Overhauling Renewable Energy Markets

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What is the Value of Biofuels?

• Market Value
  – Source of BTUs in fuel
  – Ethanol is a source of octane in fuel

• Non-market Value
  – Reduction in greenhouse gas emissions
  – Lower air pollution
  – Domestic source of fuel
Ability to Pay for Corn in E10 and E85

- E10 Pricing
- E85 Pricing

Price of Crude Oil

- $7.75
- $4.25

Price of Corn

- $7.75
- $4.25

Diagram showing the relationship between the price of crude oil and the ability to pay for corn in E10 and E85.
Ability to Pay for Corn in E10 and E85

$9.75

$5.75
Ability to Pay for Corn in E10 and E85

- **E10 Pricing**
- **E85 Pricing**

![Graph showing the relationship between the price of crude oil and the ability to pay for corn in E10 and E85. The graph indicates that as the price of crude oil increases, the ability to pay for corn in E10 and E85 also increases. At a price of $3.75 for crude oil, the chart shows that E10 pricing is around $4.00 and E85 pricing is around $1.75. At a price of $1.75 for crude oil, E10 pricing is approximately $2.00 and E85 pricing is around $3.00.](image-url)
Ability to Pay for Soybean Oil in Biodiesel

Current price = 55 cents/lb

Price of Soy oil

Price of Crude Oil

Ability to Pay for Soybean Oil in Biodiesel

36 cents/lb
Market Value Summary

• US ethanol industry is competitive with gasoline and can pay a high price for corn in E10 blends
• US ethanol is competitive at producing E85 only if crude stays at $100 or corn becomes cheap
• Biodiesel is not competitive using vegetable oil
  – Production cost from using soybean oil at least $2 per gallon too high
Policy Tools

• Tax credits increase fuel blenders’ ability to pay for biofuels
  – $1.00 per gallon for biodiesel
  – $0.45 per gallon for ethanol

• Mandates force the purchase of minimum amounts of biofuels into fuel blends
Ethanol Mandate: 2008 to 2015

The chart shows the ethanol mandate in billion gallons from 2008 to 2015. The mandate increased steadily during this period, reaching a peak of over 14 billion gallons in 2015.
Ethanol Mandate and Historical Use

- **Ethanol Mandate**
- **Production + Imports**

![Bar Chart](chart.png)

<table>
<thead>
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<th>Year</th>
<th>Ethanol Mandate</th>
<th>Production + Imports</th>
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</thead>
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<tr>
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<tr>
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<td>2015</td>
<td>15.0 billion</td>
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</table>
Biodiesel Mandate: 2009 to 2013

Billion gallons

2009 2010 2011 2012 2013

Biodiesel Mandate
Biodiesel Mandate and Historical Use

Biodiesel Mandate

US Consumption

billion gallons

2009 2010 2011 2012 2013

2009 2010 2011 2012 2013
Economics of Blending Mandates

• If market demand is high enough, mandate has no impact on production, price, or consumption of biofuels

• If demand is not high enough, then there is a gap between production costs and the market value of biofuels
Impact of Mandate

Supply of ethanol

Demand

Mandate

Cost – Value Gap

Price per gallon

$1.90

$1.50

$1.40

Gallons per year

8.0

12

Gallon s per year

Price per gallon

Impact of Mandate

Cost–Value Gap

Mandate

Supply of ethanol

Demand
Why close the gap?

• Non-market values of biofuels
  – Reduction in greenhouse gas emissions
  – Lower air pollution
  – Domestic source of fuel
How to Close the Gap?

1. Subsidize the use of biofuels through tax credit

2. Create a tradable biofuel credit program where each fuel blender must blend or buy biofuel credits from blenders who blend in excess of their obligation
Impact of Mandate

Price per gallon

Supply of ethanol

Demand

Mandate

RIN price

Gallons per year

8.0

12

$1.90

$1.40
Closing the Gap with a Subsidy

Supplied

Demand

$1.90

$1.40

Mandate

Tax credit

Subsidized Demand

Supply of ethanol

Gallons per year

Price per gallon

8.0

12
Current Policy Does Both

• Biodiesel tax credit covers about half of the price gap, RIN price covers the other half

• Ethanol tax credit covers all of the gap and pushes demand beyond mandate levels
Impacts of Alternative Policies: Biodiesel

• Elimination of biodiesel tax credit would not affect production, price of biodiesel, or price of soybeans

• Elimination of mandate would cause production to fall dramatically
  – Little or no vegetable oil would be used to produce biodiesel
  – Small impact on soybean prices
Impacts of Alternative Policies: Ethanol

• Elimination of tax credit would decrease ethanol production, the price of ethanol, and the price of corn
• Elimination of both tax credit and mandate would cause production to fall further
• Magnitude of impact depends on the price of crude oil and on the supply of corn
Simulation Results

• Looked ahead at the 2012 calendar year to estimate the impacts of eliminating the ethanol and biodiesel tax credits and on eliminating the mandate

• Key variables are the future price of crude oil and US corn yields in 2011 and 2012

• Model calibrated to July 2011 USDA-WASDE projections and current futures prices for crude oil
Elimination of Ethanol Tax Credit: 
Average Impact Across 500 Crude Oil Prices and Corn Yields

• US Ethanol Production
  – Decreases 4.7% from 13.82 to 13.16 billion gallons

• Corn price
  – Decreases 9.4% from $6.27 to $5.68/bu

• US ethanol price
  – Plant price decreases 6% from $2.43 to $2.28
  – Net cost to blenders increases 15% from $1.98 to $2.28 per gallon
Other measures of impacts from eliminating ethanol tax credit

• Taxpayer cost reduced by $6.2 billion
• Ethanol plant returns over corn costs decrease by 3% from $10.2 to $9.84 billion
• Value of corn crop decreases by $8.2 billion
• Cost of domestic feed reduced by $3 billion
• Consumer cost of fuel
  – If tax credit was passed on to consumers, increases by $4.2 billion
  – If tax credit was not passed onto consumers, decreases by $2.1 billion
Elimination of Ethanol Mandate:
Average Impact Across 500 Crude Oil Prices and Corn Yields

• US Ethanol Production
  – Decreases to 10.9 billion gallons

• Corn price
  – Decreases to $5.30/bu

• US ethanol price
  – Plant price decreases to $2.17
Drop in Ethanol Production from Elimination of Mandate

- Poil > 120
- 100 < Poil < 120
- 80 < Poil < 100
- Poil < 80

Drop in billion gallons of Crude Oil Price
Drop in Corn Price from Elimination of Mandate

Crude Oil Price

$/bu

Poil > 120
100 < Poil < 120
80 < Poil < 100
Poil < 80

$/bu

Poil > 120
100 < Poil < 120
80 < Poil < 100
Poil < 80

Crude Oil Price
General Policy Conclusions

• Lower cost ways of obtaining non-market values from biofuels
  – Tax carbon to lower greenhouse gas emissions
  – Gasoline tax to reduce consumption of imported oil
  – Ethanol may be low cost way of meeting air quality standard. If so, then market will sort it out

• But when does Congress look for low-cost ways of achieving public policy objectives?
Specific Policy Observations

• Makes no sense for taxpayers to close the gap between production costs and market value of fuel
  – Fuel users cause the problems, they should pay
  – The tax credit seems like it is ready to go, and it should
  – Biodiesel tax credit should be next
Further Conclusions

• Makes no sense to enforce costly mandate, particularly for a mature industry
  – Incremental gallon of biodiesel costs more than $2.00 per gallon more than diesel to produce.

• Mandates for advanced biofuels may have more justifications, but no clear that mandated use will drive investments.
Future Policy Direction

• Current ethanol mandate too large without extensive investment in blending infrastructure
  – Flex-fuel cars
  – Blender pumps

• Do we really want ethanol as our alternative fuel?
Biofuel Alternatives to Ethanol

- Drop-in fuels or bio-butanol can use existing blending infrastructure
- Can be produced from any source of sugar
- New processes can create synthetic diesel or gasoline
  - Feedstocks are algae, corn starch, sugar cane, cellulose
- If we invest in ethanol infrastructure, investment in drop-in fuel technologies likely to falter
Current RFS is too Aggressive for Corn Ethanol

• Department of Energy and EPA assumed that ethanol would be the preferred biofuel
• 15 billion gallons of ethanol is more than can be absorbed by US consumers without a large discount in price if complementary investments in vehicle fleet and fuel infrastructure would come about
• US needs to decide if ethanol is our future fuel