportunity from 2015 to 2024. In other words, the RFS, by the time it is finally done, will extract almost $20 billion from New England's economy and transfer that wealth directly back to ethanol producers in the Midwest.

The negative impact on household budgets and businesses that this wealth transfer precipitates will manifest itself in myriad ways – starting with lower demand for labor, costing the New England economy thousands of jobs every year. According to the analysis, the RFS will reduce labor income by $7.3 billion, and labor demand by 141,000 job-years, from 2005 to 2024. That is the equivalent of 7,050 lost jobs per year, each and every year over a 20-year time period.

Most of these economic harms derive from the fact that ethanol and gasoline are priced similarly, but ethanol provides consumers with only **two-thirds** of the energy content[5] per gallon compared to gasoline. In other words, New Englanders are paying the same price for ethanol as gasoline, but are getting one-third less mileage for each gallon of ethanol they consume. From 2005 to 2014, corn ethanol mandates, in the form of higher fuel prices, cost New England consumers anywhere from $200 million to over $2.5 billion, depending on the state in which they live. The 10-year cost across all six states totaled more than $5.6 billion.

In addition to higher fuel costs, RFS mandates have driven up corn prices over time.[6] While this increase in prices may benefit agribusinesses and farmers that produce and sell corn, those in the livestock farming sector who depend on corn and corn-related products for animal feed have seen the increase in prices affect their bottom lines. Take New England dairy farmers for example, who make up 64 percent of the livestock industry in New England. In just 2012 alone, New England farmers spent over $63.4 million more for animal feed than they otherwise would have as a result of increased corn prices due to RFS mandates.

[5] U.S. Department of Energy, "Ethanol," https://www.fueleconomy.gov/feg/ethanol.shtml.
[6] Trading Economics, "Corn," http://www.tradingeconomics.com/commodity/corn.

Until recently, the debate over the RFS has predominantly been driven by political considerations, rather than factual or scientific ones. But that is now beginning to change, with even citizens of corn states increasingly concerned about both the environmental and economic damage that aggressive ethanol mandates have caused in their communities.

Recently, U.S. Rep. Peter Welch (D-Vt.) was joined by 184 of his House colleagues on both sides of the aisle, and from corn states like Ohio, to **urge**[7] EPA not to breach the so-called "blend wall" by increasing ethanol mandates.

Residents of New England states, to their credit, have been skeptical of the RFS from the start. But until now, very little analysis has been produced that quantifies in real terms how the national corn ethanol mandates have actually affected New England families.

This report sheds new light on these overlooked impacts and clearly shows that the RFS is, was, and will continue to be a bad deal for New England.

[7] Bill Flores and Peter Welch et al., Letter to Gina McCarthy, November 4, 2015, http://flores.house.gov/uploadedfiles/rfs-letter-to-admin-mccarthy-11-4-2015.pdf.

INTRODUCTION

On November 30, 2015, the U.S. Environmental Protection Agency (EPA) is **expected**[8] to mandate an increase in the volume of of corn ethanol that must be blended into our nation's fuel supply. EPA is acting under the authority of the Renewable Fuel Standard (RFS), which has been a drain on the New England economy, siphoning off billions since it was established by Congress in 2005. Since that time, the RFS has transferred billions of dollars out of the New England economy, hurting households and small businesses, and shifted that wealth instead to a handful of states known as the "Corn Belt," resulting in high costs but little environmental gain. This has impacted household budgets and small businesses throughout the New England region, ranging from dairy farmers, to restaurants owners, to truckers, to retail outlets and mom and pop stores. The money drained from the region due to the RFS mandate could have been used to grow New England businesses and jobs, or to invest in better roads, infrastructure and other essential services.

The Center for Regulatory Solutions (CRS), a project of the **Small Business and Entrepreneurship Council**[9] (SBE Council), has long advocated for a reduction in year-by-year RFS targets until it can be phased out completely. In comments to the EPA in 2014, CRS president Karen Kerrigan stated: "Clearly, the RFS mandate makes no sense, especially given the substantial costs imposed on businesses and our economy, the environmental doubts, and the revolutionary changes in the energy position of the United States."

This report builds on SBE Council/CRS's previous work and advocacy on the RFS, and examines the economic impact of ethanol mandates across New England and on the region's six states – Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont. The report also takes a closer look at some of the more recent scientific research that's been produced specific to the corn ethanol issue that raises needed questions about its previously assumed benefits.

THE RFS: A BAD DEAL FOR NEW ENGLAND

To quantify the drag on the New England economy created by the RFS, CRS commissioned an analysis of the costs the RFS has already imposed on the region, as well as additional costs projected for the next decade. The analysis shows the RFS has cost $6.29 billion in lost GDP from 2005 to 2014, and is set to cost an additional $13.67

[8] U.S. Environmental Protection Agency, "Renewable Fuel Standard Program: Standards for 2014, 2015, and 2016 and Biomass-Based Diesel Volume for 2017," June 10, 2015, https://www.federalregister.gov/articles/2015/06/10/2015-13956/renewable-fuel-standard-program-standards-for-2014-2015-and-2016-and-biomass-based-diesel-volume-for.

[9] Karen Kerrigan, "EPA Comments: Proposal to Reduce Ethanol Blend for Renewable Fuel Standard in 2014," January 27, 2014, http://www.sbecouncil.org/2014/01/27/comments-to-epa-on-proposal-to-reduce-ethanol-blend-for-renewable-fuel-standard-in-2014/.

billion in lost GDP over the next 10 years. In other words, the RFS will extract a total of almost $20 billion in lost GDP opportunity from New England's economy and transfer that wealth to corn farmers and ethanol producers in the Midwest. The negative impact on household budgets and businesses across the economy reduces demand for labor, costing the New England economy thousands of jobs every year. These serious consequences contradict the claims of RFS proponents, who argue the mandate is an unqualified economic success story.

FUEL COSTS

While ethanol and gasoline are priced similarly, ethanol provides consumers with only **two-thirds of the energy content per gallon** compared to gasoline.[10] In other words, New Englanders are paying the same price for ethanol as gasoline but are getting one-third less mileage for each gallon of ethanol they consume. This translates into an economic loss for motorists. As Table 1 illustrates, over the 10-year period between 2005 and 2014, corn ethanol mandates have cost consumers (in the form of higher fuel prices) anywhere from nearly $200 million to over $2.5 billion, depending on the state. All told, the RFS has cost New England motorists more than $5.6 billion over the past 10 years.

Table 1: Additional Fuel Costs in New England due to RFS Mandates (millions of 2014 $)

State	2005-2014	2015-2024	Total
CT	1,440	2,812	**4,252**
MA	2,571	5,383	**7,953**
ME	431	1,366	**1,797**
NH	560	1,366	**1,926**
RI	404	723	**1,127**
VT	196	562	**759**
Total	**5,602**	**12,212**	**17,814**

Unfortunately, this hemorrhaging of resources is projected to continue into the next decade, and actually accelerate the extent to which New England motorists are forced

[10] U.S. Department of Energy, "Ethanol," https://www.fueleconomy.gov/feg/ethanol.shtml.

to pay for the privilege of filling their tanks with an inferior fuel source. The CRS analysis shows that RFS mandates could cost the region's consumers more than $12 billion between 2015 and 2024, as shown in column 2 of Table 1 above. The bulk of these costs are borne by consumers in Connecticut and Massachusetts, whose share is $8.2 billion, or two-thirds of the New England total.

This regional "ethanol tax" is not insignificant. Higher fuel costs across New England due to ethanol mandates averaged roughly $890 million annually. Needless to say, this significant sum of money could have been put to better use in myriad ways by households and businesses, or been used to support essential public services such as education. For example, had the $890 million been directed towards teachers' salaries, each of New England's 161,000 teachers in K-12 public schools could have made an extra $5,500. But instead of being invested back into the New England economy – whether by businesses or in public services, this money was lost to the RFS.

At the state level, the size of these higher fuel costs may be better understood by comparing them with significant state budget expenditures. The higher fuel costs in each state, made possible by federal corn ethanol mandates, are roughly equivalent to:

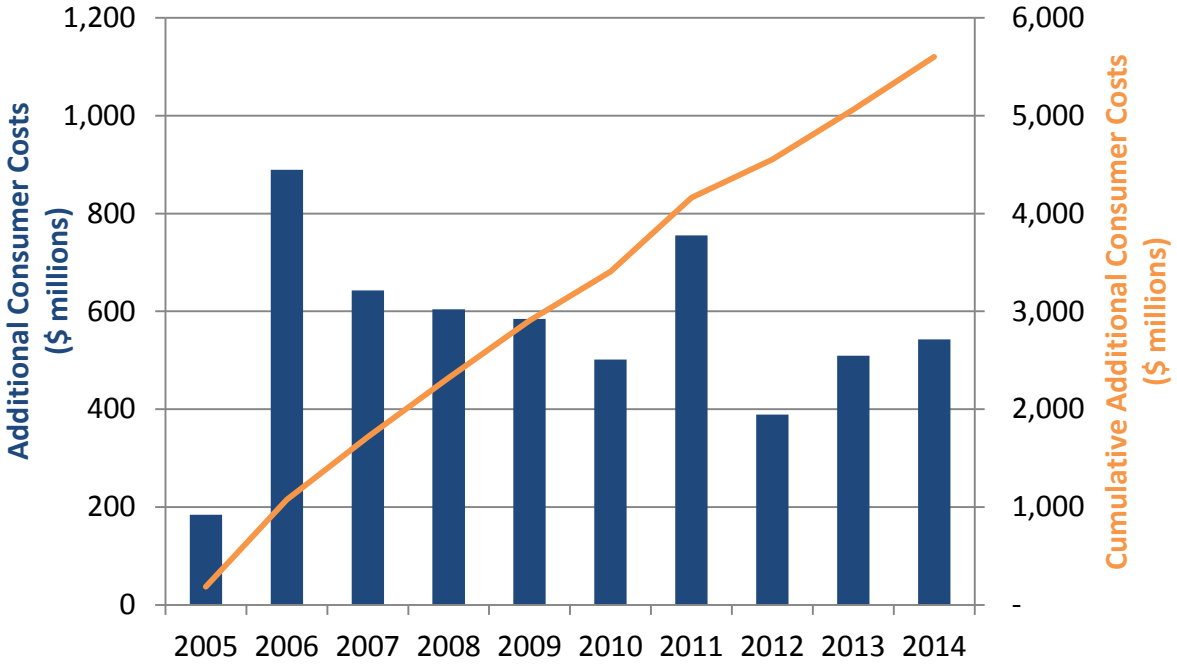
- 55 percent of Connecticut state funding on highways and bridges in fiscal year 2016.
- 80 percent of Maine's "critical priorities" budget for the elderly and disabled, nursing homes, primary care access and mental health services.
- 150 percent of Massachusetts state funding for community colleges for fiscal year 2016.
- 200 times New Hampshire's spending on the Office of Veterans Services in fiscal year 2016.
- 57 percent of Rhode Island funding for natural resources agencies, including the Department of Environmental Management and the Coastal Resources Management Council.
- 84 percent of Vermont spending on traffic and safety operations in 2016 and 2017 combined.

Again, the loss of hard-earned capital as a result of the RFS means New Englanders suffer in numerous ways. Precious capital is being drained from the region that small buisnesses need to invest in their firms or to stay afloat. Public services potentially lose out when resources are artificially diverted.

In New England as a whole, RFS mandates have cost consumers an additional $200 million to $900 million annually between 2005 and 2014 (as shown in Figure 3). New England experienced a dramatic increase in ethanol consumption between 2005 and

2006 due to the states' decision to **ban non-ethanol oxygenates from entering the fuel stream**,[11] explaining the large shift in consumer fuel costs between those years.

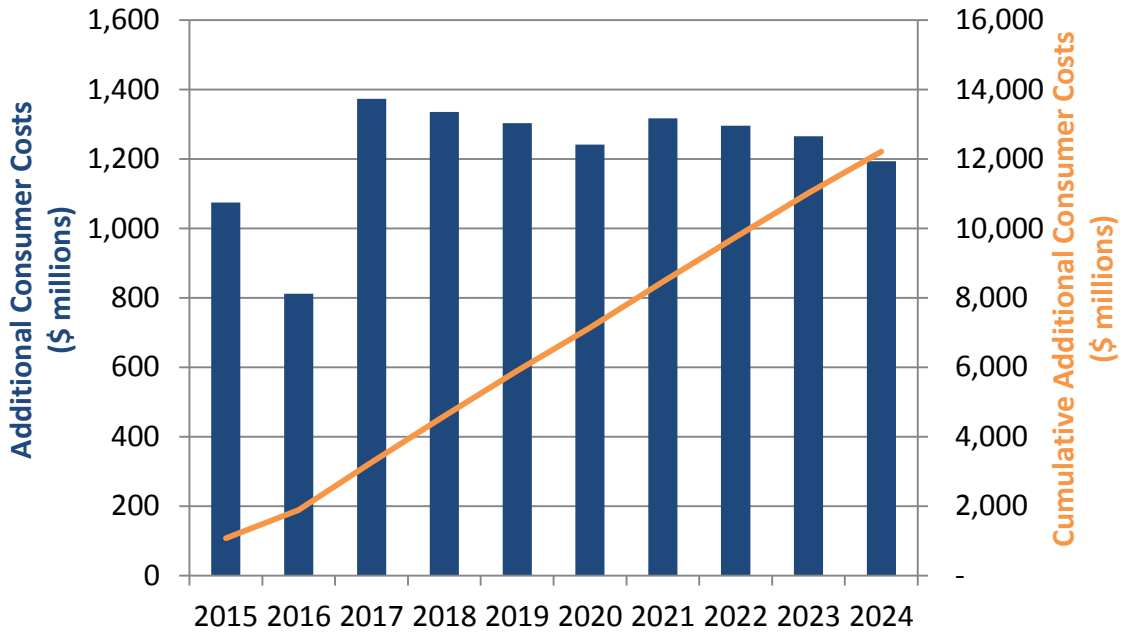
Figure 3: Annual & Cumulative Additional Consumer Fuel Costs (Direct) in New England due to RFS Mandates 2005-2014 (millions of 2014 $)



[11] U.S. Environmental Protection Agency-New England, "News to service stations and distributors regarding ethanol- blended RFG and non-ethanol blended-RFG," April 2006, http://www3.epa.gov/region1/airquality/pdfs/EthanolBlendNewEngland.pdf.

Drawing on data from the U.S. Energy Information Administration's (EIA) Annual Energy Outlook (AEO), Figure 4 demonstrates the consistent trend of increasing consumer costs from 2015 to 2024.

Figure 4: Annual & Cumulative Consumer Costs (Direct) in New England due to RFS Mandates 2015-2024 (millions of 2014 $)



Most of the additional fuel costs that come from the RFS mandate (just over $17.8 billion) between the years 2005 and 2024 will be felt by households and businesses. But the analysis reveals significant impacts in both the commercial and industrial sectors as well, as depicted in Table 2.

Table 2: Share of Total Additional Consumer Costs Associated with RFS Mandate between 2005-2024 (millions of 2014 $)

Sector	Additional Cost	% of Total
Commercial	$21	0.1%
Other	$172	1.0%
Industrial	$251	1.4%
Transportation-Commercial	$911	5.1%
Transportation-Household	$16,459	92.4%
Total	**$17,814**	**100.0%**

"Combine a rising and rigid volumetric ethanol mandate with declining gasoline use, and the result is that this year refiners hit that 10 percent 'blend wall.' … Hitting the blend wall means consumers pay more at the pump."[12]

Jason Bordoff
Director of Columbia University's Center on Global Energy Policy
July 26, 2013

[12] Jason Bordoff, "Well intentioned but flawed, U.S. biofuel policy in need of change," Reuters, July 26, 2013, http://www.reuters.com/article/2013/07/26/us-column-bordoff-mcnally-idUSBRE96P13N20130726.

AGRICULTURE IMPACTS

> *"Our research has also shown that, since 2005, the major drivers of increased food prices are conversion of corn to ethanol and financial speculation in food commodities."*
>
> **Dominic Albino**[13]
>
> ***New England Complex Systems Institute***
>
> ***April 10, 2014***

The RFS has impacted agriculture costs in the six New England states. Predictably, rising prices for corn beget increased prices for corn-based animal feed. Animal feed accounts for the largest share of agricultural production expenses, according to the U.S. Department of Agriculture's (USDA) 2012 Census of Agriculture Farm Economics report.[14] Accordingly, increases in feed prices can have a significant impact on farmers' ability to remain in business. For farmers in New England, just a small increase in corn-related feed prices could collectively amount to several million dollars lost annually.

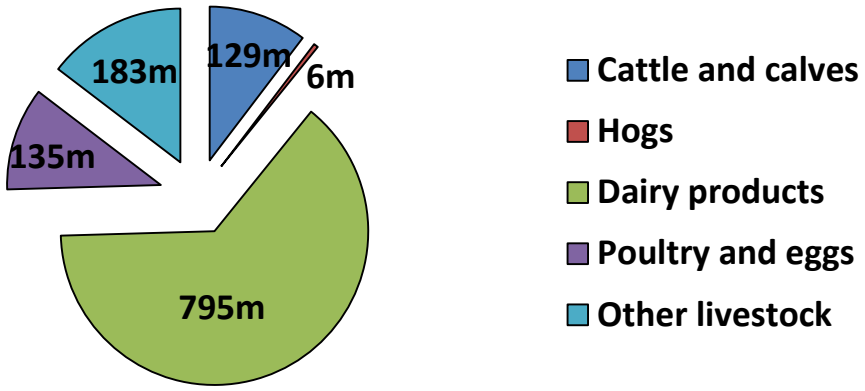
The dominant livestock industry in New England is the dairy business. Using the year 2012 as an example, livestock farming and its products contributed $1.2 billion to the New England economy. At $800 million in sales, or 64 percent of total cash receipts for New England's livestock industry, dairy farming represents the largest livestock industry sub-sector and is a major contributor to the overall regional economy (as shown in the chart below).[15]

[13] Dominic Albino, "Rep. Welch: Ethanol mandate 'killing' farmers," The Hill, April 10, 2014, http://thehill.com/policy/energy-environment/203186-rep-welch-ethanol-mandate-hurts-farmers-small-engines.

[14] U.S. Department of Agriculture, "2012 Census of Agriculture: United States Summary and State Data," May 2014, http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_US/usv1.pdf.

[15] U.S. Department of Agriculture, "2013 Farm Cash Receipts up 4 percent in New England," January 26, 2015, http://www.nass.usda.gov/Statistics_by_State/New_England_includes/Publications/cashreceipts.pdf.

Figure 5: Cash Receipt by Livestock Industry Sector in New England (2012)



*Source: "**News Release - 2013 Farm Cash Receipts up 4 percent in New England**," U.S. Department of Agriculture, National Agricultural Statistics Service, January 26, 2015.*

Among the New England states, Vermont ranks first in production, accounting for roughly $501 million in total dairy sales in 2012.[16]

According to the USDA, feed is dairy farmers' single biggest production expense, costing New England farmers $292.6 million in 2012, or about 38 percent of their operating expenses.[17] Using an USDA dairy feed price formula and 2012 average commodity prices, we estimate that corn purchases accounted for approximately 54 percent of dairy farmer's feed costs.[18] The table below shows how this value is derived.

[16] See Technical Appendix for regional breakdown of farming industry cash receipts by state.
[17] U.S. Department of Agriculture, "2012 Census of Agriculture: United States Summary and State Data." See Technical Appendix for regional breakdown of dairy farming feed cost by state.
[18] See the Technical Appendix for more information on the formula. Table 4 below shows the calculation of corn's contribution to the feed expense.

Table 3: Estimate of Corn's Contribution to 2012 Dairy Feed Prices using the Milk Protection Program Feed Price Formula[19]

	2012 average price (USD) [A]	Multiplier [B]	Contribution to feed cost (USD) [A] x [B]	Contribution to feed cost (%)
Corn	6.65 per bushel	1.07280	7.14	54%
Soybean meal	439.87 per ton	0.00735	3.23	25%
Alfalfa hay	205.33 per ton	0.01370	2.81	21%
Feed cost			**13.18**	

Source: Corn and alfalfa prices are the average monthly prices published in "Agricultural Prices," U.S. Department of Agriculture, National Agricultural Statistics Service, published monthly for 2012. Soybean meal price is average of daily 2012 prices from "Soybean Meal, Cent. Ill., rail, ton 54%" price series reported at **www.quandl.com**, a *Wall Street Journal* database.

Assuming the average New England farmer's feed stock made up of at least 54 percent corn by value (see calculation in Table 3 above), then corn accounted for $158 million of New England dairy farmers' feed costs in 2012 and $100 million to Vermont farmers' costs.

To determine how much extra New England dairy farmers paid for their corn feed thanks to the RFS, the CRS analysis relied on a recent **University of Tennessee study**, which determined that without the RFS or the Blender's Tax Credit (BTC), corn crop prices would have been 40 percent lower on average between 2008 and 2014.[20] It's worth noting that other reports have come up with similar conclusions. That is, the RFS and the associated corn ethanol boom have directly increased corn prices anywhere from 22-36 percent.[21]

Based on the data presented in those analyses, the RFS cost New England dairy farmers approximately $63.4 million more than they might have otherwise had to pay under a non-RFS scenario. Vermont dairy farmers in particular get hit hard under the mandates, spending an extra $40 million on feed in 2012 alone.

[19] This formula derivation is discussed further in the Technical Appendix.

[20] Daniel De La Torre Ugarte and Burton English (University of Tennessee, Institute of Agriculture). "10-Year Review of the Renewable Fuels Standard: Impacts to the Environment, the Economy, and Advanced Biofuels Development." October 14, 2015. http://beag.ag.utk.edu/pub/TenYrReviewRenewableFuelStandard_1015.pdf, Figure 9, page 9.

[21] Scott Baier, Mark Clements, Charles Griffiths et al., "Biofuels Impact on Crop and Food Prices: Using an Interactive Spreadsheet," March 2009, http://www.federalreserve.gov/pubs/ifdp/2009/967/ifdp967.pdf. Colin Carter, Gordon Rausser, and Aaron Smith, "Commodity Storage and the Market Effects of Biofuel Policies," 2015, http://arefiles.ucdavis.edu/uploads/filer_public/81/ba/81ba961d-fe7b-4629-8511-1b78fdf3b527/carter_rausser_smith.pdf. Bruce A. Babcock (Iowa State University), "Impact on Ethanol, Corn, and Livestock from Imminent U.S. Ethanol Policy Decisions," November 2010, http://www.card.iastate.edu/publications/dbs/pdffiles/10pb3.pdf.

Inother words, a 40 percent increase in corn prices – which is at the upper end of the scale – would lower farm margins by at least $63.4 million.The bottom line is that higher corn prices due to the RFS have increased costs for livestock farmers. Vermont and Maine see the largest losses under this policy, with costs increasing $40 million and $10.5 million, respectively, under a 40 percent corn price increase scenario.

Table 4: Calculation of Potential Savings in Feed Expenses by State (millions of 2012 $)

	New England	CT	ME	MA	NH	RI	VT
No RFS/BTC (40% reduction in corn price)	63.4	5.0	10.5	3.3	4.3	0.2	40.0

These results are consistent with general industry trends since the early 2000s. As reported by the USDA, "livestock producers' expenditure on feed more than doubled from $24.8 billion in 2001 to $54.6 billion in 2011."[22] Furthermore, research from Iowa State University's Center for Agricultural and Rural Development finds that "the price of corn is the most important factor in determining the cost of feeding livestock."[23] So while farmers in the Midwest are benefiting from higher corn prices, livestock farmers in New England are paying the price for that expensive commodity in the form of expensive feed.

"My view is that food should be put in your belly, not in your gas tank. We should try to solve our energy crisis in a way that we don't cause another problem. … We need to break with that policy now, and go down an alternative route, one that doesn't cause another problem like raising food prices."[24]

Rep. Jim McGovern (D)

August 26, 2008

[22] Jayson Beckman, Allison Borchers, and Carol A. Jones (U.S. Department of Agriculture), "Agriculture's Supply and Demand for Energy and Energy Products," May 2013, http://www.card.iastate.edu/publications/dbs/pdffiles/10pb3.pdf.

[23] Babcock, Bruce (Iowa State University). "Impact on Ethanol, Corn, and Livestock from Imminent U.S. Ethanol Policy Decisions." November 2010. http://www.card.iastate.edu/publications/dbs/pdffiles/10pb3.pdf.

[24] "Lost in the supermarket: McGovern talks corn ethanol, food prices (and Hillary)," Blue Mass Group, August 26, 2008, http://bluemassgroup.com/2008/08/lost-in-the-supermarket-mcgovern-talks-corn-ethanol-food-prices-and-hillary/.

OVERALL ECONOMIC IMPACTS

In the previous sections, the analysis explored how higher fuel costs impacted the region and how more expensive corn-based feed raised cost for New England farmers. In this section, the overall economic impact of these higher costs is further explored. To do that, the CRS analysis applied the IMPLAN input-output economic model. The IMPLAN model is licensed by IMPLAN Group LLC, a firm which works with governments, universities and other public and private organizations to assess the impacts of policies and programs across all industry sectors, along with government data and forecasts compiled by the EIA.

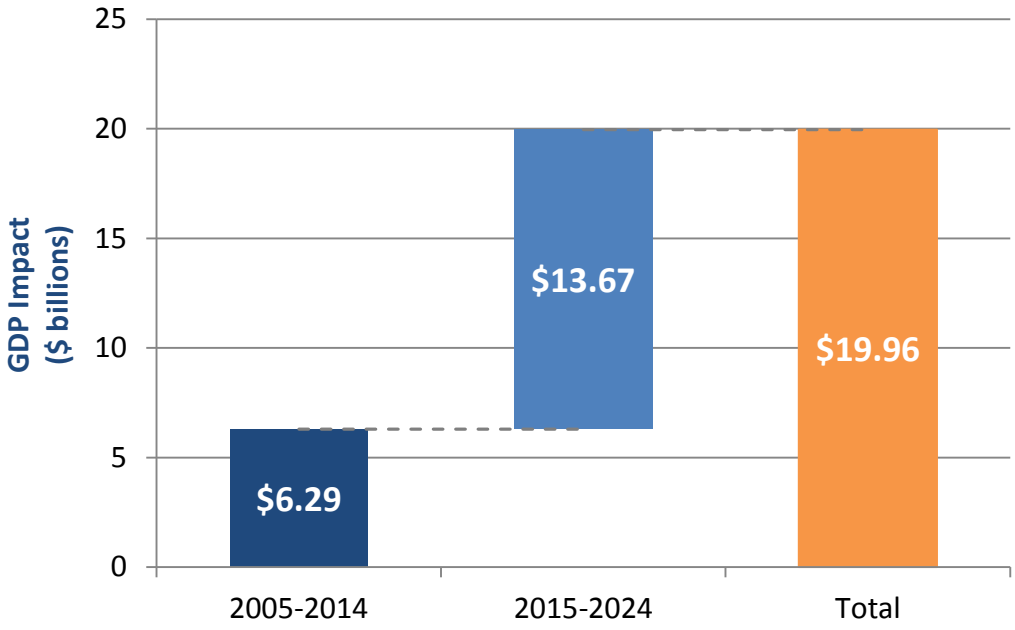
According to CRS's economic modeling, the cumulative costs of the RFS from 2005 to 2024 amount to a stunning $20 billion in lost GDP opportunity in New England. This huge economic blow equates to a loss of $7.3 billion in labor income and over 7,000 jobs annually (141,000 job-years total). These findings are presented together in Table 5.

Table 5: Aggregate Economic Impacts due to Reduced Household Spending in New England, 2005-2024

Economic Impact	Aggregate Economic Lost Opportunity
GDP	$19.96 billion
Labor Income	$7.28 billion
Annual Employment	7,050 jobs

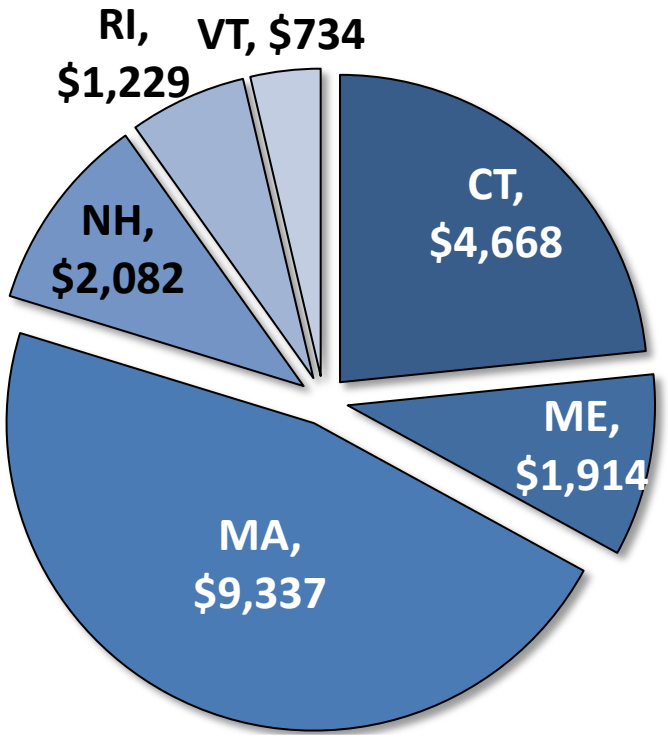
As shown in Figure 6 below, the losses in household income associated with higher fuel prices contribute to a cumulative loss in GDP opportunity of $6.29 billion over the past 10 years. This GDP opportunity loss results from household spending on a fuel that originates outside of New England instead of goods and services originating in New England, which would have boosted the region's economy. If EPA continues to enforce the mandate, the region can look forward to a much bigger cumulative lost opportunity GDP impact of $13.67 billion over the next decade.

Figure 6: Cumulative GDP Lost Opportunity in New England, 2005-2024 (billions of 2014 $)



Each state's share of the lost-GDP burden is roughly proportional to its population. Figure 7 breaks out each state's share of the nearly $20 billion impact to New England's GDP from 2005 to 2024.

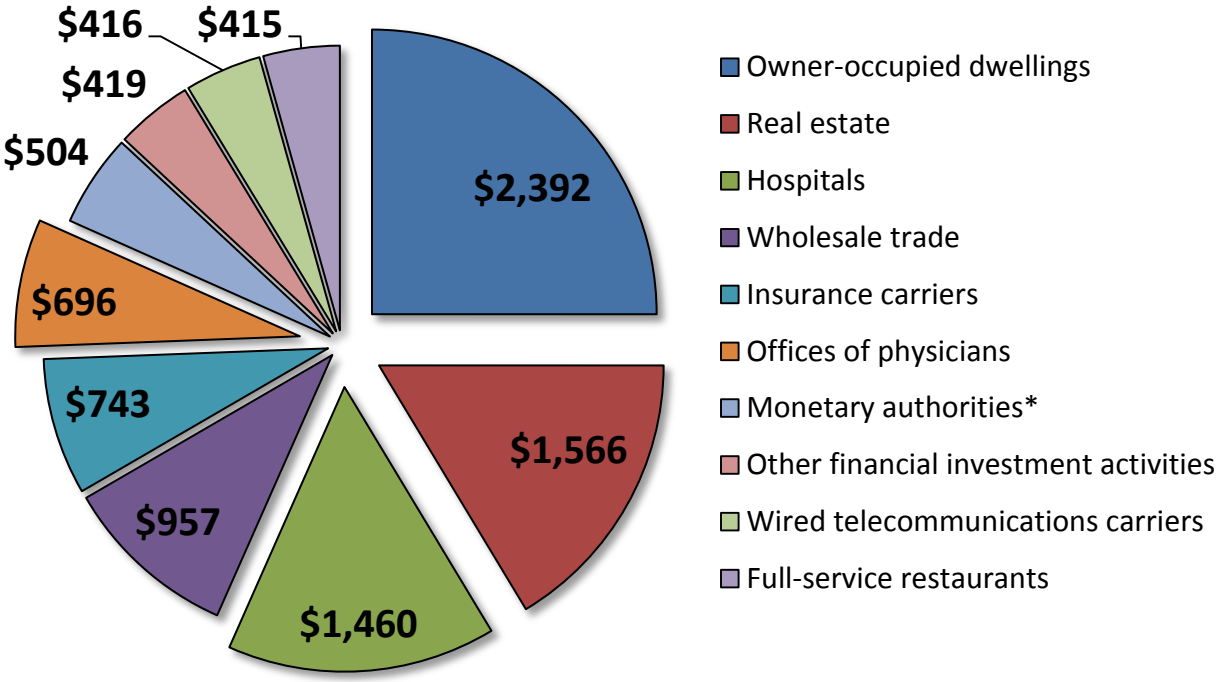
Figure 7: Breakdown of GDP Impact in New England by State (2005-2024) (millions 2014$)



As the chart demonstrates, Massachusetts pays the lion's share of the RFS's costs ($9.3 billion), while Connecticut ($4.6 billion) and Maine ($1.9 billion) round out second and third place on this ignominious list, respectively.

Using IMPLAN's modeling, the CRS analysis also examined how these GDP losses would be felt across a number of important industry sectors. Figure 8 shows the top 10 most impacted sectors and the GDP lost opportunity each sector will experience between 2005 and 2024. For example, the real estate sector (including owner-occupied dwellings) would be forced to endure a $2.39 billion hit, while healthcare (hospitals and physician offices of physicians) would lose over $2 billion. In other words, New England residents would have spent the money that went towards corn ethanol on local real estate and better local health care.

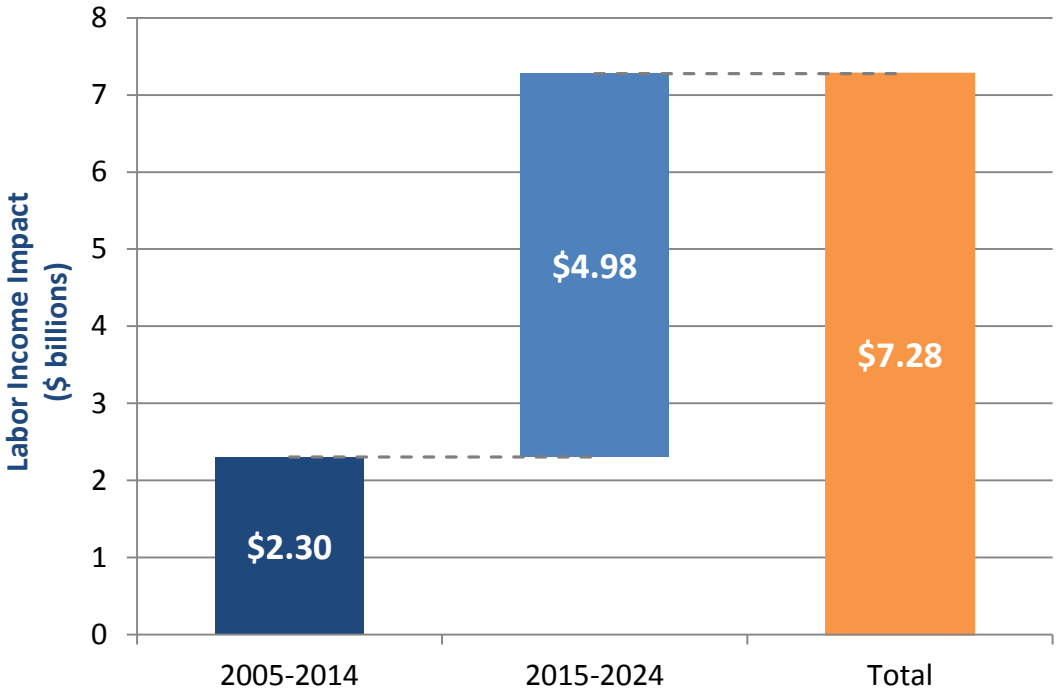
Figure 8: Breakdown of GDP Impact by Industry Sector (Top 10) in New England from 2005-2024 (millions of 2014 $)



All Other Sectors Total GDP Impact: $10,396 million
***Includes depository credit intermediation**

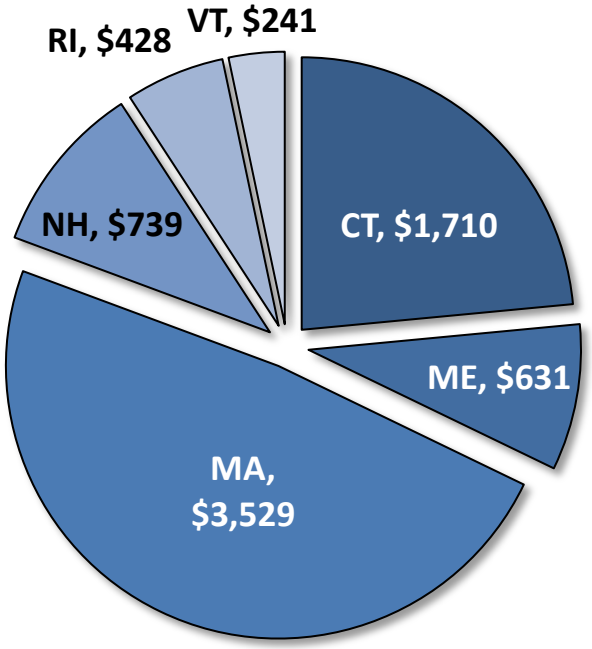
CRS also used IMPLAN modeling to project the size and distribution of the loss of labor income due to the RFS mandate. As previously described, IMPLAN modeling suggests that the RFS resulted in a $2.3 billion loss in labor income over the last 10 years. If EPA enforces the RFS targets set by Congress the model shows another $4.98 billion in lost labor income across New England. Over 20 years, this adds up to a $7.28 billion loss for the region's workers.

Figure 9: Labor Income Impact in New England due to RFS Mandates (billions of 2014 $)



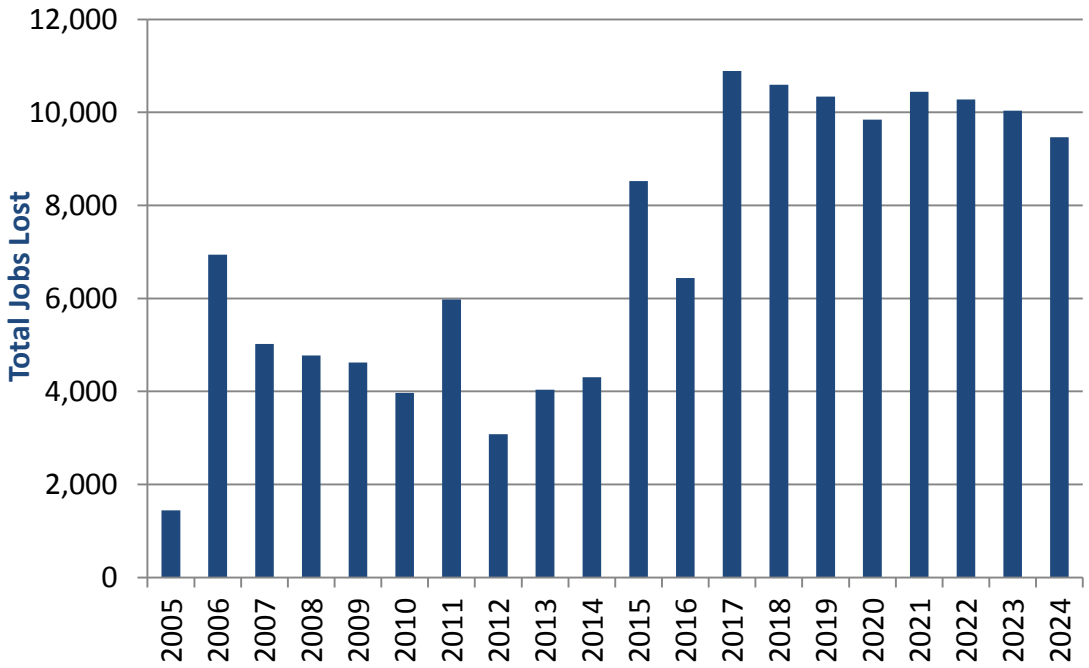
As with GDP impacts, the distribution of these losses varies across New England states, as illustrated in Figure 10.

Figure 10: Breakdown of Labor Income Impact in New England by State (2005-2024) (millions 2014$) Total $7.28 billion



The CRS analysis also used IMPLAN to forecast the lost employment due to repressed economic growth and reduced labor demand. The model shows an annual loss of more than 141,000 jobs over the 20-year period between 2005 and 2024. On average, those costs translate roughly into 7,050 lost jobs per year. But, as Figure 11 shows, the bulk of the job loss impact has yet to be realized – it will spike in 2017 and stay close to 10,000 lost jobs annually thereafter unless the RFS is fundamentally reformed.

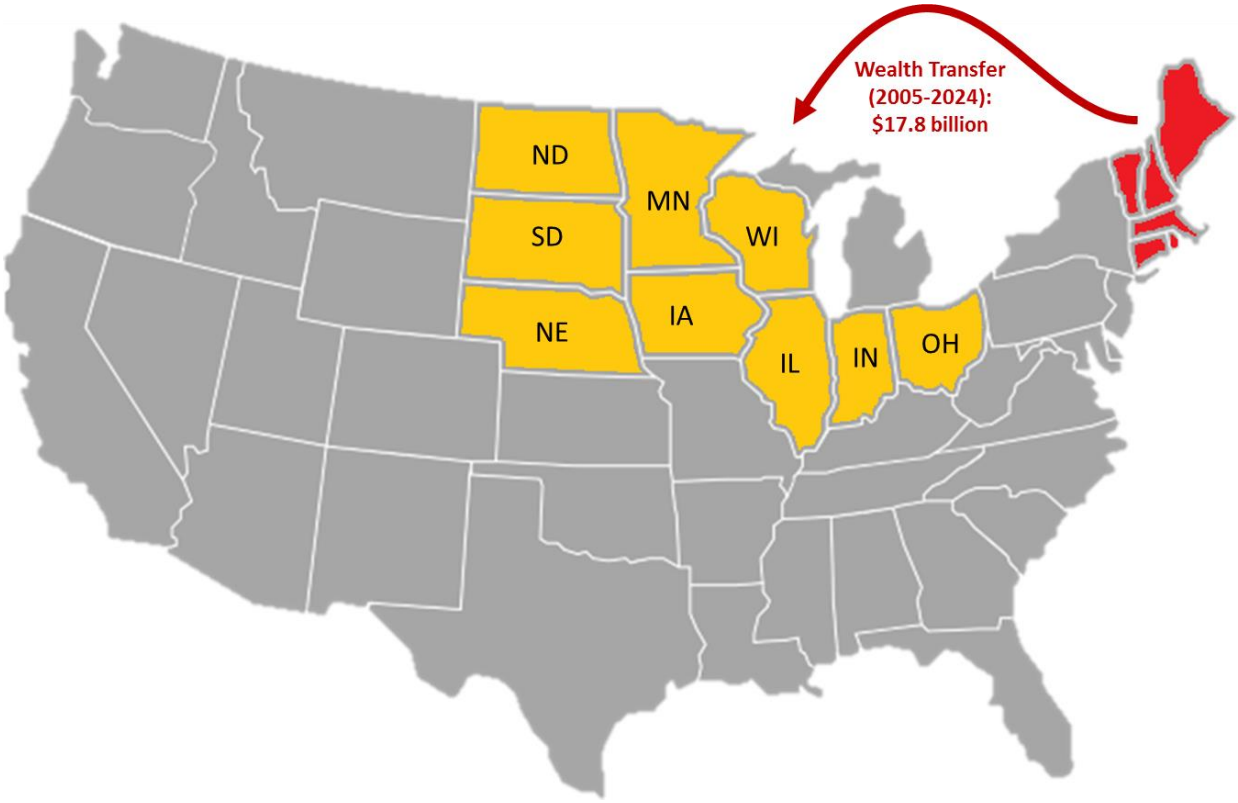
Figure 11: Labor Loss in New England by Year



WEALTH TRANSFER

As the CRS analysis demonstrates, the RFS has assessed major costs on the six New England states, and, at least heretofore, has provided very few benefits. Higher fuel prices, more expensive agricultural and farming inputs, and upward pressure on food prices have negatively affected New England's economy while benefiting the ethanol industry in the handful of corn states, as Figure 12 demonstrates.

Figure 12: Illustrative Wealth Transfer from New England to Corn & Ethanol Producing Regions



A **number of studies** produced over the past several years have discussed the negative impacts that the RFS has had from an environmental and economic standpoint.[25] A recent **study**[26] from the University of Tennessee on the national impacts of the RFS supports the findings of the CRS economic analysis. Using the POLYSYS model, Drs. Daniel De La Torre Ugarte and Burton English estimated the economic impact of the RFS over the past 10 years under various scenarios. The study finds that in 2014 alone, the RFS cost the U.S. economy $28.4 billion in lost GDP.

Additionally, the same study finds that the RFS pushed corn prices 40 percent higher than they would have otherwise been, and increased wheat and soybean prices by 13 percent. That's great news for the handful of agribusinesses and farmers in the Midwest that produce the overwhelming majority of these commodities and bad news for everyone else.

But despite the perception that the RFS has been an economic savior for the Corn Belt, the corn mandates continue to encounter vocal resistance even in the states that seem to benefit from them most. In Ohio, for example, diverse constituencies, like those in New England, have concluded that corn ethanol mandates are a bad deal. **Ohio Gov. John Kasich (R)** recently said the RFS "needs to be phased out" and the ethanol industry should "stand on its own."[27] This is stunning because Kasich is running for President and delivered these comments in Iowa, a major corn-producing state. Iowa is also the first, and among the most important, of the battleground states in the Republican presidential nomination process.

Yet even **agricultural officials** in Iowa have noted that "high corn prices have encouraged expansion of row crop production to lands which often are at greater risk for soil erosion." [28]

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[25] Center for Regulatory Solutions, "The Lost Decade: How Corn Ethanol Mandates Hurt Ohio's Environment and Economy," November 5, 2015, http://centerforregulatorysolutions.org/wp-content/uploads/2015/11/The-Lost-Decade-CRS.pdf.

[26] De La Torre Ugarte and English.

[27] America's Renewable Future, "Gov. John Kasich says RFS 'needs to be phased out'" [video], June 26, 2015, https://www.youtube.com/watch?v=B8sDul3qpxM.

[28] Iowa Learning Farms, "The Cost of Soil Erosion," January 2013, http://www.extension.iastate.edu/ilf/sites/www.extension.iastate.edu/files/ilf/Cost_of_Eroded_Soil.pdf.

> *"Because the everyday processing of ethanol requires vast amounts of coal and natural gas, and because the energy returned on energy invested is near break-even point, it is simply false to call ethanol a renewable fuel."*[29]
>
> **Kamyar Enshayan**
>
> ***Director, Center for Energy & Environmental Education, University of Northern Iowa, Cedar Falls***

U.S. Rep. Jim Jordan (R-Ohio), chairman of the conservative House Freedom Caucus, has said ethanol producers "should be able to stand on their own in the marketplace" and "I just don't believe the government should be subsidizing any alternative fuels."[30] On the Democratic side, U.S. Rep Marcia Fudge (D-Ohio) and the Congressional Black Caucus have called for RFS targets to be eased because they have "resulted in higher prices for corn and higher prices for feed and food."[31] And as far back as 2007, the Central Ohio chapter of the Sierra Club called corn ethanol a "bust" because of the amount of energy needed to produce it, the associated GHG emissions, and the land and water impacts of increased corn production.[32]

A recent CRS report on ethanol's environmental performance in Ohio helps explain some of these misgivings. The report shows corn-ethanol mandates have driven a 1.92 million metric ton increase in GHG emissions in Ohio since 2005, significant increases in ozone-forming pollution and more soil erosion, among other major environmental impacts. The RFS has also forced Ohioans to pay $4 billion in higher fuel costs so far, creating a harmful drag on the economy and job creation.

When opposition to corn ethanol mandates is this pronounced in a corn-growing state, that should tell us a lot. Because even in corn-growing Ohio, the RFS clearly benefits a very narrow set of economic interests, while everyone else picks up the tab.

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[29] Kamyar Enshayan, "'Renewable fuel' a term thrown around loosely," Des Moines Register, October 28, 2015, http://www.desmoinesregister.com/story/opinion/readers/2015/10/28/renewable-fuel-term-thrown-around-loosely/74663610/.

[30] Stephen Koff, "Ethanol debate puts conservative, corn-state congressmen in quandry [sic]," Cleveland.com, January 17, 2014. http://www.cleveland.com/open/index.ssf/2014/01/ethanol_debate_puts_conservati_1.html.

[31] Marcia Fudge et al., Letter to Gina McCarthy, January 24, 2014, http://www.api.org/~/media/Files/News/2014/14-April/CBC-RFS-letter-McCarthy.pdf.

[32] Anita Laurin, "Environmental Organizations Must Fight Bush's Ethanol Surge," May/June 2007, http://www.sierraclubcentralohio.org/2007_05_Ethanol.asp.

HOW WE GOT HERE

In July 2005, Congress passed and President Bush signed the bipartisan *Energy Policy Act*, which established the RFS. The RFS created a set of mandates – known as **Renewable Volume Obligations (RVOs)**[33] – that require ever-increasing volumes of ethanol to be added to the nation's fuel supply. Politicians supporting the ethanol mandate **promised**[34] a cleaner environment, enhanced energy security, and greater economic support for domestic farmers and rural communities across the country.

In 2007, after Democrats won control of the U.S. House and U.S. Senate, President Bush found common cause with the new congressional majority and greatly expanded the RFS mandates via passage of the *Energy Independence and Security Act* (EISA). Celebrating the agreement, then-Speaker of the House **Nancy Pelosi** said: "We will send our energy dollars to the Midwest, not the Middle East."[35]

In EISA, Congress **mandated**[36] that 100 million gallons of cellulosic ethanol – produced from non-starchy feedstock, such as grass, wood, and crop residues – had to be blended into the fuel supply in 2010, 250 million gallons in 2011, and then, from there, 16 billion gallons by 2022. The amount of ethanol derived from corn was capped at 15 billion gallons, starting in year 2015.

However, the targets set by Congress, which included a mandate for the consumption of cellulosic ethanol, have proved chimerical – because converting cellulosic feedstock into usable energy is much more challenging than starch-based crops, like corn.

[33] U.S. Energy Information Administration, "RINs and RVOs are used to implement the Renewable Fuel Standard," June 3, 2013, http://www.eia.gov/todayinenergy/detail.cfm?id=11511.
[34] George W. Bush, "President Signs Energy Policy Act," August 8, 2005, http://georgewbush-whitehouse.archives.gov/news/releases/2005/08/20050808-6.html.
[35] "House approves boost in auto fuel efficiency," Oklahoman, December 6, 2007, http://newsok.com/house-approves-boost-in-auto-fuel-efficiency/article/3177809.
[36] Randy Schnepf and Brent D. Yacobucci (Congressional Research Service), "Renewable Fuel Standard (RFS): Overview and Issues," March 14, 2013, https://www.fas.org/sgp/crs/misc/R40155.pdf.

In fact, commercial volumes of cellulosic ethanol were essentially non-existent in 2010 and 2011, and only 20,000 gallons were produced in 2012[38] by a company that subsequently filed for bankruptcy. In 2013, about 230,000 gallons of cellulosic biofuel were produced by KiOR,[39] which went bankrupt in 2014.[40] In effect, Congress mandated the use of a fuel that did not – and still does not – exist on a commercial scale. In the last few years, production of cellulosic ethanol has increased modestly, but nowhere near the amount mandated by EISA.

Despite this reality, EPA administrator Gina McCarthy, whose agency is responsible for implementing the RFS, is pledging to get the RFS mandate "back on track"[41] and eventually align its targets with congressional mandates. Pursuant to this strategy, EPA is proposing to set 2014 cellulosic levels to ones that align with what was actually produced and used as fuel, or 33 million gallons. For 2015 and 2016, EPA is proposing 106 million gallons in 2015 and 206 million gallons in 2016. This would allow set volumes[42] of corn ethanol to satisfy

> *"The RFS policy was originally intended to counter rising oil imports and heightened demand for gasoline in the mid-2000s. But an unanticipated boom in domestic energy production, improvements in vehicle fuel economy technologies, unanticipated market failure of some ethanol products, and the weak economy disproved the assumptions that drove energy policies at the time… To make matters worse, higher ethanol fuel blends have less energy content than regular gasoline, delivering lower fuel economy. Ethanol contains 33 percent less energy per gallon than gasoline and that forces Americans to return to the pump more often and spend more money."*[37]
>
> **Gregory M. Cohen**
>
> ***President and CEO of the American Highway Users Alliance***
>
> ***"Highway Users Alliance on federal policy affecting I-90 commuters," Cleveland.com, July 10, 2014.***

[37] Gregory M. Cohen, "Highway Users Alliance on federal policy affecting I-90 commuters," Cleveland Plain Dealer, July 10, 2014, http://www.cleveland.com/opinion/index.ssf/2014/07/highway_users_alliance_on_fede.html.
[38] U.S. Energy Information Administration, "Cellulosic biofuels begin to flow but in lower volumes than foreseen by statutory targets," February 26, 2013, http://www.eia.gov/todayinenergy/detail.cfm?id=10131.
[39] Rob Nikoewski, "Is cellulosic biofuel ready for prime time?" Iowa Watchdog, June 15, 2015, http://watchdog.org/223693/cellulosic-biofuel-ready/.
[40] Robert Rapier, "Congress Mandates Cellulosic Ethanol and The EPA Tracks It," Energy Trends Insider, May 20, 2015, http://www.energytrendsinsider.com/2015/05/20/where-are-the-unicorns/.
[41] Alex Guillen, "McCarthy vows to return to statutory RFS levels," Politico, September 17, 2015, http://www.governorsbiofuelscoalition.org/?p=14706.
[42] U.S. Environmental Protection Agency, "EPA Proposes Renewable Fuel Standards for 2014, 2015, and 2016, and the Biomass-Based Diesel Volume for 2017," May 2015, http://www2.epa.gov/sites/production/files/2015-08/documents/420f15028.pdf.

the total RFS mandate at 13.25 billion gallons, 13.4 billion gallons, and 14 billion gallons for 2014, 2015, and 2016 respectively. EPA is under court order to issue a final decision by November 30, 2015.

Despite the cost imposed on Massachusetts – $9.337 Billion between 2005 and 2024 – U.S. Sen. Ed Markey (D-Mass.) support the RFS. In a recent **letter**[43] to EPA, he and his cosigners argued:

> *The RFS has already proven to be an effective driver of alternative fuels and economic development. It has strengthened agriculture markets and created hundreds of thousands of jobs in the new energy economy, many of which are in rural areas. Setting strong biofuels volume requirements for 2014 and beyond will ensure this progress continues.*

His predecessor in the U.S. Senate, John Kerry, initially **rejected**[44] federal support for corn ethanol, but then quickly changed his tune when running for president in 2003: "I'm for ethanol, and I think it's a very important partial ingredient of the overall mix of alternative and renewable fuels we ought to commit to." [45] In a 2006 **interview,**[46] Kerry maintained that, "I did vote for ethanol. Every time we've had a chance to vote for it on the floor, I vote for ethanol." Kerry now serves as U.S. Secretary of State.

Presidential candidate and U.S. Sen. from Vermont Bernie Sanders was historically an ethanol opponent, having **written** the EPA in 2007 to "urge [the] Administration to carefully evaluate and respond to unintended public health and safety risks that could result from the increased use of ethanol as a 'general purpose' transportation fuel." And in 2011, Sanders proudly **boasted** that he had voted "to end the ethanol subsidy which would save taxpayers $3 billion for the remainder of this year."[47] But when asked for his views on the RFS during an **Iowa TV interview** earlier in 2015, Sanders sang a very different tune: "Iowa is one of the leaders in the country in wind and biofuels," he said. "So, I support the Renewable Fuel Standard."[48]

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[43] Erin Voegele, "37 senators issue letter in support of a strong RFS," Biomass Magazine, April 24, 2015, http://biomassmagazine.com/articles/11860/37-senators-issue-letter-in-support-of-a-strong-rfs.

[44] "John Kerry's Flip Flops," Free Republic, April 18, 2004, http://www.freerepublic.com/focus/news/1119904/posts.

[45] "Kerry Calls for Suspending Work of Base," Free Republic, September 28, 2004, http://www.freerepublic.com/focus/f-news/1096620/posts.

[46] "Exclusive! Sen. John Kerry Enters the 'No Spin Zone,'" Fox News, June 30, 2006, http://www.foxnews.com/story/2006/06/30/exclusive-sen-john-kerry-enters-no-spin-zone.html.

[47] Andrew Schenkel, "Ethanol unites extremes of the Senate," Mother Nature Network, June 17, 2011, http://www.mnn.com/earth-matters/politics/blogs/ethanol-unites-extremes-of-the-senate.

[48] "America's Renewable Future Commends VT Sen. Bernie Sanders For Renewable Fuel Standard Support," Biofuels Journal, September 15, 2015, http://www.biofuelsjournal.com/articles/America_s_Renewable_Future_Commends_VT_Sen__Bernie_Sanders For_Renewable_Fuel_Standard_Support-153347.html.

SCIENTISTS, EXPERTS SEPARATE FACT FROM FICTION

Notwithstanding perceived political pressure, policy makers are slowly, sometimes reluctantly, coming to grips with the serious environmental costs of the government's corn ethanol mandate. These costs include increased GHG emissions, increased pollution of water and waterways, and increased emissions of ozone precursors.

> *"As farmers rushed to find new places to plant corn, they touched off a cascade of unintended consequences, including the elimination of many acres of conservation land."*[49]
>
> **Associated Press**
> ***"AP investigation explores hidden cost of ethanol."***
> ***Associated Press, November 6, 2013.***

Unlike politicians, the scientific community began sounding alarms about the RFS almost immediately after the mandate became law. In January 2008, a **study**[50] in the journal *Science* warned that the RFS might undermine GHG reductions if the policy encouraged farmers to plow into untouched grassland or farmland that had been set aside for conservation. Developing this conservation land releases stored carbon dioxide and, therefore, increases GHG emissions. These concerns were **echoed**[51] by Dr. Dan Kammen and Dr. Michael O'Hare of the Energy and Resources Group at the University of California, Berkeley [emphasis added]:

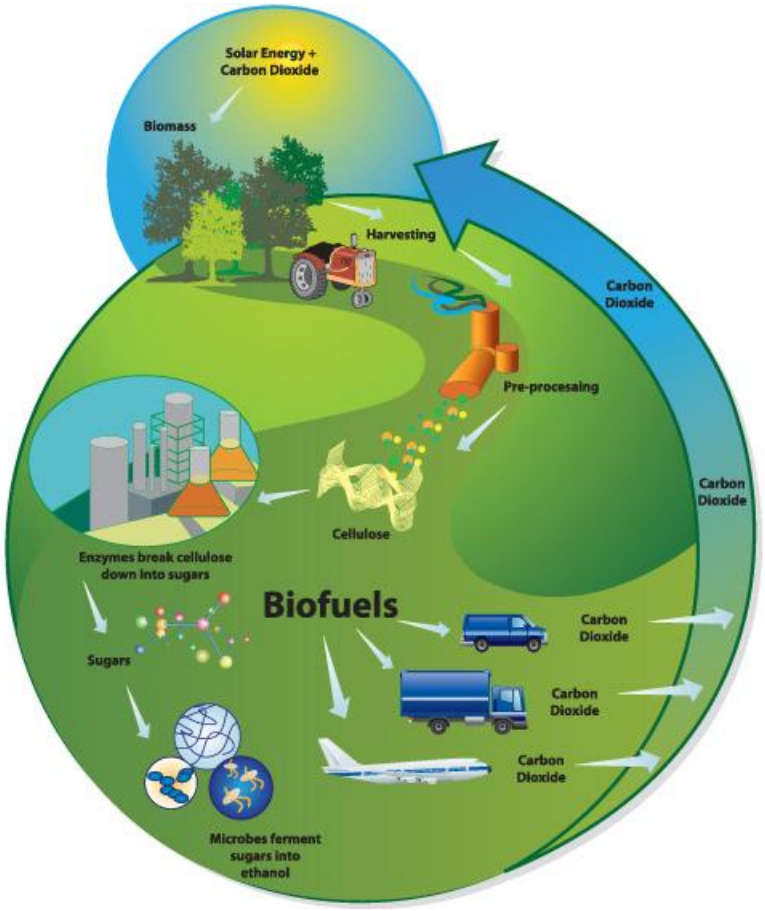
> *"Simply said, ethanol production today using U.S. corn contributes to the conversion of grasslands and rainforest to agriculture, causing very large GHG emissions. … [E]ven if only a small fraction of the emissions calculated in this crude way [through land use change] are added to estimates of direct emissions for corn ethanol, total emissions for corn ethanol are higher than for fossil fuels."*

[49] "AP investigation explores hidden cost of ethanol," Associated Press, November 6, 2013, http://www.ap.org/Content/Press-Release/2013/AP-investigation-explores-hidden-cost-of-ethanol.

[50] Jörn P. W. Scharlemann and William F. Laurance, "How Green Are Biofuels?" Science 319 (2008), http://www.sciencemag.org/content/319/5859/43.summary?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&fulltext=biofuels&searchid=1&FIRSTINDEX=0&resourcetype=HWCIT.

[51] Alex Farrell and Michael O'Hare (Energy & Resources Group, University of California Berkeley). Memo to John Courtis (California Air Resources Board), January 12, 2008, http://www.arb.ca.gov/fuels/lcfs/011608ucb_luc.pdf.

Similarly, a **study**[52] produced by researchers from the University of Minnesota found that corn ethanol has a greater impact on climate change than gasoline. In 2011, the National Academy of Sciences (NAS) **reported**[53] that the RFS may be an ineffective policy for reducing global GHG emissions because of how biofuels are produced and what land-use or land-cover changes occur in the process. A 2013 **study**[54], published in the *Proceedings of the National Academy of Sciences*, used satellite data to confirm that the RFS encourages development of conservation land. The **graphic**[55] below shows the GHG lifecycle of ethanol.



[52] Jason Hill, Stephen Polasky, Erik Nelson et al, "Climate change and health costs of air emissions from biofuels and gasoline," Proceedings of the National Academy of Sciences of the United States of America 106 (2009), http://www.pnas.org/content/106/6/2077.full.pdf?sid=c28dd213-1611-4770-9241-534bf28b6521.

[53] National Research Council of the National Academies, "Summary" in "Renewable Fuel Standard: Potential Economic and Environmental Effects of U.S. Biofuel Policy," 2011, http://www.nap.edu/read/13105/chapter/1.

[54] Christopher Wright and Michael C. Wimberly, "Recent land use change in the Western Corn Belt threatens grasslands and wetlands," Proceedings of the National Academy of Sciences of the United States of America 110 (2013), http://www.pnas.org/content/110/10/4134.full.

[55] Electrical and Mechanical Services Department, Hong Kong Special Administrative Region Government, "Biomass Energy," http://www.energyland.emsd.gov.hk/en/energy/renewable/biomass.html.

"Without reduced food consumption, each of the models would estimate that biofuels generate more emissions than gasoline ."[56]

Prof. Tim Searchinger

Research Scholar at Princeton University's Woodrow Wilson School of Public and International Affairs

March 27, 2015

In addition to adding to GHG emissions and making climate change worse, the ethanol lifecycle emits higher concentrations of ozone precursors relative to gasoline. Nitrogen oxides and volatile organic compounds (VOCs) react in the atmosphere in the presence of sunlight to form ground-level ozone. According to a 2010 **study**[57] by Stanford researchers, vehicles running on E85 (a blend of gasoline and ethanol that is 85 percent ethanol) produce different byproducts than gasoline and generate substantially more aldehydes, which are precursors to ozone. The **NAS**[58] study also reported that overall production and use of ethanol will result in higher pollutant concentrations for ozone and particulate matter than gasoline on a national scale.

The National Oceanic and Atmospheric Administration (**NOAA**[60]) earlier this year confirmed the role that ethanol plays in contributing to higher ozone levels. NOAA found "a pretty substantial increase in ozone production from E85 at cold temperatures, relative to gasoline, when emissions and atmospheric chemistry alone were considered." Moreover, NOAA found that airborne emission levels captured downwind from an ethanol fuel refinery in Decatur, Ill., were 30 times higher than previous government estimates. VOCs

"[I]t is important to recognize that some of the assumptions underlying the RFS2 have turned out to be wrong, and that has created significant implementation challenges."[59]

Alliance of Automobile Manufacturers

July 23, 2013

[56] Catherine Zandonella, "Do biofuel policies seek to cut emissions by cutting food?" March 27, 2015, https://blogs.princeton.edu/research/2015/03/27/.

[57] Louis Bergeron, "Stanford researchers: Ethanol results in higher ozone concentrations than gasoline," December 14, 2009, http://news.stanford.edu/news/2009/december14/ozone-ethanol-health-121409.html.

[58] National Research Council of the National Academies, "Summary" in "Renewable Fuel Standard: Potential Economic and Environmental Effects of U.S. Biofuel Policy," 2011, http://www.nap.edu/read/13105/chapter/1.

[59] Alliance of Automobile Manufacturers, "The alliance testifies before the House Energy and Commerce Committee's Subcommittee on Energy and Power," July 23, 2013, http://www.autoalliance.org/index.cfm?objectid=DABF5DD0-F3B9-11E2-8898000C296BA163.

[60] National Oceanic and Atmospheric Administration, "Quantifying the emissions from a large ethanol refinery," May 5, 2015, http://research.noaa.gov/News/NewsArchive/LatestNews/TabId/684/ArtMID/1768/ArticleID/11152/Quantifying-the-emissions-from-a-large-ethanol-refinery.aspx.

were five times higher than inventories estimated, and emissions of ethanol itself, which is also a VOC, were about 30 times higher.

Ethanol production also exacts a heavy toll on water resources, from growing crops to processing those materials into the fuel. The 2011 **NAS study**[61] found that the increase in corn production had adverse environmental impacts on surface water and groundwater, including hypoxia, harmful algal blooms and eutrophication. The NAS paper predicted that additional increases in corn production – mandated under the law thanks to the RFS – would have additional negative environmental consequences.

In light of all these environmental impacts, the EPA Inspector General (IG) recently announced an investigation into EPA's methodology for calculating the GHG benefits associated with the RFS. In a **letter**[62] posted on its website, the EPA IG said it "plans to begin preliminary research" to determine whether EPA has properly accounted for the full greenhouse gas emissions of biofuels. The IG indicated that it would be looking more closely at the 2011 NAS study, as well as others, to determine if EPA's analysis with respect to the RFS is properly supported.

GROWING OPPOSITION TO THE RFS

In light of the serious economic and environmental impact associated with Washington's corn ethanol mandate, politicians are finally waking up to the mistake they made 10 years ago. For example, New Hampshire U.S. Sen. **Kelly Ayotte**[63] (R) took an anti-RFS stand in 2011 saying:

> *"Congress should not be spending billions of dollars that we do not have on a policy that fails to achieve its intended goal – American energy independence. Our nation's energy policy mandates ethanol's use at the gas pump, subsidizes its blending with gasoline, and protects it from low-cost foreign imports. And according to the Congressional Budget Office, the diversion of corn crops for ethanol production has contributed to a 10 to 15 percent increase in food prices, through increased corn, feed grain, land, and other input costs."*

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[61] National Research Council of the National Academies, "Summary" in "Renewable Fuel Standard: Potential Economic and Environmental Effects of U.S. Biofuel Policy," 2011, http://www.nap.edu/read/13105/chapter/1.

[62] Patrick Gilbride (U.S. Environmental Protection Agency), Memo to Janet McCabe and Thomas Burke, October 15, 2015, http://www2.epa.gov/sites/production/files/2015-10/documents/newstarts_10-15-15_rfs.pdf?cm_mid=5081307&cm_crmid=e7f555c5-d923-e411-becb-6c3be5a81b7c&cm_medium=email.

[63] Kelly Ayotte, "Senator Ayotte Supports Repeal of Wasteful Ethanol Subsidies," June 14, 2011, http://www.ayotte.senate.gov/?p=press_release&id=77.

Sen. Ayotte's concerns were recently **affirmed**[64] by Harvard Professor James H. Stock, who observed, "The current combination of RFS policy uncertainty, the E10 blend wall, high RIN prices, and low investment means that the RFS currently is imposing costs while failing to provide the future benefits associated with domestic, low-greenhouse gas, second-generation advanced biofuels."

> *"It is not a good policy to have these massive subsidies for (U.S.) first generation ethanol. … First generation ethanol I think was a mistake. The energy conversion ratios are at best very small. It's hard once such a program is put in place to deal with the lobbies that keep it going. … The size, the percentage of corn particularly, which is now being (used for) first generation ethanol definitely has an impact on food prices. The competition with food prices is real."*[65]
>
> **Former Vice President Al Gore**
> ***"U.S. corn ethanol 'was not a good policy'-Gore." Reuters, November 22, 2011.***

New Hampshire State Rep. Joe Pitre, a Republican from Farmington, recently **criticized**[66] EPA's effort to increase the ethanol mandates, saying, "We can't continue to force the production and consumption of a product that isn't safe for our engines just because it sounds good in some people's narratives." Pitre is joined by his colleague, state Rep. David Campbell (D), who **said**[67] ethanol is "incredibility inefficient. It takes more energy to make it than what you get when you burn it."

Both environmentalists and business interests continue to be skeptical of the RFS. For example, Rob Green, the Executive Director of the National Council of Chain Restaurants **said**[68] the RFS "affects poultry, beef, pork, other agricultural products. And at a local level ... it costs $18,000 a year for each restaurant because of the RFS. And if you sell more beef, it can be as high as $35,000 a year per restaurant." On the other end of the spectrum, national environmental groups like **Friends of the Earth**, the **Environmental Working Group** (EWG), and the **Natural Resources Defense Council** argue that corn ethanol is actually hurting the environment.

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[64] James Stock (Center on Global Energy Policy, Columbia University), "The Renewable Fuel Standard: A Path Forward," April 2015, http://energypolicy.columbia.edu/sites/default/files/energy/Renewable%20Fuel%20Standard_A%20Path%20Forward_April%202015.pdf.

[65] Gerard Wynn, "U.S. corn ethanol 'was not a good policy'-Gore," Reuters, November 22, 2011, http://www.reuters.com/article/2010/11/22/ethanol-gore-idAFLDE6AL0YT20101122.

[66] Joe Pitre, "My Turn: Let's ban corn-based ethanol in gas," Concord Monitor, June 21, 2015, http://www.concordmonitor.com/home/17398043-95/my-turn-lets-ban-corn-based-ethanol-in-gas.

[67] David Campbell, "N.H. Senate ponders limits on corn-based ethanol," New Hampshire Business Review, May 5, 2014, http://www.nhbr.com/May-16-2014/NH-Senate-ponders-limits-on-corn-based-ethanol/.

[68] Rob Green, "Rep. Welch: Ethanol mandate 'killing farmers,'" The Hill, April 10, 2014, http://thehill.com/policy/energy-environment/203186-rep-welch-ethanol-mandate-h.

> *"Unfortunately, the EPA has refused to follow even the limited environmental safeguards built into the RFS and as a result, the RFS is causing environmental degradation and making climate change worse. In addition, we are concerned about the impact that increased biofuel production driven by the RFS is having on global food prices. For these reasons, Friends of the Earth believes that the RFS must either be fixed or ditched."*[69]
>
> **Friends of the Earth**

Even **former Vice President Al Gore** has said that his past support for corn ethanol was a "mistake" and candidly admitted that his position was influenced by his attempts to win votes in Iowa while running for president in 2000.[70] Gore and the environmental movement in general continually battle pro-business groups on a range of policy issues. But in criticizing the RFS, they have found a rare point of agreement.

The anti-ethanol views of national environmental organizations are shared by green groups in New England, too. Environment Massachusetts **has called**[71] the federal government's support for corn ethanol "worse than a waste of money, it's an artificial and unnecessary subsidy of destructive environmental practices that pollute our air and water." Jonathan Lewis of the Boston-based Clean Air Task Force **delivered** the following indictment against the ethanol mandate:

> *"The RFS is better at generating problems than it is at delivering solutions. The program's main achievement to date—shepherding an enormous scale-up in corn ethanol consumption—has pushed up food prices in the US and around the world and increased GHG emissions, air pollution, water pollution, and habitat destruction. While Congress had good intentions to reduce global climate change with passage of the RFS, the vast majority of fuel produced and consumed in accordance with the program has had the opposite effect."*

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[69] Friends of the Earth, "Renewable Fuel Standard," http://www.foe.org/projects/climate-and-energy/biofuels/renewable-fuel-standard.

[70] Wynn.

[71] Rob Sargent, "Senate Votes to Protect Dirty and Wasteful Ethanol Subsidies," June 14, 2011, http://environmentamerica.org/news/ame/senate-votes-protect-dirty-and-wasteful-ethanol-subsidies.

"The government subsidy for corn ethanol is worse than a waste of money, it's an artificial and unnecessary subsidy of destructive environmental practices that pollute our air and water."[72]

Environment Massachusetts

June 14, 2011.

In Maine, there was a serious bipartisan attempt to ban the sale of ethanol in 2013. The state House of Representatives voted 109-32 in favor of the proposed ban, which would have entered into force if two or more New England states followed suit with similar prohibitions. **State Rep. Richard Campbell** said the bill was intended to "eliminate food in our fuel" because "[f]ood in our fuel just doesn't make any sense."[74] House Republicans issued a **statement** charging that "ethanol is a failure in virtually every way" and "takes more energy to produce … than the fuel provides."[75] The proposed ban was not supported by the Senate, with lawmakers fearing legal and regulatory sanctions if the state effectively opted out of a federal mandate.

However, Maine lawmakers agreed on a **measure**[76] that would ban the sale of gasoline with more than 10 percent ethanol content if the state was joined by two other New England states. This was a response to ethanol pressure groups that have demanded the EPA to ignore the E10 "blend wall" and mandate higher percentage blends, such as E15. The damaging effect of ethanol blends on some automobile and marine engines is also a major concern. "I

"MRAA is opposed to increased ethanol levels in transportation gasoline and is part of a multi-industry coalition, Smarter Fuel Futures, which advocates for a complete reform of our country's biofuel policies."[73]

William Higgins

Marine Retailers Association of the Americas

June 9, 2015.

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[72] Ibid.

[73] William Higgins (Marine Retailers Association of the Americas), "EPA Releases Ethanol Standards," June 9, 2015, http://www.mraa.com/news/235811/EPA-Releases-Ethanol-Standards.htm.

[74] Matthew Stone, "Lawmakers vote to ban ethanol in Maine," Bangor Daily News, May 8, 2013, http://bangordailynews.com/2013/05/08/politics/maine-house-takes-stand-against-ethanol-in-fuel/.

[75] Ari LeVaux, "The One Issue Republicans and Democrats Can Agree On," Slate, July 12, 2013, http://www.slate.com/articles/news_and_politics/food/2013/07/renewable_fuel_standard_repeal_how_states_are_chipping_away_at_the_corn.html.

[76] Holly Jessen, "Maine passes bill limiting ethanol blending, conditions apply," Ethanol Producer Magazine, May 21, 2013, http://www.ethanolproducer.com/articles/9886/maine-passes-bill-limiting-ethanol-blending-conditions-apply.

don't know how many stories I've heard about people having engines that were ruined," **State Sen. Troy Jackson (D)** said at the time.[77]

> *"Ethanol was always a way to help the corn industry, not the environment. The energy balances have always been terrible."*[78]
>
> **Bill McKibben**
> ***Founder, 350.org***
> ***"How Big Corn Is Killing the Earth," Yahoon News. Nov. 15, 2013***

Meanwhile in Vermont, examples abound of otherwise fierce political and ideological opponents coming together to oppose out-of-control ethanol mandates.. "Ethanol was always a way to help the corn industry, not the environment,"[79] **Bill McKibben**, founder of the environmental activist group 350.org and a scholar in residence at Middlebury College, said in 2013. "The energy balances have always been terrible." More recently, **U.S. Rep. Peter Welch (D)** has been pushing legislation in Congress to repeal the corn ethanol mandate because the program is "a well-intended flop."[80] Talk to any mechanic, Welch says "and you'll get an earful on the serious damage being done to the engines of snowmobiles, chainsaws and boats." Welch also says the ethanol mandate is "driving up feed prices which is hurting our farmers and contributing to increased food prices." On most issues, the leader of a national environmental activist group and a Vermont Democrat would not find themselves in agreement with a free-market think tank, like the state's Ethan Allen Institute. But the institute's vice president, **John McClaughry**, made almost the same argument as Welch in a recent op-ed:

> *"In terms of costs and consequences, the ethanol subsidy, tax exemption, and mandate program is perhaps the worst single program carried out by the federal government – and that's saying a lot. The time is long overdue to repeal the ethanol and biofuels mandates and close this embarrassing chapter in costly special interest politics."*[81]

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[77] Michael Shepherd, "Maine Senator votes against possible ethanol ban," Portland Press Herald, May 15, 2013, http://www.pressherald.com/2013/05/15/maine-senate-votes-against-possible-ethanol-ban/.
[78] Steve Holt, "How Big Corn Is Killing the Earth," Yahoo! News, November 15, 2013, http://news.yahoo.com/big-corn-killing-earth-203905103.html.
[79] Ibid.
[80] Peter Welch, "Welch Reintroduces Legislation to Reform Federal Ethanol Mandate," March 23, 2015, https://welch.house.gov/media-center/press-releases/welch-reintroduces-legislation-reform-federal-ethanol-mandate.
[81] John McClaughry, "Repeal the ethanol mandate," Vermont Business Magazine, August 20, 2015, http://www.vermontbiz.com/news/august/mcclaughry-repeal-ethanol-mandate.

In addition to public officials and advocacy groups, some newspaper editorial boards from New England have warned of the unintended consequences of the ethanol mandate. The *Boston Globe* **opined**[82] in March 2015:

> *"The Federal mandate for ethanol, known as the Renewable Fuel Standard, has very little to recommend it. Ethanol preferences distort US agriculture, diverting 40 percent of the nation's corn crop to produce about 9 percent of its fuel supply. They drive up the price of food, making everything from bread to beef more expensive. They cost drivers at the pump an extra $10 billion a year, as the Manhattan Institute's Robert Bryce has shown. The promote inefficiency, since ethanol, though more expensive than gasoline, contains one-third less energy. They don't even reduce atmospheric carbon dioxide, which was always ethanol's main selling point."*

Moreover, the *Concord Monitor* **editorialized,**[83] "The renewable fuel standard was well-meaning legislation rendered irrelevant by the rapid increase in fuel efficiency standards and vehicle technology. Consumers are burning much less gas while farmers, save during droughts, are producing more ethanol than refiners can safely mix with gasoline… From our vantage point, far from the endless fields of Midwestern maize, running vehicles on food seems like not just a boondoggle but an environmental dead end. Millions of otherwise fallow acres have been ploughed up and put into corn to meet a government-created demand for a troublesome fuel most people would prefer not to buy."

New England papers are not alone in their distrust of the mandate. The ***Chicago Tribune***[84] argued the ethanol mandate should be cut significantly, with the ultimate goal for it to be eliminated entirely. The views of these editorial boards have been echoed by the ***Wall Street Journal,***[85] ***The Pittsburgh Tribune-Review,***[86] ***Fort Wayne News-Sentinel***[87] and many others.

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[82] "Bucking the ethanol lobby – even in Iowa," Boston Globe, March 16, 2015, https://www.bostonglobe.com/opinion/editorials/2015/03/16/bucking-ethanol-lobby-even-iowa/9QP6HclZ1oavVCBkQmQjJO/story.html.

[83] "Editorial: Can't we keep gas from turning to goo?" Concord Monitor, August 29, 2013, http://www.concordmonitor.com/home/8248210-95/editorial-cant-we-keep-gas-from-turning-to-goo.

[84] "Editorial: Dump the ethanol mandate," Chicago Tribune, January 6, 2014, http://articles.chicagotribune.com/2014-01-06/opinion/ct-ethanol-mandate-edit-0106-20140106_1_fuel-blenders-ethanol-mandate-more-ethanol.

[85] "Dirty Rotten Ethanol Scoundrels," Wall Street Journal, June 7, 2015, http://www.wsj.com/articles/dirty-rotten-ethanol-scoundrels-1433716070?alg=y.

[86] "The ethanol racket: More perversion," Pittsburgh Tribune-Review, June 16, 2015, http://limaohio.com/opinion/5440/pittsburgh-tribune-review-the-ethanol-racket-more-perversion.

[87] "Let's stop using food for fuel," The News-Sentinel, June 3, 2015, http://petelandrysrealgas.com/2015/06/lets-stop-using-food-for-fuel/.

CONCLUSION

President Bush and Congress may have had good intentions when they created the RFS a decade ago. But the facts show those good intentions were misguided, and 10 years later, consumers in New England continue to pay a heavy price for them.

The energy security benefits that were promised by ethanol proponents did actually come to pass – but not because of ethanol. Thanks to a domestic energy renaissance that transformed the United States from a huge importer of energy to the world's largest producer of oil and natural gas, those critical benefits were realized. The promised environmental benefits have not materialized either. In fact, far from cutting GHG emissions, ethanol is staunchly opposed by many environmental groups because of its carbon footprint and other impacts on land and water resources.

Simply put, the RFS did not work and does not work, but New Englanders are still forced to pay for it. The economic toll for the region, measured in lost GPD opportunity, has already reached $6 billion and could rise to $20 billion over the next decade if nothing is done to fundamentally reform or rescind the program. Higher fuel and agricultural input costs may also destroy the equivalent of 141,000 jobs over 20 years. In effect, the RFS threatens to extract $18 billion from the New England economy and transfer that wealth to a narrow set of interests in corn-growing states of the Midwest.

To be sure, support for the RFS remains strong in pockets of the Midwest where the vast majority of corn production takes place, and especially in Iowa, home of the first-in-the-nation presidential caucuses. But even in the Corn Belt, there is a rising tide of opposition to the RFS. **Ohio Gov. John Kasich (R)**[88] recently said the RFS "needs to be phased out" and the ethanol industry should "stand on its own" – to a crowd in Iowa no less. Governor Kasich is far from alone: Democrats, Republicans, environmentalists and pro-business advocates in the Buckeye State are criticizing the corn ethanol mandates of the RFS.

The rising level of opposition to corn ethanol mandates in a corn-growing state shows just how badly the RFS is failing. The mandate is an even worse deal for communities outside the Corn Belt, and New England's economy has suffered enough damage from this costly and badly conceived program. With corn ethanol interests pressuring the EPA to make the RFS even worse, responsible officials in New England should continue their leadership on this issue and demand fundamental reforms before it's too late.

[88] America's Renewable Future.

TECHNICAL APPENDIX

This technical appendix explains the steps and calculations used to estimate the figures within this report. In each section below, we discuss the data, methodology and assumptions used to calculate the effect the RFS has had on the New England economy.

Increased Fuel Costs

The calculation of increased fuel costs in each New England state relies on data from the Energy Information Administration (EIA), Bureau of Labor Statistics (BLS), and the USDA Economic Research Service (ERS).

The calculation of increased fuel costs are broken down into two periods: 2005-2014 (historical) and 2015-2024 (projected).

***Historical Analysis*:**

Historical ethanol consumption data comes from the **EIA SEDS database**. The analysis draws on energy consumption data for each New England state, and used the Mnemonic Series Names (MSN) of "ENTCP."[89] This data was then converted from thousands of barrels to millions of gallons (multiplying by 42 and dividing by 1,000).

For 2014, state-level ethanol consumption data was not available, the study team estimated values by calculating each state's **share of total U.S. 2013 ethanol consumption**, multiplied by the **total U.S. 2014 ethanol consumption**. For example, Massachusetts (281 million gallons) accounted for 2.2 percent of total 2013 U.S. consumption (13.2 billion gallons). This same percentage was applied to total U.S. 2014 consumption (13.5 billion gallons) to get an estimated 2014 value for Massachusetts (287 million gallons).

Once consumption for each year is calculated, we then look at the additional cost associated due to ethanol consumption. To do this, we use data from the USDA Economic Research Service (ERS) (**Fuel ethanol, corn and gasoline prices, by month**). Ethanol has about one-third less energy content than gasoline. As such, we convert the ethanol price to a dollar-per-gallon gasoline equivalent and take the difference between this and the gasoline price per gallon for each month. The gasoline and ethanol prices are wholesale prices at Omaha, Neb. We assume the same ethanol-gasoline price relationship for each of the New England states.

[89] EIA defines "ENTCP" as "Fuel ethanol total consumed" in thousand barrels.

Finally, to calculate the total additional fuel cost by state, we take the average ethanol-to-gasoline price difference over each year and multiply it by the state's consumption. The ethanol-to-gasoline price difference is in nominal dollars, so we adjust the final additional costs based on the Consumer Price Index (CPI), provided by the BLS.

Projected Analysis:

The projected (2015-2024) additional fuel cost by state is calculated using consumption data from the EIA's Annual Energy Outlook 2015 (AEO 2015) for Energy Consumption by Sector and Source, New England, Reference case. Total ethanol consumption is converted from quadrillion Btu (as shown in the table) to million gallons using the assumption that there are **76,330 Btu's per gallon of ethanol**.[90] The consumption is then allocated based on each state's share of the 2014 New England total consumption. For example, Connecticut's 2014 consumption (150 million gallons) is 23 percent of the total New England consumption for 2014 (651 million gallons).

For ethanol-to-gasoline price differences, we use ethanol wholesale price projections from the AEO 2015 Petroleum and Other Liquids Prices, Reference case and wholesale gasoline prices from the AEO 2015 Components of Selected Petroleum Product Prices, United States, Reference case datasets. Both datasets are converted from 2013 dollars per gallon to 2014 dollars per gallon using CPI data from the BLS.

Finally, ethanol prices are converted to a dollar-per-gallon-of-gasoline equivalent and the ethanol-to-gasoline price difference is calculated. We assume the same ethanol-gasoline price relationship for each of the New England states. The total additional cost in the projected period is calculated by taking this price difference, multiplied by the consumption estimate for each state.

Breakdown by Industry Segment:

In order to break down the additional fuel costs into the various sectors, we use EIA'S AEO 2015 Energy Consumption by Sector and Source, New England, Reference case and Transportation Sector Energy Use by Fuel Type within a Mode, Reference case datasets. The first dataset is used to calculate the share of motor gasoline that is consumed within New England and by which sector (e.g., Industrial, Commercial, Transportation, and Other). The relative share of each sector's consumption (weighted average over the 2015-2024 period) is calculated and then applied to the total additional fuel costs, assuming that the motor gasoline used in each sector includes the same proportion of ethanol. The table below shows this calculation.

[90] U.S. Department of Energy, Alternative Fuels Data Center, "Fuel Properties Comparison," http://www.afdc.energy.gov/fuels/fuel_comparison_chart.pdf.

Appendix Table 1: Sector Shares of Gasoline Consumption

		Motor Gasoline Consumption (million gallons)				
		Commercial	Industrial	Transportation	Other	Total
	[a]	[b]	[c]	[d]	[e]	[f]
[1]	2015	10.7	128.5	9,720.0	134.6	9,993.8
[2]	2016	10.1	128.2	9,698.9	135.0	9,972.0
[3]	2017	10.4	127.7	9,526.3	106.5	9,770.9
[4]	2018	10.7	129.6	9,353.8	79.2	9,573.3
[5]	2019	10.9	131.3	9,208.6	77.9	9,428.7
[6]	2020	11.1	132.9	9,056.8	76.6	9,277.5
[7]	2021	11.3	133.6	8,890.7	75.2	9,110.8
[8]	2022	11.4	134.0	8,714.5	73.7	8,933.6
[9]	2023	11.5	134.3	8,527.7	72.2	8,745.7
[10]	2024	11.6	134.7	8,329.1	70.5	8,545.9
[11]	2015-2024 Share	0.1%	1.4%	97.5%	1.0%	100.0%

Notes:

EIA data from AEO 2015.

To break out the transportation sector, we calculate household versus commercial share of motor gasoline consumption (including E85) from the second dataset mentioned above (weighted average over the 2012-2024 period). This dataset breaks includes consumption by Light-duty vehicles, Commercial Light Trucks, Freight Trucks, Bus Transportation, and Recreational Boats (all using motor gasoline). The transportation sector breakdown is calculated using the following shares:

Appendix Table 2: Sector Shares of Transportation Gasoline Consumption (trillion Btu)

		Motor Gasoline including E85 Consumption (trillion Btu)		
		Household	Commercial	Total
	[a]	[b]	[c]	[d]
[1]	2012	15,093	807	15,901
[2]	2013	15,208	824	16,032
[3]	2014	15,041	818	15,858
[4]	2015	15,171	833	16,004
[5]	2016	15,146	824	15,969
[6]	2017	15,068	819	15,887
[7]	2018	14,953	819	15,772
[8]	2019	14,788	816	15,604
[9]	2020	14,613	814	15,427
[10]	2021	14,424	809	15,233
[11]	2022	14,212	807	15,019
[12]	2023	13,980	806	14,786
[13]	2024	13,735	804	14,539
[14]	Share of Total	94.8%	5.2%	100.0%

Notes:

EIA data from AEO 2015.

To calculate state-level impact, we calculate the aggregate household versus commercial transportation impact using the relative share of consumption and multiply that by each state's share of total New England population. For example, Maine encompasses nine percent of total New England population. Thus, the Transportation – Household share of total impacts would be as follows:

$17.3 billion total additional transportation fuel costs (New England) x 95% household transportation share x 9% Maine population share = $1.5 billion

Economic Impacts

To calculate the economic impacts of the lost household income due to increased fuel prices, we rely on the IMPLAN model. We used the 2014 estimates for lost household income as a result of the RFS and ran IMPLAN for each state. The IMPLAN model for

each state reports the GDP Impact, Labor Income Loss, and Employment Loss resulting from a change in household income.

To generate results for the 2005-2024 period, we ran the following the steps:

1. Input into IMPLAN the household income loss by state in 2014 dollars for each year from 2005-2024 associated with RFS.

2. Generate state-level results for GDP, Labor Income and Employment impacts.

New England Farming Data and Analysis

In order to estimate economic impacts of increased corn prices to New England farmers, we rely on various reports and data from the USDA's National Agricultural Statistics Service (NASS). To further break down the size of the New England farming industry, we include the following table.

Appendix Table 3: Breakdown of Farm Commodity Cash Receipts in 2012 ($ thousands)

(USD'000)	New England	CT	ME	MA	NH	RI	VT
All farm commodities	2,750,081	547,645	729,114	473,578	183,036	59,845	756,862
Livestock and products	1,247,937	162,894	305,906	100,295	82,139	9,001	587,702
Dairy products, Milk	795,247	69,935	124,236	43,400	53,508	3,584	500,584
Dairy as % of livestock and products	64%	43%	41%	43%	65%	40%	85%

Source: "News Release - 2013 Farm Cash Receipts up 4 percent in New England" USDA, National Agricultural Statistics Service, January 26, 2015.

This table shows the following key points:

- In 2012, New England's dairy industry was worth (reported cash receipts of) $795 million to the local economy.
- The New England dairy industry contributed 29 percent of all farm commodity cash receipts and 64 percent of livestock and products cash receipts.
- Vermont dominates the New England dairy industry, contributing 63 percent of cash receipts, or $500.6 million to the regional economy.

The table below shows the feed expenses reported for dairy farmers in each state in New England.

Appendix Table 4: Dairy Farm Feed Expenses by State in 2012 ($ thousands)

	New England	CT	ME	MA	NH	RI	VT
Total farm production expense	779,386	81,196	117,812	45,928	59,665	4,670	470,115
Dairy farmer's feed costs	292,556	23,091	48,341	15,116	20,039	1,131	184,838
Feed as % of production expense	38%	28%	41%	33%	34%	24%	39%

Source: USDA Census of Agriculture, 2012.

To calculate corn's contribution to dairy feed costs, we rely on the 2014 U.S. Farm Bill, which introduced a new Dairy Margin Protection Program that calculates the margin over feed cost.[91] The average feed cost is calculated by using the sum of:[92]

- 1.0728 times the price of corn per bushel, plus
- 0.00735 times the price of soybean meal per ton, plus
- 0.0137 times the price of alfalfa hay per ton.

The corn and alfalfa hay prices are those reported in the monthly NASS Agricultural Prices report. The price of soybean meal is the Central Illinois soybean meal price delivered by rail as reported in the Agricultural Marketing Service (AMS) Market News-Monthly.[93]

This formula is based on a feed ration that was developed by the National Milk Producers Federation in collaboration with animal nutritionists shown in the table below.[94]

[91] Agricultural Act of 2014," http://www.gpo.gov/fdsys/pkg/BILLS-113hr2642enr/pdf/BILLS-113hr2642enr.pdf.
[92] "Agricultural Act of 2014," http://www.gpo.gov/fdsys/pkg/BILLS-113hr2642enr/pdf/BILLS-113hr2642enr.pdf.
[93] U.S. Department of Agriculture, "2014 Farm Bill Factsheet - Margin Protection Program for Dairy (MPP-Dairy)," June 2015, https://www.fsa.usda.gov/Internet/FSA_File/mpp_dairy.pdf.
[94] Marin Bozic (University of Minnesota), "Farm Bill Dairy Margin Formula Explained," August 19, 2013, http://www.marinbozic.info/blog/?p=316.

Appendix Table 5: Daily Quantities of Feed Ingredients for the Entire Herd

			Quantity in Commercial Units (units/day)			
Cow Type	**Proportion of Herd**	**Dry Matter Consumed (lbs/day)**	**Shell Corn (bu/day)**	**Corn Silage (tons/day)**	**Soybean Meal (tons/day)**	**Alfalfa Hay (tons/day)**
Milking Cows	52.49%	47.1	0.3198	0.0229	0.0032	0.0059
Hospital Cows	1.05%	47.1	0.3198	0.0229	0.0032	0.0059
Dry Cows	8.82%	24.0	0.0249	0.0172	0.0020	0.0042
Replacement Heifers						
To calve within 1 year	18.53%	23.0	0.0239	0.0164	0.0020	0.0041
500 pounds and over	9.55%	15.0	0.0311	0.0107	0.0013	0.0022
Less than 500 pounds	9.55%	7.0	0.0363	0.0045	0.0006	0.0006

Source: "Foundation for the Future - A New Direction for U.S. Dairy Policy", National Milk Producers Federation, June 2010

Using the Dairy Margin Protection Program formula, we calculated the average feed cost per hundredweight of milk using the average 2012 component prices:

Appendix Table 6: Estimate of corn's contribution to 2012 dairy feed prices using the Milk Protection Program feed price formula

	2012 average price (USD) [A]	Multiplier [B]	Contribution to feed cost (USD) [A] x [B]	Contribution to feed cost (%)
Corn	6.65 per bushel	1.07280	7.14	54%
Soybean meal	439.87 per ton	0.00735	3.23	25%
Alfalfa hay	205.33 per ton	0.01370	2.81	21%
Feed cost			**13.18**	

Source: Corn and alfalfa prices are the average monthly prices published in "Agricultural Prices", USDA, published monthly for 2012.. Soybean meal price is average of daily 2012 prices from "Soybean Meal, Cent. Ill., rail, ton 48%" price series reported at ***www.quandl.com****, a* Wall Street Journal *database.*

Note that this calculation assumes that (1) New England dairy farmers' feed rations mirror those used to derive the USDA's price formula; and (2) the New England has the same commodity price relationship as the 2012 average price used.

Finally, to calculate the impact to New England, we run the following steps:

1. Multiply dairy farmers' feed costs ($292.6 million) by 54 percent (corn's share of feed costs) = $158.4 million corn-based feed cost.

2. Calculate the effect of increased corn price cost by taking increase scenario (40 percent) and multiply by the $158.4 million total corn contribution calculated above.

Note that this analysis does not take into account the effect of substitution where farmers might have substituted lower cost feed during periods of high corn prices. Additionally, it could be the case that farmers are able to grow their own corn silage to reduce the impact of high corn prices; however, that is not reflected in the estimation.

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