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Understanding Ethanol Plant Economics: *Will Boom Turn Bust?*

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Table of Contents

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Introduction

Nebraska, along with several other midwestern states, is in the middle of an ethanol boom. In the past few years, a combination of high oil prices, cheap corn and favorable government policy have driven expansion of the industry. In turn, this has generated an unprecedented amount of industrial investment in many rural communities. However, local governments and economic developers have little information regarding the long-term economic viability of these plants, leaving critical questions unanswered. Will the ethanol boom turn bust? Is there future demand for ethanol and will prices stay high? What will be the impact of high corn prices? How much profit will the plant make? Do local incentives matter to the plant's bottom line? How much will local investors make? This information gap limits the ability of local governments to make informed public policy decisions about ethanol plants in their community, especially in terms of local tax incentives and abatements.

The purpose of this analysis is to assist local government officials and economic developers in understanding the future economic viability of ethanol plants. The analysis will focus on four key areas. First, understanding future revenue and cost structures helps communities see how price changes impact plant operations. Second, understanding future profitability helps communities assess the long-term viability of the plant, which matters when planning local economic development strategies related to ethanol production. In addition, understanding profitability allows communities to judge the appropriateness and amount of local tax incentives and their future ability to recover these costs. Third, understanding future dividends helps communities estimate how much local wealth will be created through local investors, if any. Lastly, understanding how a proposed change to the federal Renewable Fuel Standard impacts ethanol profitability is essential for local planning efforts, especially in the areas of economic development and government finance.

Ethanol production has expanded at a phenomenal rate. According to the U.S. Department of Agriculture, the nation produced about 5 billion gallons of ethanol in 2006, an increase of 210 percent from 2000 when only 1.6 billion gallons were produced (Westcott 2007). Over the next year another 2 billion gallons of production will be added as new plants go into operation. By the end of 2009 the nation is expected to produce over 10 billion gallons of ethanol per year. *Figure 1* shows that ethanol production is primarily concentrated in the Corn Belt. Iowa leads the nation in ethanol production at 1.5 billion gallons annually, followed by Nebraska with 1.1 billion gallons. Illinois, South Dakota and Minnesota also rank near the top, each producing about 700 million gallons annually.

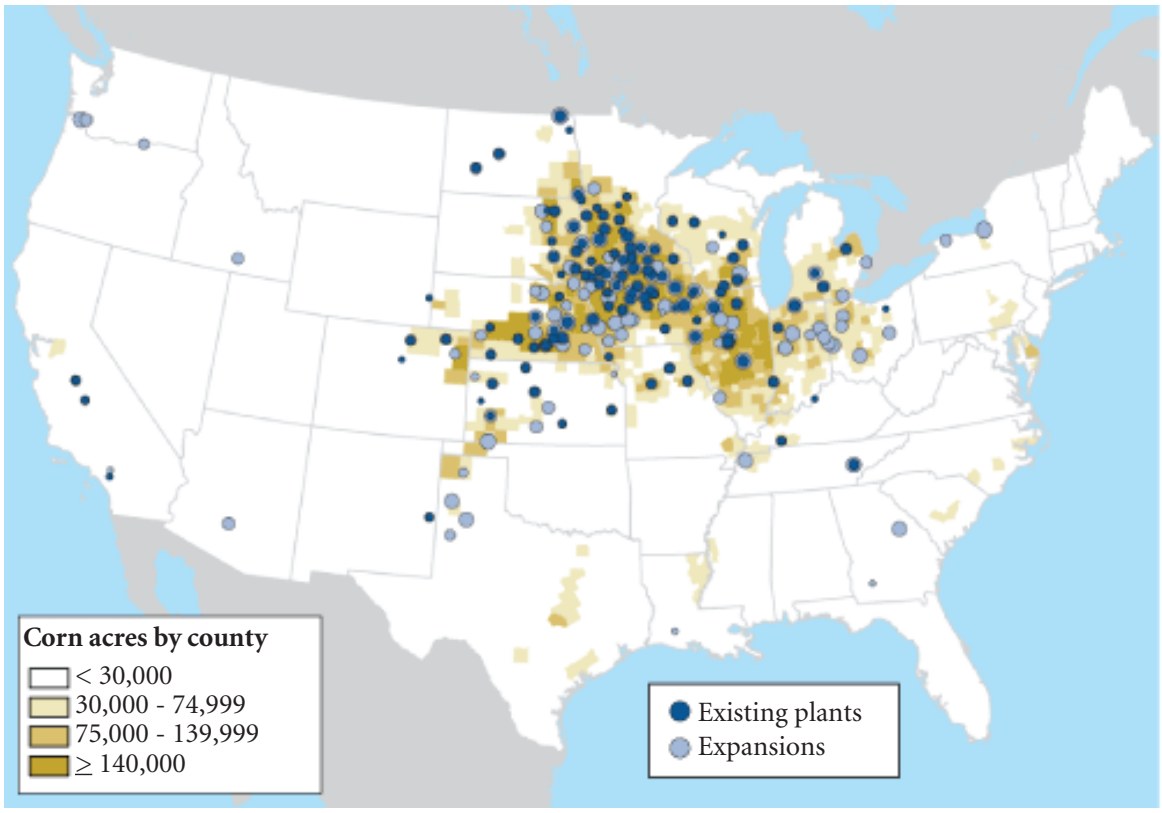

Figure 1. U.S. ethanol existing and planned capacity, updated in April 2007, based on Renewable Fuels Association data.

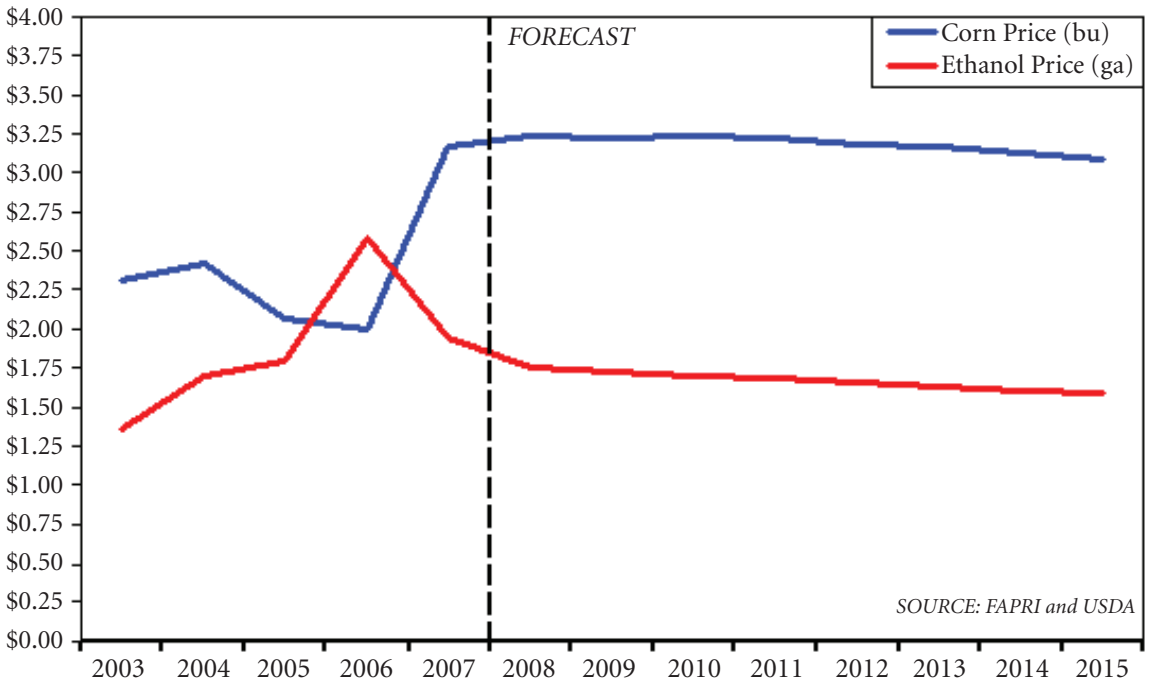

Figure 2. Under the 7.5-BGY Renewable Fuel Standard corn and ethanol prices fall.

What caused this ethanol boom? There are several drivers behind the rapid expansion of the ethanol industry. First, higher oil prices have increased the demand for ethanol. Throughout much of the 1990s oil hovered around $20 per barrel. However, by the mid 2000s oil prices rose to over $60 per barrel due to increased global demand, mainly from economic growth in the developing world (especially India and China) and poor energy conservation in the developed world (especially the United States). Higher oil prices have translated into higher gasoline prices, and blending ethanol into gasoline is one way to reduce the costs and increase the volume of gasoline produced.

Second, the U.S. Congress passed the Energy Policy Act of 2005 which created a government mandated demand for renewable fuels. The law required that 7.5 billion gallons of renewable fuels be used per year in gasoline by 2012. The law also offered no liability protection for the use of methyl tertiary butyl ether (MTBE), a clean air additive that was found to contaminate drinking water. These mandates generated a strong market demand for ethanol, both as a renewable fuel and as an MTBE replacement, which drove prices upward. Further, at least five states have enacted their own Renewable Fuel Standards, generally requiring that all gasoline sold in the state contain 10 percent ethanol.

Third, federal tax and trade policies have promoted the use of ethanol by affecting its price on the market. In terms of tax policy, the federal government provides a $0.51 tax credit to blenders for each gallon of ethanol blended with gasoline, now called the Volumetric Ethanol Excise Tax Credit (VEETC). The federal government also provides a production tax credit of $0.10 per gallon for the first 15 million gallons of ethanol produced by small facilities. Further, some 15 states have also enacted ethanol production tax credits. Nebraska provides a tax credit of $0.18 per gallon for the first 15.625 million gallons of ethanol produced for facilities in operation before state fiscal year 2004. In terms of trade policy, the federal government levies a $0.54 secondary tariff on most imported ethanol, although a small amount can be imported duty-free from certain Caribbean nations. This tends to keep domestic prices high by preventing the import of cheaper ethanol produced abroad.

These factors taken together, along with low corn prices over the past few years, have provided a strong profit incentive that has driven growth in the industry. However, it is important to note that much of the demand for ethanol is government driven, and thus the future of the industry depends greatly on future public policy. One example of this comes from the federal Renewable Fuel Standard. According to the U.S. Department of Agriculture, given current trends, ethanol production will reach its peak at 12 billion gallons per year in 2015 (Westcott 2007). This is much more than the current 7.5 billion gallons mandated by the federal Renewable Fuel Standard.

National forecasts presented in *Figure 2*, which include petroleum prices, indicate that under the current standard, ethanol prices will drop considerably in the

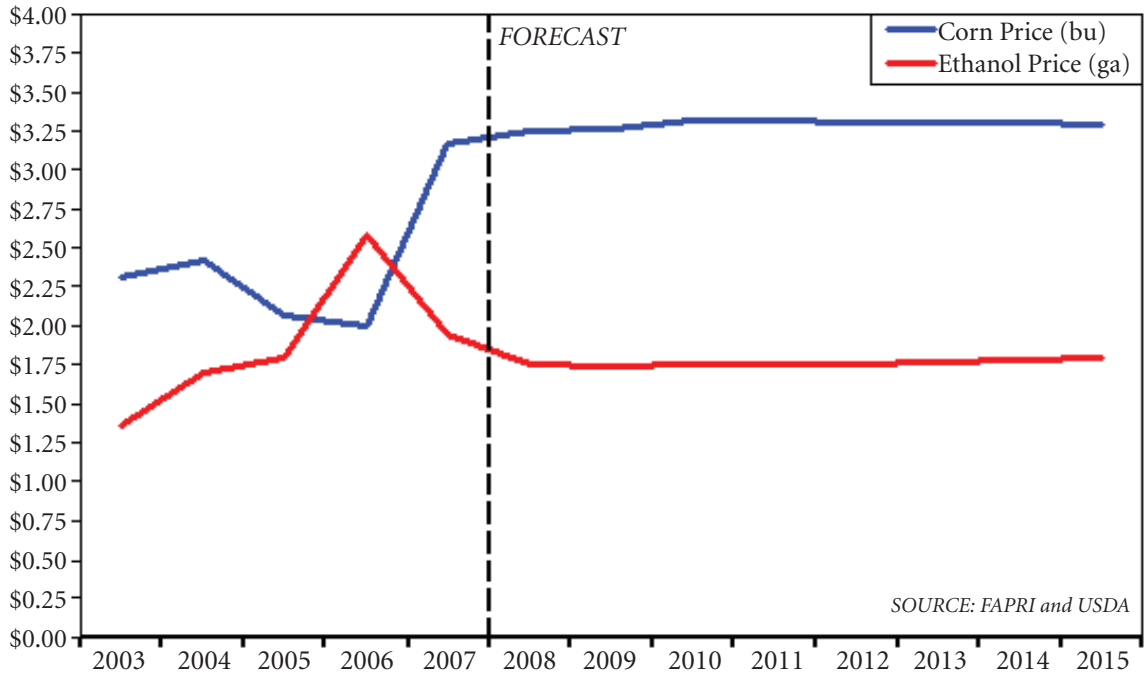

Figure 3. Under a 15-BGY Renewable Fuel Standard corn prices stabilize and ethanol prices rise.

coming years (FAPRI 2007*a*). Since 2003 ethanol prices have risen considerably, peaking in 2006 at over $2.50 per gallon. The 2006 peak was due to increased ethanol demand as a replacement for MTBE. During the same period, corn prices dropped to about $2.00 per bushel, making ethanol production very lucrative. However, it is projected that from 2007 onward ethanol prices will drop and corn prices will rise, squeezing profit margins in the ethanol sector. Ethanol prices are expected to drop from $1.95 per gallon in 2007 to $1.60 per gallon by 2015. Corn prices are expected to hover around $3.20 per bushel between 2007 and 2011, and then drop to about $3.10 per bushel by 2015.

However, proposed legislation now under consideration in Congress would stabilize prices by creating additional demand for ethanol. The proposed Energy Saving Act of 2007 would increase the Renewable Fuel Standard to 15 billion gallons a year by 2015, all of which can be supplied by ethanol derived from corn starch. If the proposed standard were to go into effect, it is expected to raise ethanol and corn prices from current projected levels (FAPRI 2007*b*). Ethanol prices would increase $0.02 above projected levels starting in 2009 and increase to nearly $0.20 above projected levels by 2015 *(Figure 3)*. This would stabilize ethanol prices at about $1.75 to $1.80 per gallon from 2008 through 2015. Corn prices would increase $0.05 above projected levels in 2009 and $0.20 above projected levels by 2015. Clearly, an expanded 15-billion gallon per year Renewable Fuel Standard would greatly benefit ethanol producers and corn growers.

Of course, these forecasts are all subject to unforeseen economic and policy shocks that could change the outcomes considerably. Future developments in agricultural markets appear even more uncertain than in past years. For example, the outlook for biofuels and agricultural markets may look very different if petroleum prices increase or decrease from currently projected levels. The FAPRI forecasts for corn and ethanol used in this analysis recognize this uncertainty and consider 500 alternative outcomes for the future built on different assumptions about the price of petroleum, the weather and other factors that will affect the supply and demand for agricultural commodities. Wherever possible, the reported prices for corn and ethanol are the averages of the 500 alternative outcomes. Readers should keep in mind that these numbers are a projection of what could happen if certain economic assumptions and policies remain in place.

Data and Methods

To understand ethanol plant economics requires a model of how plants operate in terms of revenues and costs. For this analysis, hypothetical scenarios for two types of ethanol plants most prevalent in Nebraska were developed. The first scenario models a 40-million-gallon per year (MGY) ethanol plant that was constructed in 2002 and represents the future viability of older ethanol plants. The second scenario models a 100-MGY ethanol

plant built in 2005, and represents the future viability of newer ethanol plants.

It needs to be stressed that these scenarios make a number of assumptions about how ethanol plants operate and respond to market conditions. It is necessary to make reasonable assumptions for two reasons. First, we cannot perfectly predict future economic conditions because markets change rapidly. Second, we cannot perfectly predict how individual ethanol plants will respond to market changes, nor can we model all possible strategies taken by these plants. The model is not a forecast of what will happen, but rather a projection of what could happen if certain economic assumptions and policies remain in place. Nonetheless, making reasonable assumptions allows us to better understand how ethanol plants are affected by production and price changes over time. The assumptions of the model are presented in detail below and in the *Appendix*.

In terms of **production capacity**, both the 40-MGY and 100-MGY plants are assumed to operate at 100 percent capacity. For 40-MGY plants, ethanol yield per bushel of corn is 2.6 gallons in the first year of operation, which increases to 2.8 gallons by the 10th year. For 100-MGY plants, ethanol yield per bushel of corn starts at 2.7 gallons in the first year and then increases to 2.9 gallons by the 10th year. Increases in ethanol yield per bushel of corn reflect advances in technology and gains in plant efficiency. For both types of plants, it is assumed that one bushel of corn yields 19.0 lb of dry distiller's grains and 17.5 lb of carbon dioxide. Inputs also remain fixed between the two plants, both requiring 7 gallons of water per bushel of corn, 1.1 kilowatt hours of electricity per gallon of ethanol, and 35,000 BTUs of natural gas per gallon of ethanol. Production information is taken from Tiffany and Eidman (2003) at the University of Minnesota, and Swenson and Eathington (2006) at Iowa State University.

Investment costs are the total capital needed to construct and equip an ethanol plant. Capital costs for a 40-MGY plant are estimated at $60 million and for a 100-MGY plant, $140 million — both in nominal dollars. These capital costs are much lower than they are today because demand for ethanol construction has grown sizable since 2005, mainly fuelled by rising ethanol prices. Also, average capital costs decrease as newer and larger plants are built, possibly due to more efficient plant designs and economies of scale. Investment information is taken from Gallagher, Brubaker, and Shapouri (2005) at Iowa State University.

For **financial** matters it is assumed that both plants are financed through 60 percent debt (paid over 10 years at 8 percent interest per annum) and 40 percent equity (with an expected return of 15 percent per annum). Straight-line depreciation is assumed over 20 years with a salvage value equaling 25 percent of total investment costs.

Labor requirements assume that a 40-MGY plant will need to employ 30 workers and that a 100-MGY plant will need to employ 45 workers. In both cases, average annual wages per job are assumed to be $45,000 per year (2007 dollars), with wage growth of 3 percent per annum. Benefits are estimated at 13 percent of the wage base. Other labor and management costs are assumed to be 10 percent of total wage costs. Labor information is taken from the Nebraska Department of Labor's employment and wages database.

Costs of **primary inputs** are the same for both types of plants, yet are adjusted for inflation. Historical corn prices are taken from the U.S. Department of Agriculture's feed grains database, while projected corn prices are taken from baseline projections developed by Food and Agricultural Policy Research Institute (FAPRI) at the University of Missouri. Water costs are from the Nebraska Department of Natural Resources and assumed to grow by 2 percent per annum. Electricity and natural gas costs for Nebraska are taken from the U.S. Department of Energy, with electricity and natural gas each expected to grow by 2 percent per annum.

Costs of **secondary inputs** are also the same for both types of plants and are taken from primary data collected by Tiffany and Eidman (2003) and Swenson and Eathington (2006). Secondary inputs include enzymes, denaturants, yeasts, chemicals for processing and cooling, various antibiotics, waste management, maintenance, transportation costs and miscellaneous administrative costs. These costs are assumed to grow by 2 percent per year.

In terms of **revenues**, historical ethanol prices are taken from the Nebraska Energy Office, while projected ethanol prices are taken from FAPRI's baseline projections. Petroleum prices paid by refiners are included in the ethanol forecast and are assumed to drop from $60 per barrel in 2006 to $50 per barrel in 2015. Historical dry distiller's grains prices are taken from the U.S. Department of Agriculture's feed grains database, while projected distiller's grains prices are taken from FAPRI's baseline projections. Prices for carbon dioxide are taken from Tiffany and Eidman (2003) and are expected to grow by 2 percent per annum.

Taxes are estimated from data provided by the Nebraska Department of Revenue. Property taxes are estimated at 1.75 percent of assessed valuation (estimated at 90 percent of total investment). Sales taxes are assumed to be levied on 50 percent of the input costs for enzymes, yeasts and chemicals. Corporate income taxes are applied to any gross profit, with a rate of 10 percent

on the first $50,000 and a rate of 20 percent thereafter. Insurance trust taxes are estimated at 10 percent of total wages paid and include Social Security, Medicare, unemployment and workers compensation.

For **tax credits**, only the 40-MGY plant qualifies for the federal small producer credit and the Nebraska production incentive credit. The 100-MGY plant is too large to qualify for federal credits and went into production too late to qualify for Nebraska credits. It is assumed that neither plant qualifies for Nebraska Advantage or other state tax credits. Local incentives, such as tax increment financing, are not considered in this analysis.

In terms of **profit allocation**, it is assumed that any after-tax profits are allocated in the following manner. First, 5 percent of net profits are directed to a reserve fund that can be used as working capital. Second, equity dividends are paid to investors equaling a 15 percent annual rate of return. Third, after reserves and minimum dividends are paid all surplus profit is directed toward debt reduction. Fourth, if there is no outstanding debt, all surplus profit is paid as dividends to investors after 5 percent is directed to reserves. Any losses are offset by available reserves.

The *Ethanol Plant Economics Tool* was developed to model the scenarios presented here, which require a number of assumptions about how plants operate under certain economic conditions. The assumptions in the tool can be customized to model most types of ethanol plants under a variety of economic conditions. This allows users to run "what-if" scenarios for use in local economic development planning. Those interested in having customized scenarios run for their community can contact the author or their local UNL extension educator.

Economics of a 40-MGY Ethanol Plant

This scenario models the economics of an older 40-million-gallon per year ethanol plant under two market conditions. The first models the economic viability of a 40-MGY ethanol plant under current market demand conditions. This assumes that the current 7.5 billion gallon per year federal Renewable Fuel Standard remains unchanged through 2015. The second models economic viability under expanded market demand conditions. This assumes that the proposed 15 billion gallon per year federal Renewable Fuel Standard will be passed in 2007 and fully implemented by 2015.

Current Ethanol Demand — 7.5-BGY Renewable Fuel Standard

In terms of revenues, the first three years of operation show a marked growth in sales, growing from $71.54 million in 2003 to $119.27 million by 2006 *(Figure 4)*. This is likely due to the 7.5 billion gallon fuel standard and, more importantly, demand for an MTBE replacement. However, sales are expected to drop considerably

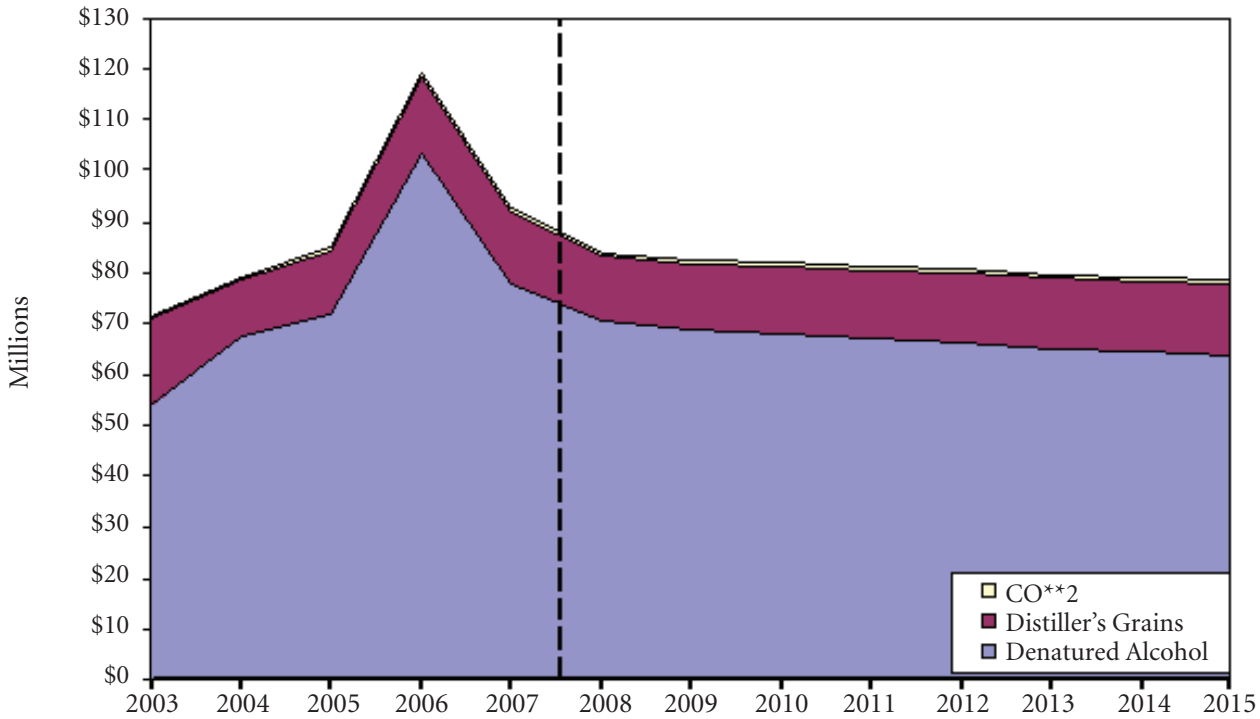

Figure 4. Revenues of a 40-MGY plant under the current 7.5-BGY Renewable Fuel Standard.

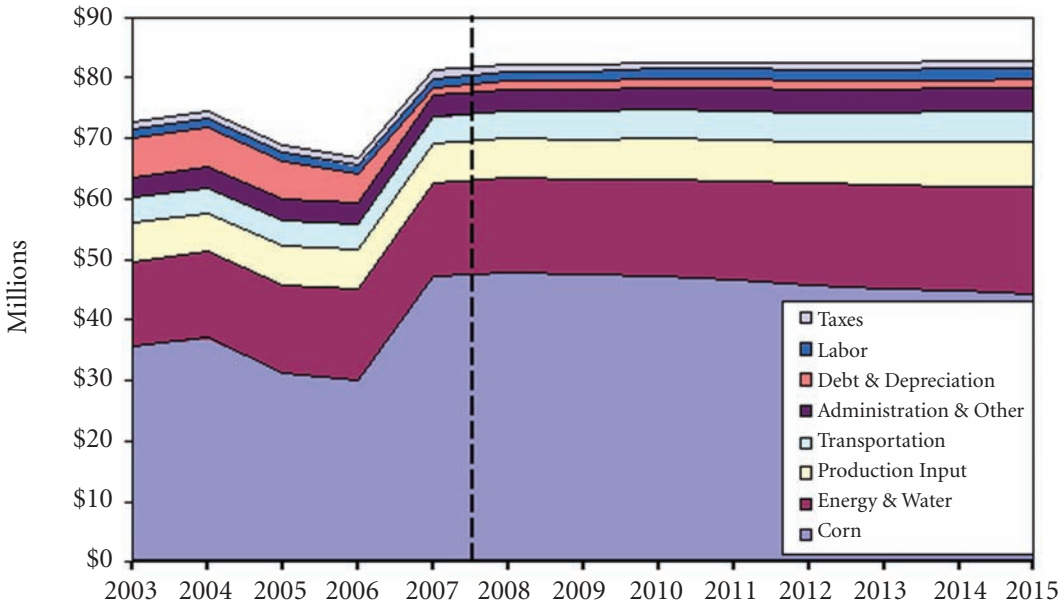

Figure 5. Costs of a 40-MGY plant under the current 7.5-BGY Renewable Fuel Standard.

by 2007 as demand for MTBE is met. Revenues also are projected to drop further over the coming decade as the 7.5 billion gallon standard is met, with sales dropping from $84.08 million in 2008 to $78.76 million by 2015.

Ethanol prices drive revenues. Ethanol sales are at their highest between 2004 and 2007 at around 85 percent of total sales, and at their lowest in 2003 at 75 percent of sales. Distiller's grains contribute about 20 percent of total sales, and generally add more to revenues when ethanol prices are low. Distiller's grains revenues are at their highest in 2003 and 2015 and at their lowest in 2006. Carbon dioxide generates only a small fraction of total sales.

In terms of total costs, not including tax credits and other incentives, the first several years of operation generally have lower costs than later years *(Figure 5)*. Total costs drop from $72.63 million in 2003 down to $66.68 million in 2006. However, in 2007 costs jump up to $81.06 million. From 2008 through 2015 total costs rise slightly, yet remain stable at about $82.50 million. Since corn is the largest input, changes in corn prices drive much of the total costs of production.

Corn accounts for 50 percent of costs in 2003, which drops to 45 percent by 2006. However, corn costs rise to 58 percent by 2009, then remain steady at around 55 percent through 2015. Energy and water comprise about 20 percent of total costs, which grow at about the rate of inflation over time. Other production inputs, like chemicals and yeasts, account for 9 percent of costs; and these also remain fairly constant over time. Debt and depreciation consume 9 percent of total costs in 2003. Yet as debt is paid off early this drops to 7 percent by 2006, and from 2007 onward the only costs are 2 percent for depreciation. Transportation costs, mainly rail, constitute about 6 percent of total costs across all years. About 5 percent goes to administrative and other costs. Labor costs account for 2 percent and taxes also account for 2 percent of the total, and these remain stable over time.

Profits and losses of a 40-MGY ethanol plant can be estimated by taking total revenues less net costs, which includes tax credits and other government incentives. Gross profit is the difference between total revenues and net costs. Net profit deducts the costs of corporate income taxes. Referring to the information presented in *Figure 6*:

- In the first year of operation in 2003 costs exceed revenues; however, due to salable tax credits the plant experiences a gross profit of $1.73 million. Deducting corporate income taxes from this amount results in a net profit of $1.39 million for the first year.
- In 2006 the plant has it most profitable year, generating $56.90 million in gross profits and $45.33 million in net profits after taxes. Sizable profits in 2006 are due to high ethanol prices ($2.58 per gallon) and low corn prices ($2.00 per bushel).
- By 2009 the profit margin narrows considerably, with gross profits of $4.43 million and net profits of $3.55 million. Tax credits are again responsible for generating nearly all of the profits.
- However, as federal and state tax credits expire in 2011 the ethanol plant fails to be profitable. The plant experiences a gross and net loss of $1.41 million in 2011 and a gross and net loss of $1.79

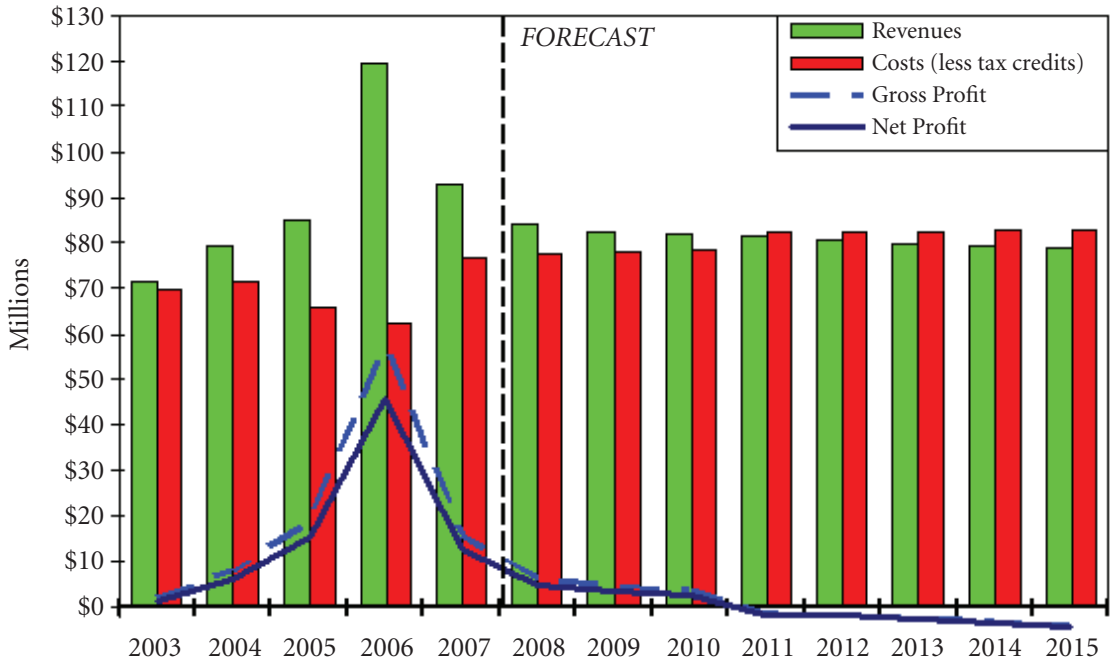

Figure 6. Profits and losses of a 40-MGY plant under the current 7.5-BGY Renewable Fuel Standard.

million in 2012; however, cash reserves are able to cover net losses in 2011 and 2012.

- The plant is not able to cover losses between 2013 and 2015 as cash reserves are depleted. By 2015 the plant experiences a gross and net loss of $4.17 million for the year. These losses are caused by a combination of higher corn prices ($3.09 per bushel), low ethanol prices ($1.59 per gallon), and expiration of tax credits.

Another way to look at plant profitability is to allocate revenues to various costs and profits per gallon of ethanol produced. Revenues are from all sources, including the sale of ethanol and its byproducts. Costs include inputs (less tax credits), financial, labor and taxes. Some results may not sum due to rounding. Referring to the information presented in *Figure 7*:

- In the first year of operation in 2003, the plant generates $1.79 in revenues per gallon of ethanol. Total production costs account for $1.75 of these revenues, comprising inputs ($1.51), debt repayment ($0.17) and labor and taxes ($0.07). The result is a net profit of nearly $0.04 per gallon of ethanol produced.
- Over the next several years profits grow as revenues increase and costs decline. The most profitable year is 2006, when producers earn $1.14 in net profit per gallon of ethanol. In that year, total revenues peak at a high of $2.98 per gallon. Costs fall to a low of $1.84 per gallon, with $1.37 going toward inputs, $0.35 toward taxes and labor, and $0.12 toward debt repayment.
- Profits are greatly reduced through 2010, although the plant still generates decent profits. Total revenues generated from ethanol production fall to $2.04 per gallon while total costs grow to $1.97 per gallon, resulting in a net profit of $0.07 per gallon of ethanol produced. Input costs jump to $1.85 per gallon, while labor and taxes drop to $0.09, and financial costs drop to $0.03 as debt obligations are retired.
- The plant ceases to be profitable by 2011 as tax credits expire and as ethanol prices fall and corn prices rise. By 2012 the plant loses $0.04 per gallon of ethanol produced. Total revenues drop slightly to $2.02 per gallon. By contrast, total costs rise to $2.06 per gallon as tax credits expire, which increases input costs to $1.95 per gallon with other costs remaining constant.
- Losses grow larger by 2015 as prices for ethanol continue to drop. Total revenues fall to $1.97 per gallon in 2015, while costs remain steady at $2.07 per gallon. This results in a net loss of $0.10 per gallon of ethanol produced.

Once profits and losses have been determined it is possible to model how they are distributed. In this analysis, it is assumed that a 40-MGY plant will direct 5 percent of net profits into a cash reserve fund, with the remaining profits directed toward debt reduction and

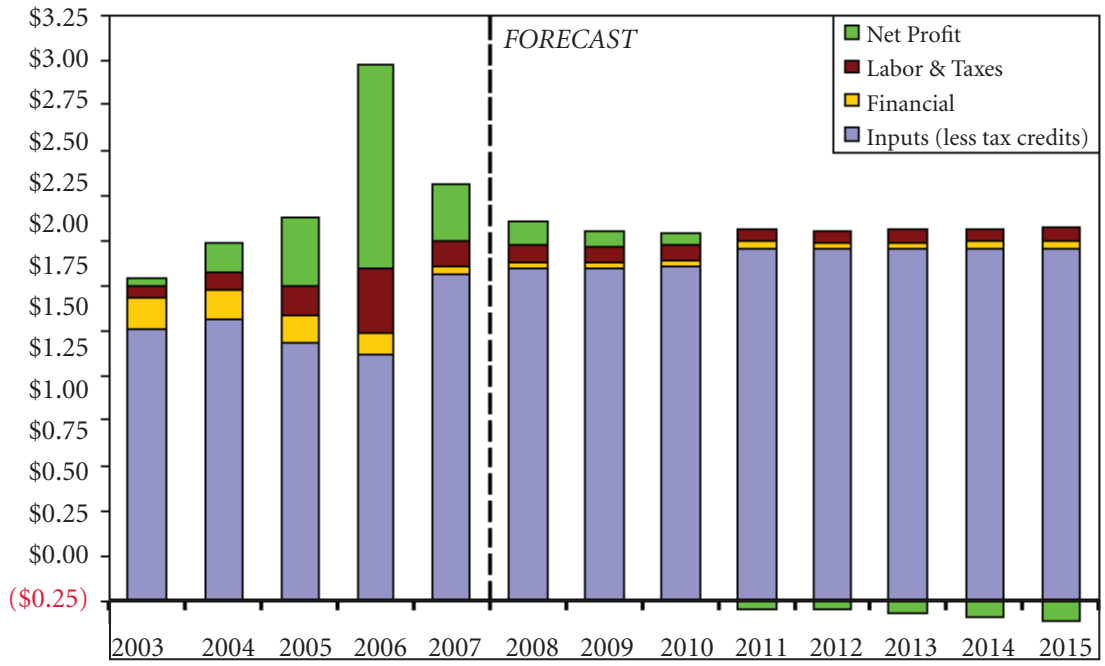

Figure 7. Costs per gallon of ethanol produced by a 40-MGY plant under the current 7.5-BGY Renewable Fuel Standard.

investor dividends. Referring to the information presented in *Figure 8*:

- In 2003, the plant issues $1.32 million in equity dividends to investors, equaling an annual rate of return of 5 percent. Since this is below the minimum 15 percent return expected by investors, no early debt repayments are made.
- Over the next two years the plant returns a 15 percent dividend to investors and makes $13.01 million in early debt repayments.
- By 2006 the plant posts record profits and retires its debt obligations. Investors are paid $20.31 million in dividends for a stunning 85 percent return rate for the year. The plant also pays $22.94 million to retire the last of its outstanding debt. Cash reserves grow to $3.41 million.

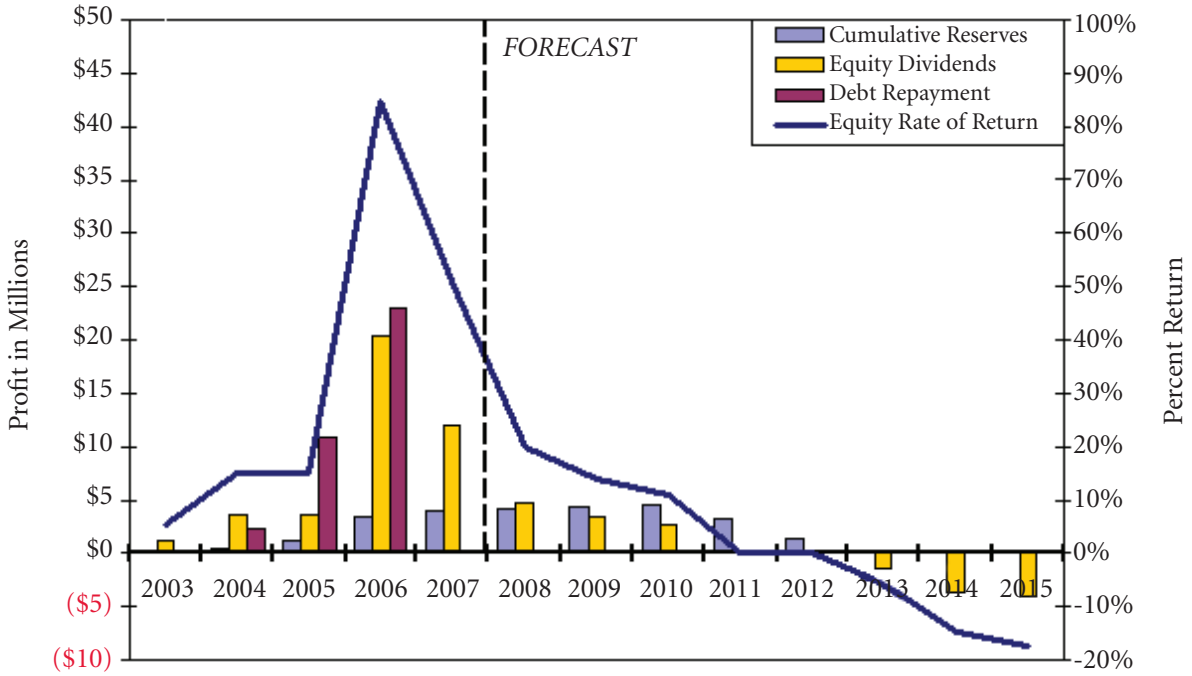

Figure 8. Gross profit allocation of a 40-MGY plant under the current 7.5-BGY Renewable Fuel Standard.

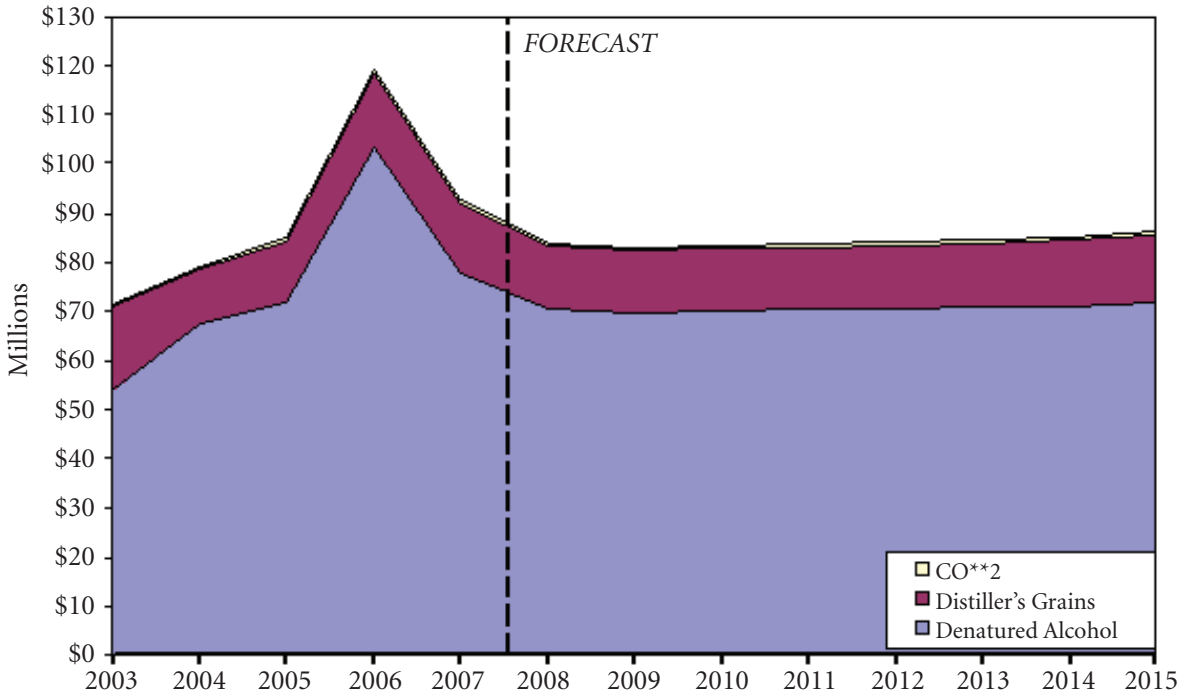

Figure 9. Revenues of a 40-MGY plant under the proposed 15-BGY Renewable Fuel Standard.

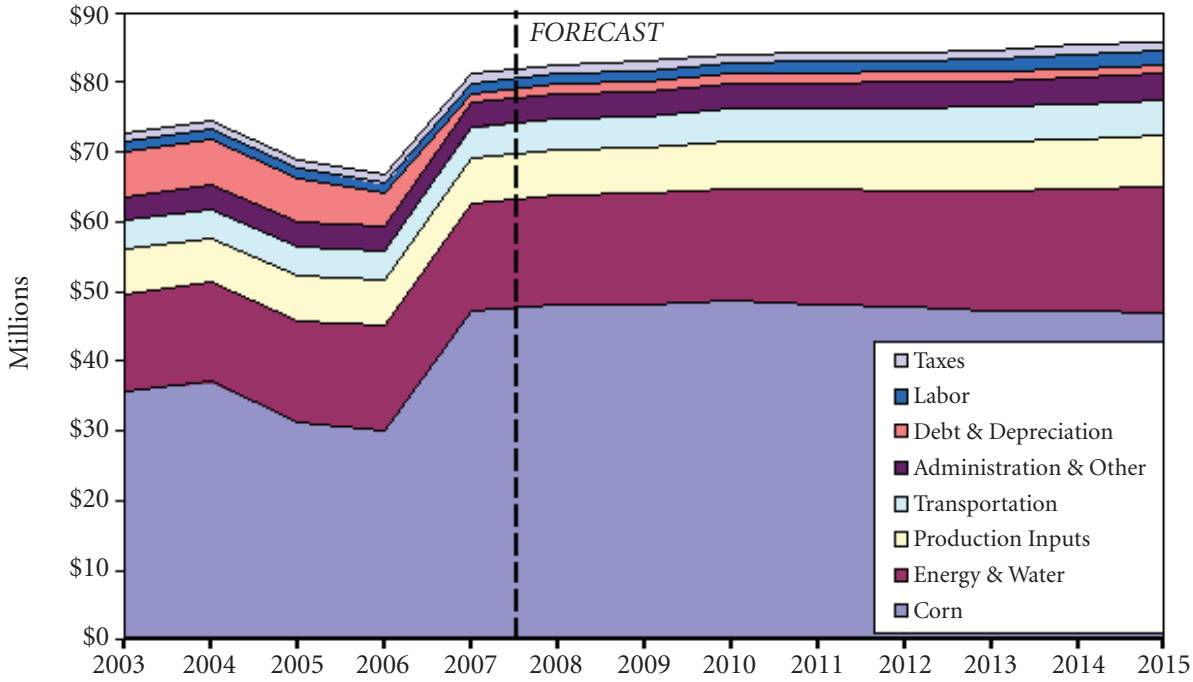

Figure 10. Costs of a 40-MGY plant under the proposed 15-BGY Renewable Fuel Standard.

- Through 2010 the plant still remains profitable, paying returns of over 10 percent to investors and continuing to build its cash reserves.
- However, between 2011 and 2012 the plant experiences net losses and is forced to cover these gaps by taking $3.20 million from cash reserves. During this period, investors receive no equity returns.
- By 2013 cash reserves are exhausted and investors experience a negative rate of return. In 2013 investors lose $1.36 million equaling a 6 percent loss, and by 2015 this expands to $4.17 million equaling a 17 percent loss for the year.

In summary, under the current Renewable Fuel Standard a 40-MGY ethanol plant only remains profitable between 2003 and 2010. The plant fails to be profitable by 2011 and generates losses by 2013. Losses are primarily due to falling ethanol prices as the 7.5-BGY standard is met, relatively high corn prices, and the expiration of tax credits. Given current demand, the ethanol boom for a 40-MGY plant only lasts until 2010, after which the plant will struggle to make a profit and may go bust by 2013.

Expanded Ethanol Demand — 15-BGY Renewable Fuel Standard

If the proposed Energy Saving Act of 2007 is passed, it would increase the Renewable Fuel Standard to 15 billion gallons a year by 2015. This is expected to raise ethanol and corn prices from the current projected levels. The proposed standard greatly enhances the profitability of a 40-MGY ethanol plant. For the most part, prices do not change significantly under the proposed standard until 2009.

The plant generates $83.04 million in revenues in 2009, which is only $679,900 higher than under the current standard; however, sales grow from $84.17 million in 2012 to $86.31 million by 2015, which is $3.51 million and $7.56 million more than under the current standard, respectively. Ethanol prices drive revenues and are presented in *Figure 9*.

There is also a corresponding rise to total costs compared to the current standard, mainly due to increased corn prices. Under the proposed standard, costs of production rise to $735,300 for a total cost of $82.98 million in 2009. Costs grow slightly from $84.33 million in 2012 to $85.79 million by 2015, representing an increase of $1.87 million and $2.86 million from the current standard, respectively. Corn, energy and water prices drive costs and are presented in *Figure 10*.

Again, for the most part profits and losses do not change significantly until 2009 (*Figures 11* and *12*). Gross profits, including tax credits, are $4.37 million in 2009 and net profits after corporate income taxes are $3.50 million. Surprisingly, net profits under the proposed standard are slightly lower ($44,400) than under

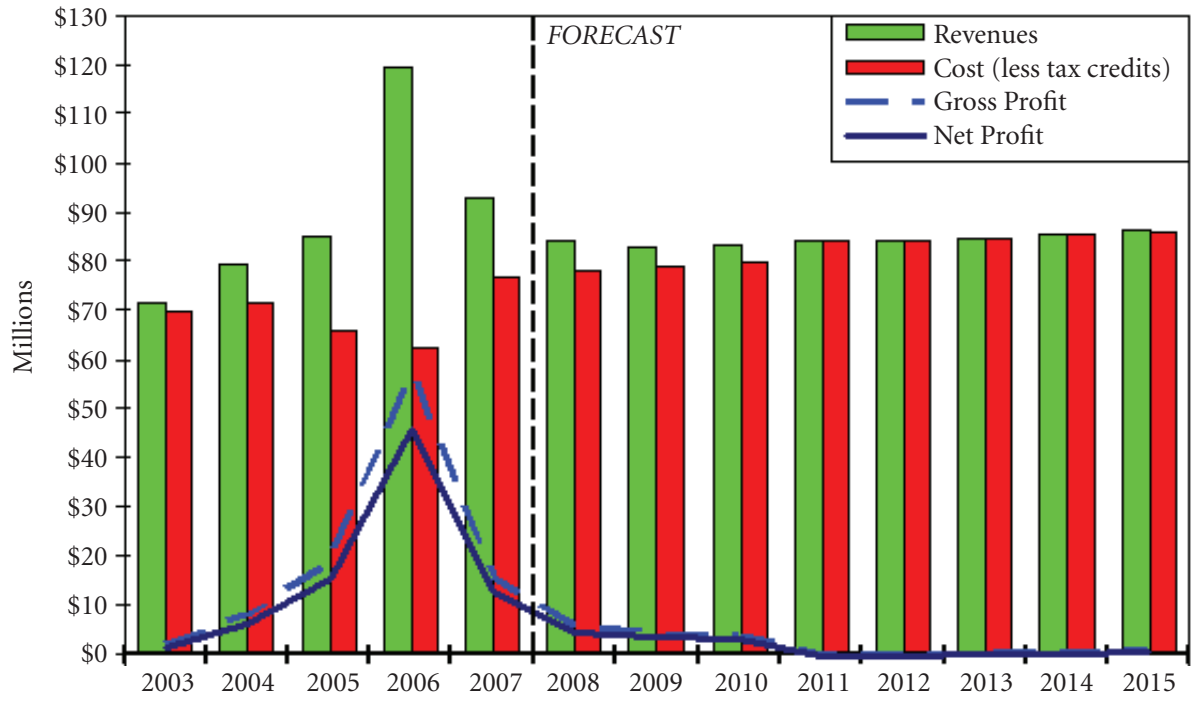

Figure 11. Profits and losses of a 40-MGY plant under the proposed 15-BGY Renewable Fuel Standard.

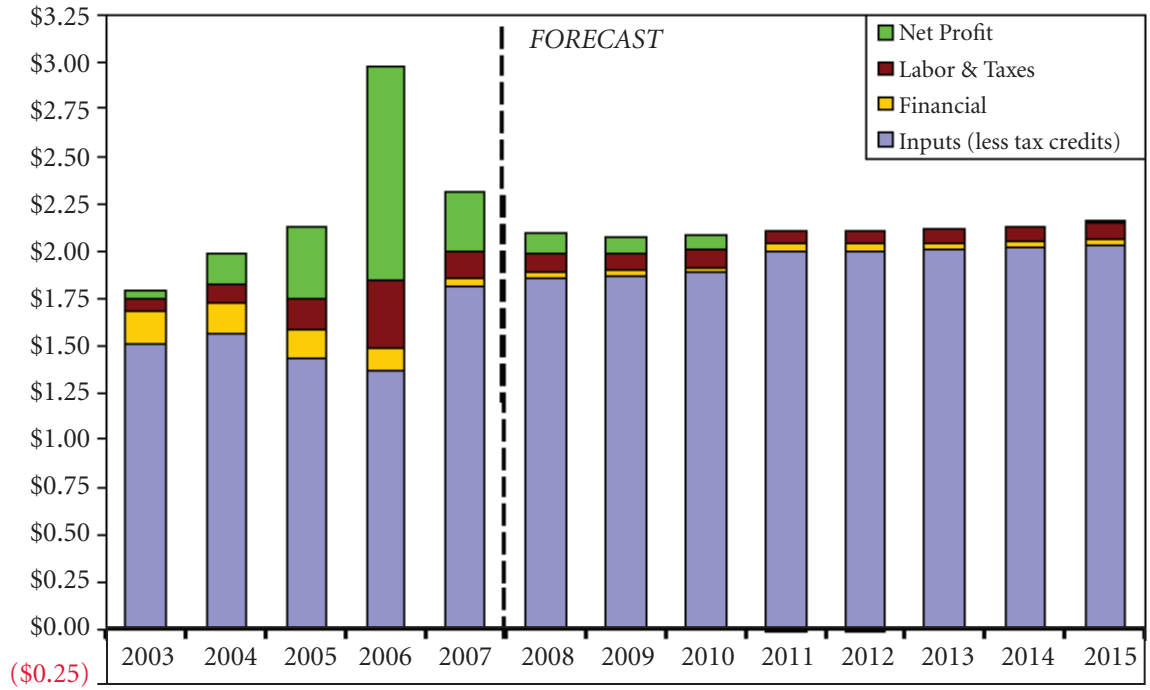

Figure 12. Costs per gallon of ethanol produced by a 40-MGY plant under the proposed 15-BGY Renewable Fuel Standard.

the current standard. This is due to corn prices rising faster than ethanol prices. In terms of profits per gallon of ethanol produced, both the current and proposed standards result in a net profit of $0.09 per gallon in 2009. Under the proposed standard both revenues and costs rise by $0.02, putting total revenues at $2.08 per gallon and total costs at $1.99 per gallon.

The profit margin narrows after 2010 as tax credits expire. The plant generates a small net loss of $151,300 in 2012, however this is much less that the $2.76 million net loss under the current standard. In per-gallon terms, the proposed standard in 2012 raises total revenues to $2.10 per gallon and total costs to $2.11 per gallon, compared to $2.02 and $2.06 under the current standard. On balance, under the proposed standard the plant breaks even, while under the current standard it experiences a $0.04 loss.

By 2015 revenues continue to exceed costs, resulting in a small net profit caused by rising ethanol prices due to increased demand triggered by the proposed standard. Net profits in 2015 are $424,400, which again is much higher that the net loss of $4.17 million experienced under the current standard. On a per gallon basis, the proposed standard generates $0.01 in net profit per gallon of ethanol, compared to the $0.10 net loss experienced under the current standard. Total revenues rise to $2.16 and total costs rise to $2.15 per gallon, compared to $1.97 in revenues and $2.07 in costs under the current standard.

In terms of profit allocation, the proposed standard results in a small net profit and some returns to investors between 2013 and 2015 *(Figure 13)*. Although there are small losses in 2011 and 2013, these are easily covered by cash reserves. By contrast, the current standard results in net losses and no dividends between 2011 and 2015 — with investors experiencing negative returns between 2013 and 2015. Under the proposed standard, in 2013 investors are paid $68,900 in dividends, although this is less than a 1 percent rate of return. By 2015 investor dividends expand to $424,400, representing a 2 percent annual return.

In summary, the proposed 15-BGY Renewable Fuel Standard would return a 40-MGY ethanol plant back to profitability and generate small net profits between 2013 and 2015. Further, the plant has sufficient cash reserves to cover small net losses in 2011 and 2012, and these reserves could also be used to pay investors a larger return. By contrast, the current 7.5-BGY standard results in sizable net losses during this same period. Given an expanded demand, the ethanol boom is expected to last through 2010. The plant will struggle to break even in 2011 and 2012, but from 2013 onward the plant is expected to generate small net profits with no bust expected. In short, an expanded Renewable Fuel Standard is necessary in order to keep an older 40-MGY ethanol plant economically viable.

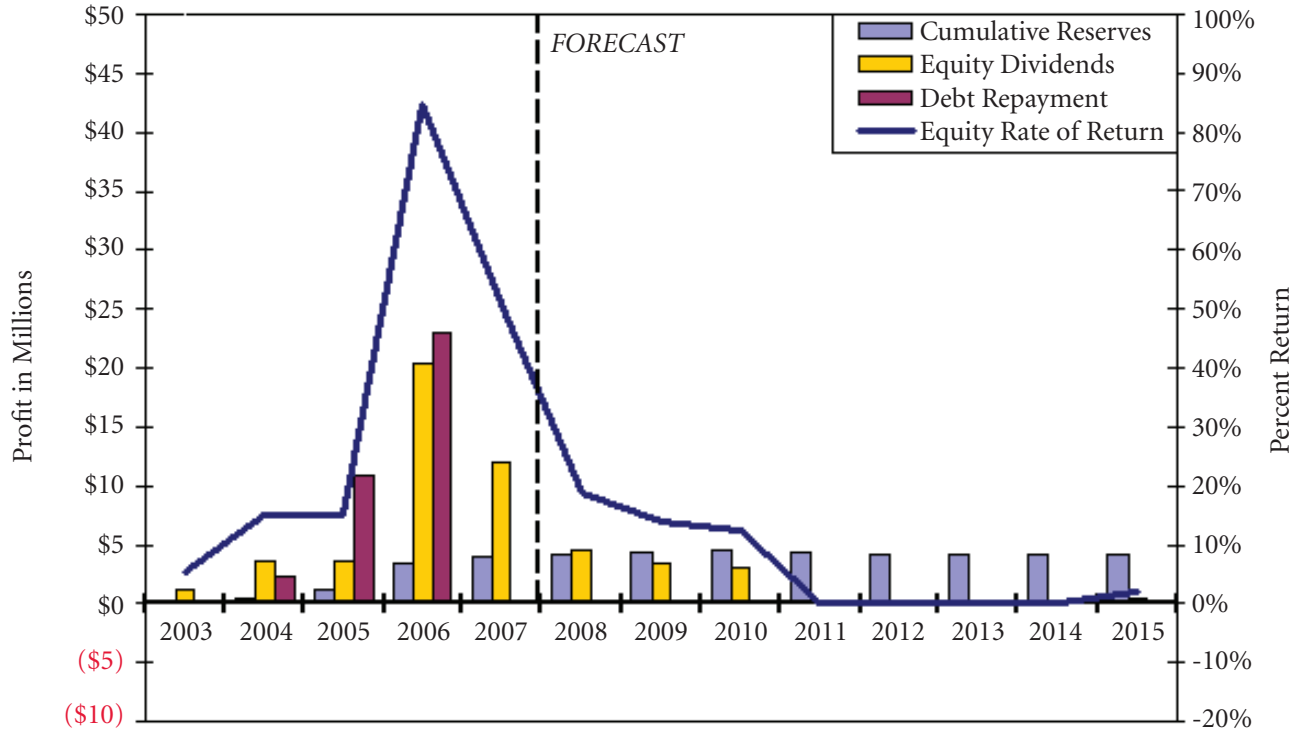

Figure 13. Gross profit allocation of a 40-MGY plant under the proposed 15-BGY Renewable Fuel Standard.

Economics of a 100-MGY Ethanol Plant

This scenario models the economics of a newer 100-million-gallon per year ethanol plant, which is assumed to be more productive than older 40-MGY plants. As before, scenarios have been developed under two market conditions. The first models the economic viability of a 100-MGY ethanol plant under current market demand conditions. This assumes that the current 7.5-billion-gallon per year federal Renewable Fuel Standard remains unchanged through 2015. The second models the economic viability under expanded market demand conditions. This assumes that the 15-billion-gallon per year federal Renewable Fuel Standard will be passed and fully implemented by 2015.

Current Ethanol Demand — 7.5-BGY Renewable Fuel Standard

In terms of revenues, the first year of operation generates the highest level of sales at $297.52 million in 2006 *(Figure 14)*. This is likely due to the 7.5 billion gallon fuel standard and, more importantly, demand for an MTBE replacement. However, as demand for MTBE is met, sales are expected to drop considerably in 2007 and 2008 — dropping by $230.69 million in 2007 and $209.64 million in 2008. Revenues are projected to stabilize by 2009, yet will experience a slow decline over the coming decade as the 7.5-billion-gallon fuel standard is met. During this period revenues will drop from $205.35 million in 2009 to $195.78 million by 2015.

Ethanol prices drive revenues in a 100-MGY plant. Ethanol sales account for 87 percent of total sales in 2006, but this share drops over the decade to 81 percent by 2015. Distiller's grains contribute about 13 percent of total sales in 2006, and this share grows to 18 percent by 2015 as ethanol revenues drop. Carbon dioxide generates only a small fraction of total sales.

In terms of costs, the first year of operation in 2006 has the lowest costs of production at $164.42 million *(Figure 15)*; however, in 2007 costs jump significantly to $195.68 million driven by high corn prices. From 2008 through 2014 total costs remain stable at about $198.50 million. By 2015 the costs of production drop slightly to $197.72 million. Since corn is the largest input, changes in corn prices drive much of the total cost of production.

Corn accounts for around 60 percent of total costs in a 100-MGY plant. The exception to this occurs in 2006, when corn only accounts for 45 percent of costs. However, by the next year in 2007 corn prices jump and consume 60 percent of total costs that remain steady through 2012. Corn costs drop slightly by 2013 and 2015, accounting for about 55 percent of costs. Energy and water comprise about 20 percent of total costs between 2007 and 2015, and these are expected to grow

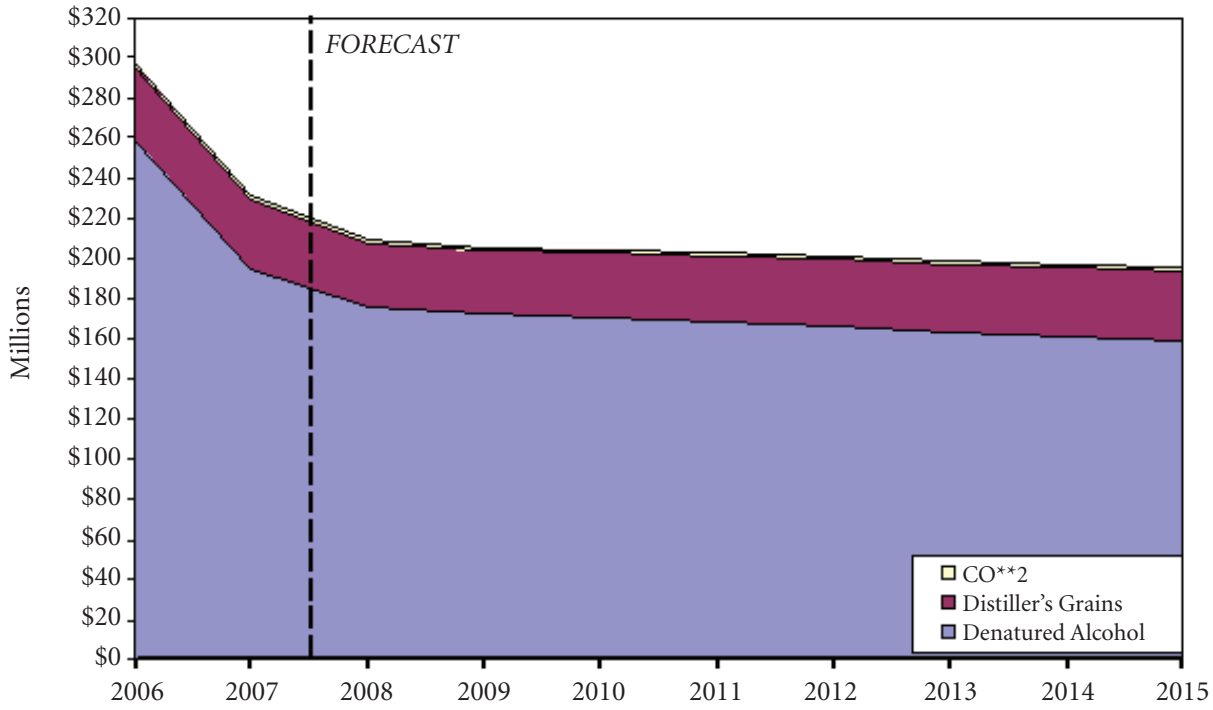

Figure 14. Revenues of a 100-MGY plant under the current 7.5-BGY Renewable Fuel Standard.

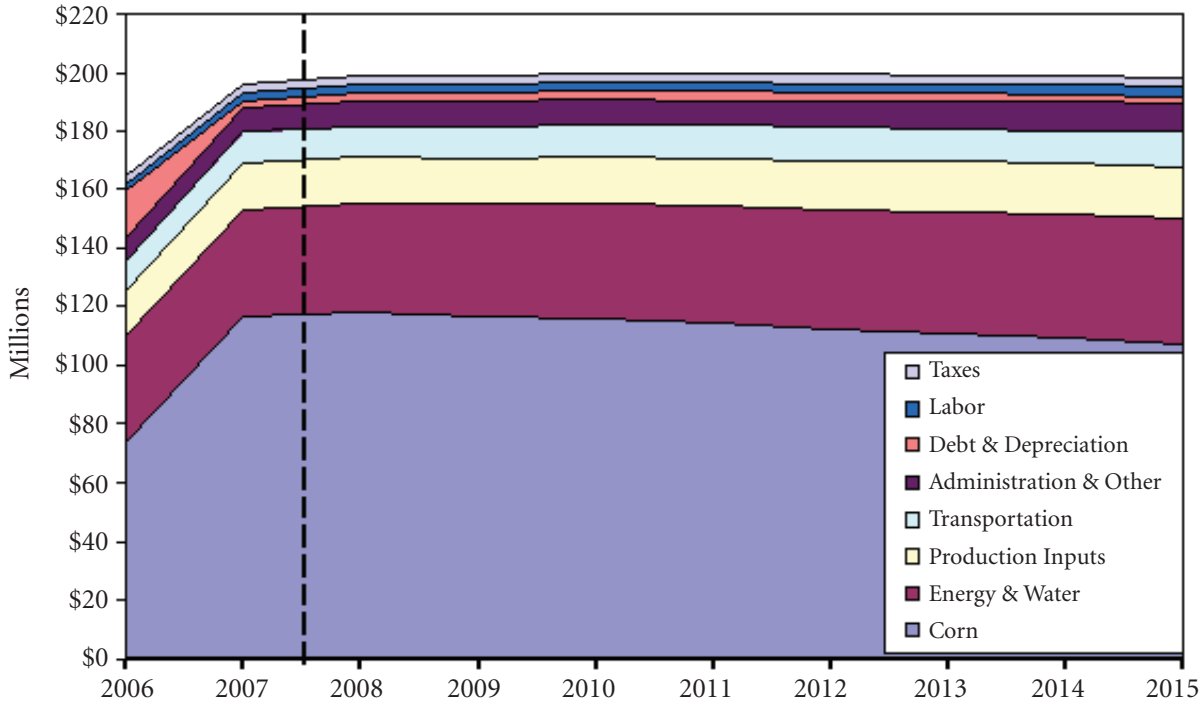

Figure 15. Costs of a 100-MGY plant under the current 7.5-BGY Renewable Fuel Standard.

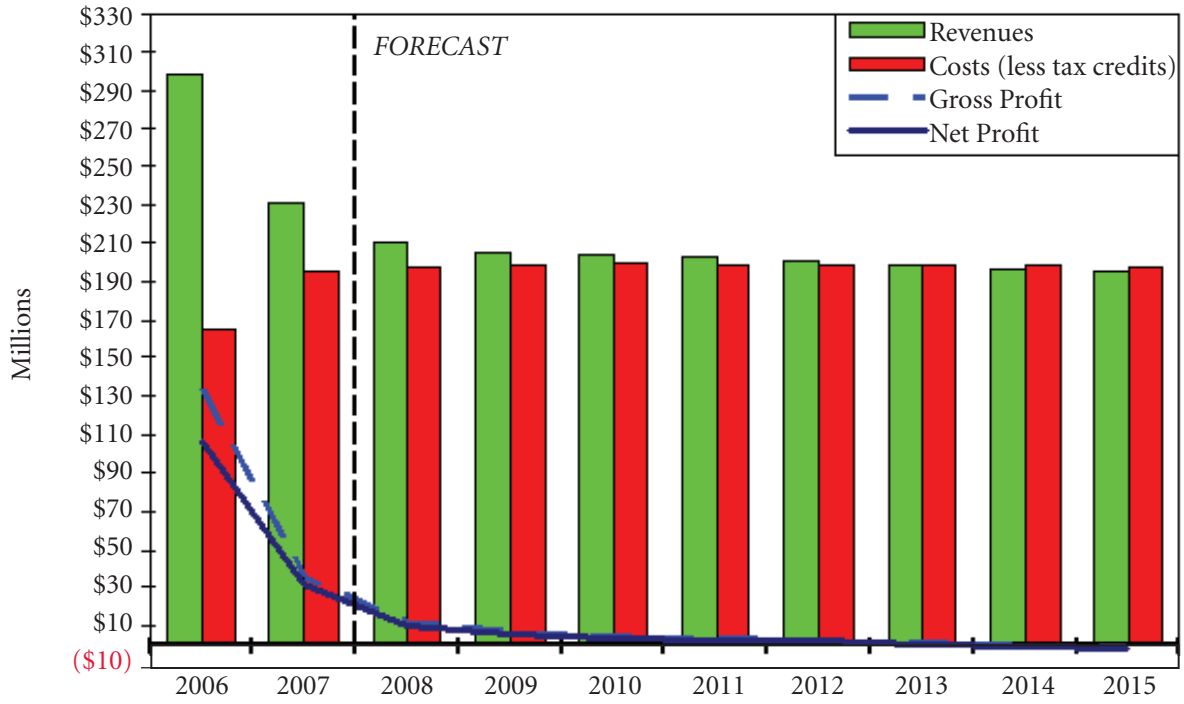

Figure 16. Profits and losses of a 100-MGY plant under the current 7.5-BGY Renewable Fuel Standard.

through the coming decade. Other production inputs, like chemicals and yeasts, vary between 8 and 9 percent of total costs and are expected to grow between 2007 and 2015. Debt and depreciation consume nearly 10 percent of costs in 2006, and as debt is paid off in the first year, these costs drop to 1.5 percent from 2007 onward for depreciation. Transportation costs, mainly rail, will grow from 5 percent to 6 percent over the coming decade. Administrative and other costs are expected to grow by 4 to 5 percent during the same period. Labor costs and taxes each account for 1.5 percent of total costs, and these generally remain stable over time.

As with previous scenarios, profits or losses of a 100-MGY ethanol plant are estimated by taking total revenues less net costs. Gross profit is the difference between total revenues and net costs. Net profit includes the costs of corporate income taxes. A 100-MGY ethanol plant built in 2005 does not qualify for any federal or state production tax credits. Referring to the information presented in *Figure 16*:

- In the first year of operation in 2006, the plant has its most profitable year by generating $133.10 million in gross profits and $106.49 million in net profits after taxes. High profits in 2006 are due to high ethanol prices ($2.58 per gallon) and low corn prices ($2.00 per bushel).
- By the following year in 2007 profits drop considerably as ethanol prices decrease ($1.95 per gallon) and corn prices increase ($3.17 per bushel). However, with gross profits of $35.01 million and net profits of $32.28 million the plant is still very profitable.
- Profits continue to drop over the next six years as ethanol prices continue to fall and corn prices remain high. In 2009 the plant posts a gross profit of $6.89 million and a net profit of $6.35 million after taxes. These profits are cut by over half by 2011, at $3.23 million in gross and $2.98 million in net profits. By 2013 the plant breaks even.
- By 2014 the ethanol plant fails to be profitable, resulting in a gross and net loss of $1.23 million. These losses grow slightly larger by 2015, with a gross and net loss of $1.94 million for the year. Again, losses are caused by a combination of falling ethanol prices ($1.60 per gallon) and high corn prices ($3.10 per bushel); however, the plant is able to cover these losses through its sizable cash reserves.

Another way to look at plant profitability is to allocate revenues to various costs and profits per gallon of ethanol produced. Revenues are from all sources, including the sale of ethanol and its byproducts. Costs include inputs, financial, labor and taxes. Some results may not total due to rounding. Referring to the information presented in *Figure 17*:

- As stated previously, the first year of operation in 2006 is the most profitable, where producers earn $1.06 in net profit per gallon of ethanol. In that

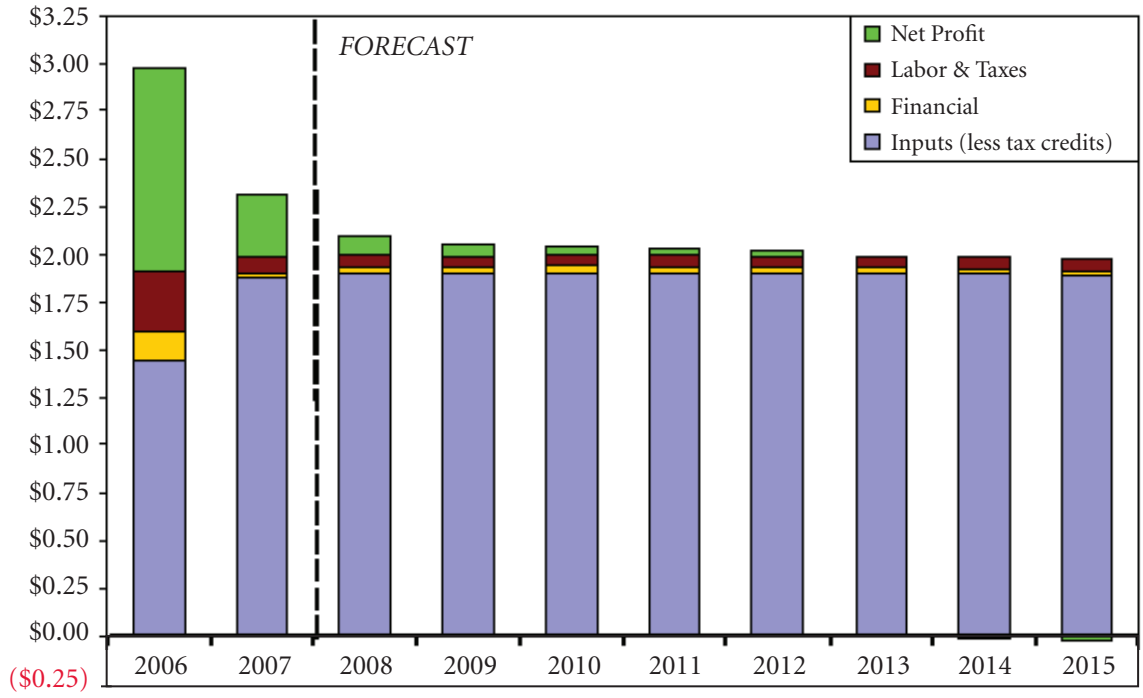

Figure 17. Costs per gallon of ethanol produced by a 100-MGY plant under the current 7.5-BGY Renewable Fuel Standard.

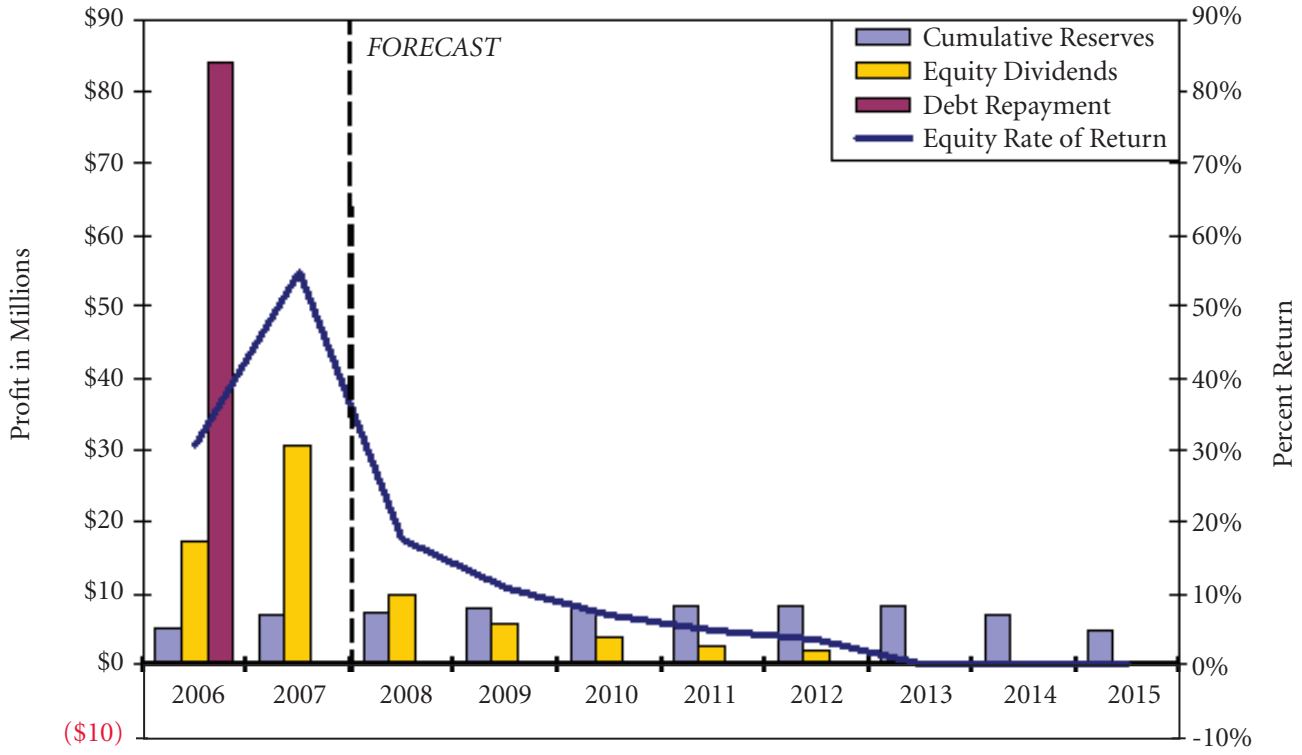

Figure 18. Gross profit allocation of a 100-MGY plant under the current 7.5-BGY Renewable Fuel Standard.

year, total revenues peak at a high of $2.98 per gallon. Costs also fall to a low of just under $1.92 per gallon, with $1.44 going toward inputs, $0.32 toward taxes and labor, and $0.16 toward debt repayment.

- However, by 2007 falling ethanol prices and rising corn prices greatly reduce profits. Total revenues generated from ethanol production fall to $2.31 per gallon while total costs grow to nearly $1.99 per gallon, but this still results in a healthy net profit of $0.32 per gallon of ethanol produced. Input costs jump to $1.87 per gallon, while labor and taxes drop to $0.08, and financial costs drop to $0.03 as debt obligations are retired.
- Over the next six years profit margins are squeezed as ethanol prices continue to fall as corn prices remain high. During this period, net profits drop from $0.10 per gallon in 2008 to a break-even point by 2013. Falling profits are driven by decreasing revenues, which fall from $2.10 per gallon of ethanol produced in 2008 to $2.00 per gallon by 2013. Total costs remain relatively fixed over this period at around $1.99 per gallon.
- In 2014 and 2015 a 100-MGY plant fails to be profitable, generating a small net loss of $0.01 to $0.02 per gallon of ethanol produced. In 2014 revenues are $1.97 and net costs are $1.98 per gallon. In 2015 revenues are $1.96 and net costs are $1.98 per gallon.

Once profits and losses have been determined, it is possible to model how they are distributed. In this analysis, it is assumed that a 100-MGY plant will direct 5 percent of net profits into a cash reserve fund, with the remaining profits directed toward debt reduction and investor dividends. Referring to the information presented in *Figure 18*:

- In the first year of operation a 100-MGY plant returns sizable dividends and pays off its entire debt obligation. In 2006 investors are paid $17.16 million in dividends equaling a high rate of return of 31 percent. The plant also directs $84.00 million in profits to pay off its entire debt obligations. In addition, $5.32 million is placed into cash reserves.
- Investors experience a higher rate of return in 2007, as $30.67 million in dividends are paid out for a return of 55 percent for the year.
- Over the next six years the plant still pays dividends, but these are generally below the 15 percent return expected by investors. In 2009 the plant pays $6.04 million in dividends for an annual return of 11 percent. Returns drop by over half in 2011, with $2.83 million in dividends paid, equaling a 5 percent return. By 2013 the plant essentially breaks even, generating no dividends. However, during this time the plant builds up $8.24 million in cash reserves.
- By 2014 and 2015 the plant experiences net losses and is forced to cover these gaps by taking $3.17 million from its cash reserves. These gaps are easily covered by cash reserves, which still stand at $5.08 million in 2015. Cash reserves also can be used to cover future losses or to pay investors larger dividends.

In summary, under the current Renewable Fuel Standard, a 100-MGY ethanol plant remains profitable between 2006 and 2013. The plant generates losses in 2014 and 2015, but these losses are easily covered by existing cash reserves. Losses are primarily due to relatively high corn prices and falling ethanol prices as the 7.5-BGY standard is met. Given current demand, the ethanol boom for a 100-MGY plant lasts until 2013, after which the plant generates losses. However, the plant will have adequate cash reserves to cover any losses in the coming years.

Expanded Ethanol Demand — 15-BGY Renewable Fuel Standard

If the proposed Energy Saving Act of 2007 is passed, it would increase the Renewable Fuel Standard to 15 billion gallons a year by 2015. This is expected to raise ethanol and corn prices from the current projected levels, but prices are not expected to change much until 2009. An expanded 15-billion-gallon per year standard greatly enhances the profitability of a 100-MGY ethanol plant.

The plant generates $207.06 million in revenues in 2009, which is $1.70 million higher than under the current standard. Sales grow from $209.84 million in 2012 to $214.73 million by 2015. This is $8.80 million more than under the current standard in 2012, and $18.95 million more than in 2015. Ethanol prices drive revenues and are presented in *Figure 19*.

There is also a corresponding rise in total costs compared to the current standard, mainly due to increased corn prices. Under the proposed standard, costs of production rise to $1.81 million for a total cost of $200.27 million in 2009. Costs grow slightly from $203.36 million in 2012 to $204.66 million by 2015, representing an increase of $4.61 million and $6.94 million from the current standard, respectively. Corn, energy and water prices drive costs and are presented in *Figure 20*.

For the most part profits and losses do not change significantly until 2009. Gross profits for 2009 are $6.78

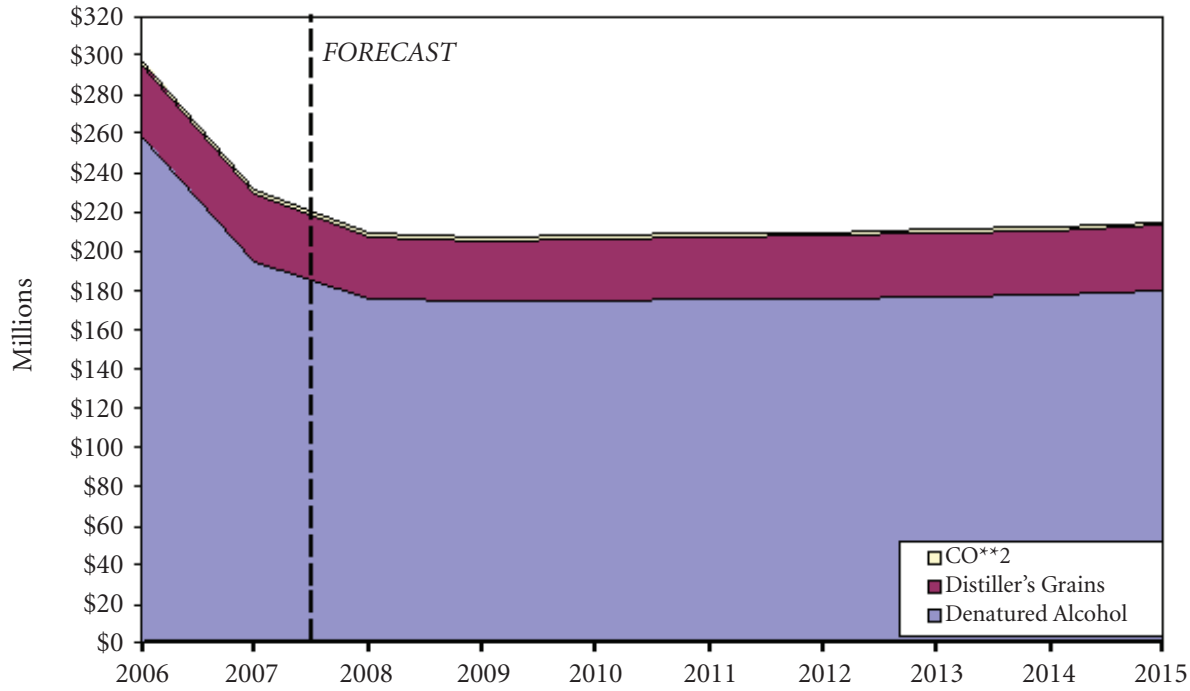

Figure 19. Revenues of a 100-MGY plant under the proposed 15-BGY Renewable Fuel Standard.

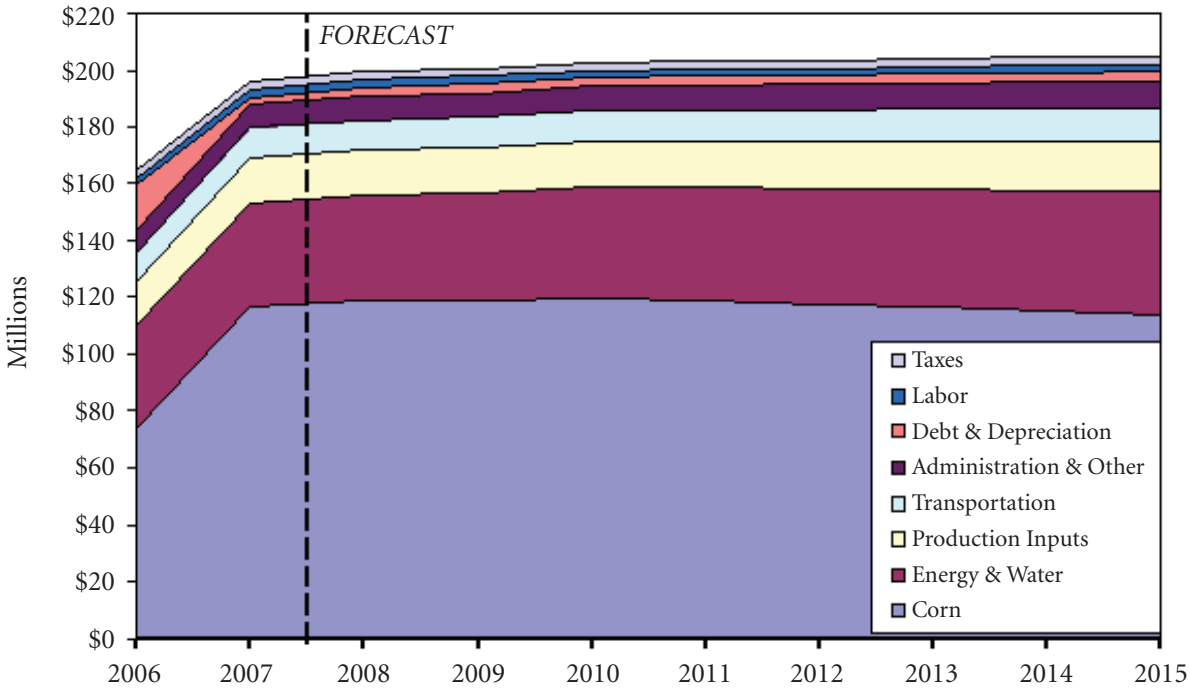

Figure 20. Costs of a 100-MGY plant under the proposed 15-BGY Renewable Fuel Standard.

million and net profits are $6.25 million (*Figures 21* and *22*). Surprisingly, net profits under the proposed standard are about $100,000 lower than under the current standard. This is due to corn prices rising faster than ethanol prices. In terms of profits per gallon of ethanol produced, both the current and proposed standards result in a net profit of $0.06 per gallon in 2009. Under the proposed standard both revenues and costs rise by $0.02 compared to the current standard, placing total revenues at $2.07 and total costs at $2.01 per gallon.

Between 2009 and 2012 the net profit per gallon of ethanol under the proposed standard hovers around $0.06. By 2012, the plant generates a net profit of $6.03

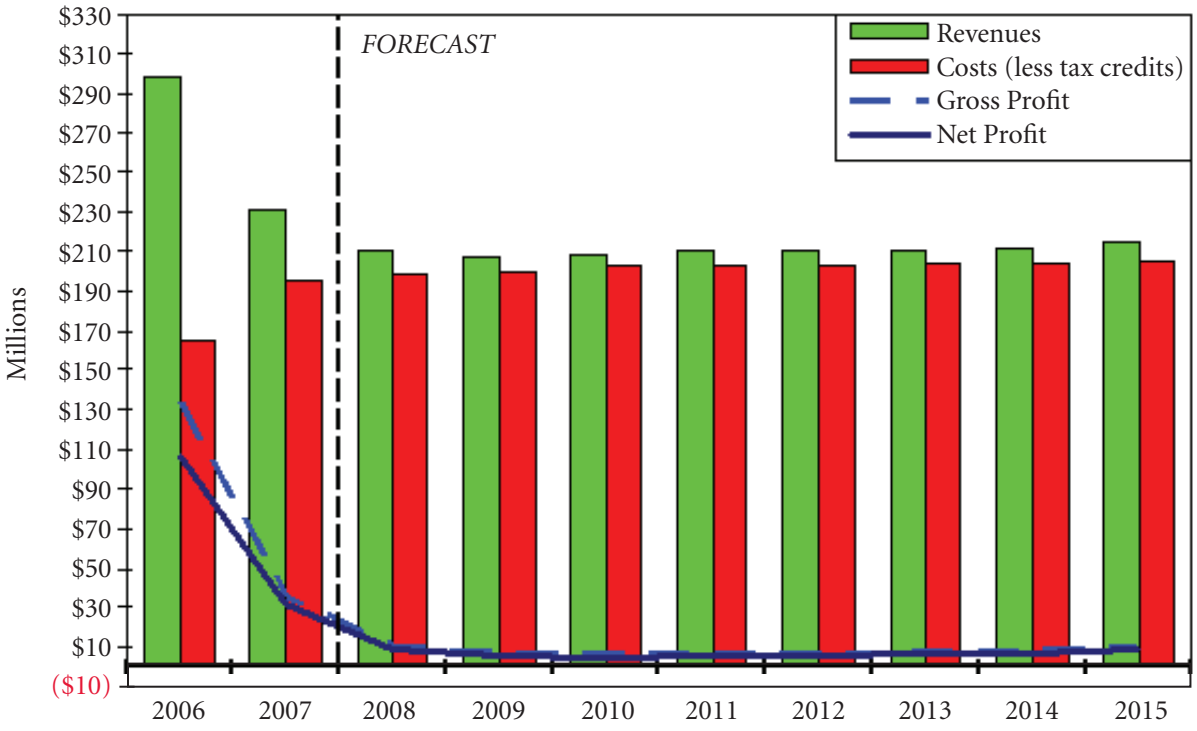

Figure 21. Profits and losses of a 100-MGY plant under the proposed 15-BGY Renewable Fuel Standard.

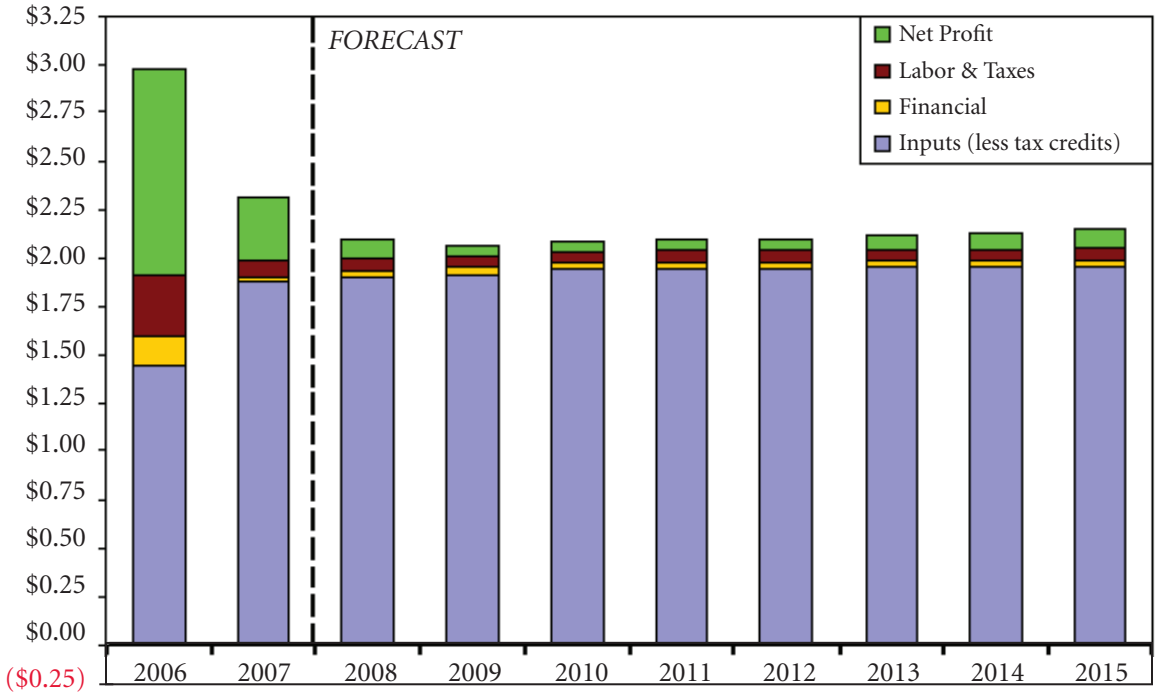

Figure 22. Costs per gallon of ethanol produced of a 100-MGY plant under the proposed 15-BGY Renewable Fuel Standard.

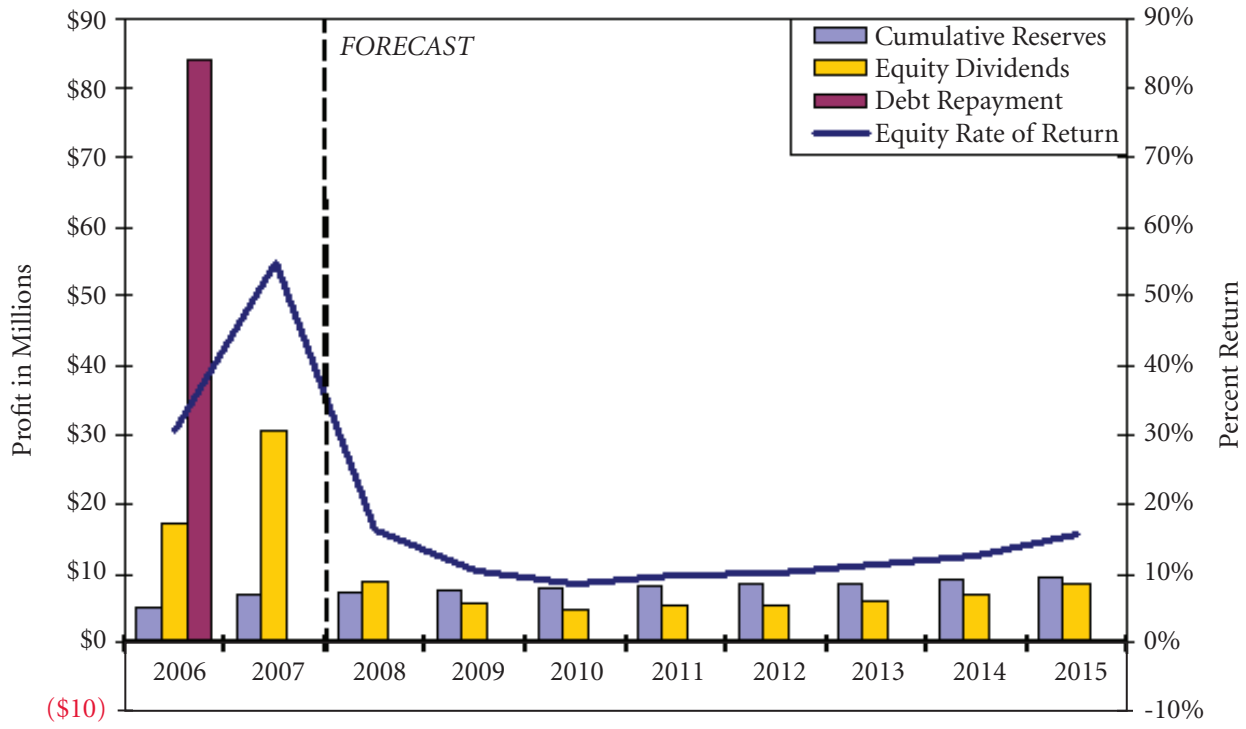

Figure 23. Gross profit allocation of a 100-MGY plant under the proposed 15-BGY Renewable Fuel Standard.

million, which is much more than the $2.17 million net profit obtained under the current standard. In per gallon terms, the proposed standard in 2012 raises total revenues to $2.10 per gallon (compared to $2.01) and total costs to $2.04 per gallon (compared to $1.99). On balance the proposed standard results in a net profit of $0.06, which is more than the small $0.02 per gallon profit under the current standard.

By 2015 revenues continue to exceed costs as ethanol prices rise due to increased demand triggered by the expanded standard. Net profits in this year are $9.28 million, which is much higher than the net loss of $1.94 million experienced under the current standard. On a per gallon basis, the proposed standard generates $0.09 in net profit per gallon of ethanol, compared to the $0.02 net loss experienced under the current standard. Total revenues rise to $2.15 and total costs rise to nearly $2.06 per gallon, compared to $1.96 in revenues and $1.98 in costs under the current standard.

In terms of profit allocation, the proposed standard results in decent net profits and good returns to investors in all years, although these are generally below the 15 percent minimum return expected by investors *(Figure 23)*. By contrast, the current standard results in poor investor returns in 2011 and 2012, and investors experience no annual returns between 2013 and 2015. Under the proposed Renewable Fuel Standard, in 2011 investors are paid $5.88 million in dividends, equaling a 10 percent rate of return, which is higher than the 5 percent return under the current standard. By 2013 investors earn a return of 11 percent as $6.32 million in dividends are paid out, compared to the current standard when no dividends were paid. By 2015 investor dividends expand to $8.82 million, representing a 16 percent annual rate of return. Again, this is in contrast to the current standard where investors are not paid dividends.

In summary, the proposed 15-BGY Renewable Fuel Standard would greatly enhance the profitability of a 100-MGY ethanol plant, generating sizable net profits and double digit returns to investors in all years. By contrast, the current 7.5-BGY standard results in relatively marginal or no profits during the same period. Given an expanded market demand, the ethanol boom for a 100-MGY will last through 2015. In short, ethanol plants of this size will likely gain the most from any expanded Renewable Fuel Standard.

Summary and Implications

The purpose of this analysis is to assist local government officials and economic developers in understanding the future economic viability of ethanol plants. To understand ethanol plant economics requires a model of how plants operate in terms of revenues and costs. For this analysis, hypothetical scenarios for two types of ethanol plants most prevalent in Nebraska were developed — a 40-million-gallon per year plant built in 2002 and a 100-million-gallon per year plant built in 2005. It is important to note that the model is not a forecast of what will happen, but rather a projection of what could happen if certain economic assumptions and policies remain in place. Further, these scenarios do not model how ethanol plants will respond to price changes to ensure profitability, such as reducing costs or increasing efficiency and productivity. Nonetheless, making reasonable assumptions allows us to better understand how ethanol plants are affected by production and price changes over time.

The first scenario models a 40-million-gallon per year (MGY) ethanol plant that was constructed in 2002 and represents the future viability of older plants. Assuming that the current 7.5-billion-gallon per year (BGY) federal Renewable Fuel Standard remains unchanged through 2015, a 40-MGY ethanol plant only remains profitable between 2003 and 2010. The plant fails to be profitable by 2011 and generates losses by 2013. Losses are primarily due to falling ethanol prices as the 7.5-BGY standard is met, relatively high corn prices and the expiration of tax credits. Given current demand, the ethanol boom for a 40-MGY plant only lasts until 2010, after which the plant will struggle to make a profit. It may go bust by 2013 if it does not reduce costs or increase efficiency and productivity.

However, proposed legislation in Congress seeks to increase the Renewable Fuel Standard to 15 billion gallons a year by 2015, which is expected to raise ethanol and corn prices from the current projected levels. The proposed 15-BGY Renewable Fuel Standard would return a 40-MGY ethanol plant back to profitability and generate small net profits between 2013 and 2015. Further, the plant has sufficient cash reserves to cover small net losses in 2011 and 2012, and these reserves could also be used to pay investors a larger return. By contrast, the current 7.5-BGY standard results in sizable net losses during this same period. Given an expanded demand, the ethanol boom is expected to last through 2010. The plant will struggle to break even in 2011 and 2012, but from 2013 onward the plant is expected to generate small net profits with no bust expected. In short, an expanded Renewable Fuel Standard is necessary in order to keep an older 40-MGY ethanol plant economically viable.

The second scenario models a 100-MGY ethanol plant that was constructed in 2005, and represents the future viability of newer plants which are assumed to be more productive than older 40-MGY plants. Again, assuming that the current 7.5-BGY standard remains unchanged through 2015, a 100-MGY ethanol plant remains profitable between 2006 and 2013. The plant generates losses in 2014 and 2015, but these losses are easily covered by existing cash reserves. Losses are primarily due to relatively high corn prices and falling ethanol prices as the 7.5-BGY standard is met. Given current demand, the ethanol boom for a 100-MGY plant lasts until 2013, after which the plant generates losses; however, the plant will have adequate cash reserves to cover any losses in the coming years.

The proposed 15-BGY Renewable Fuel Standard, if passed and fully implemented by 2015, would greatly enhance the profitability of a 100-MGY ethanol plant, generating sizable net profits and double digit returns to investors in all years. By contrast, the current 7.5-BGY standard results in relatively marginal or no profits during the same period. Given an expanded market demand, the ethanol boom for a 100-MGY plant will last through 2015. In short, ethanol plants of this size will likely gain the most from any expanded Renewable Fuel Standard.

As stated previously, the purpose of this analysis is to understand the future economic viability of ethanol plants. The *Ethanol Plant Economics Tool* was developed to model the scenarios presented in this report, which require a number of assumptions about how plants operate under certain economic conditions. The assumptions in the tool can be customized to model most types of ethanol plants under a variety of economic conditions. This allows users to run "what-if" scenarios for use in local economic development planning. Those interested in having customized scenarios run for their community can contact the author or their local UNL extension educator.

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Appendix

Ethanol Plant Economics Tool — Model Scenarios

Hypothetical 40-MGY Plant Under 7.5-BGY Renewable Fuel Standard

Hypothetical 40-MGY Plant Under 15-BGY Renewable Fuel Standard

Hypothetical 100-MGY Plant Under 7.5-BGY Renewable Fuel Standard

Hypothetical 100-MGY Plant Under 15-BGY Renewable Fuel Standard

ETHANOL PLANT ECONOMICS TOOL FOR

Hypothetical 40 MGY Plant -- Current 7.5-BGY Renewable Fuels Standard
Central Nebraska

University of Nebraska Lincoln

OPERATIONS ANALYSIS

PRODUCTION INFORMATION	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
PRIMARY INPUT REQUIRMENTS															
Corn (bu		15,384,615	15,267,176	15,151,515	15,037,594	14,925,373	14,814,815	14,705,882	14,598,540	14,492,754	14,388,489	14,285,714	14,285,714	14,285,714	$14,740,300
Water (ga)		107,692,308	106,870,229	106,060,606	105,263,158	104,477,612	103,703,704	102,941,176	102,189,781	101,449,275	100,719,424	100,000,000	100,000,000	100,000,000	$103,182,098
Electricity (KwH)		44,000,000	44,000,000	44,000,000	44,000,000	44,000,000	44,000,000	44,000,000	44,000,000	44,000,000	44,000,000	44,000,000	44,000,000	44,000,000	$44,000,000
Natural Gas (millionBTU)		1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	$1,400,000
PRODUCTION YIELD															
Denatured Alcohol (ga)		40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	$40,000,000
Distillers Grains (ton)		146,154	145,038	143,939	142,857	141,791	140,741	139,706	138,686	137,681	136,691	135,714	135,714	135,714	$140,033
CO**2 (ton)		134,615	133,588	132,576	131,579	130,597	129,630	128,676	127,737	126,812	125,899	125,000	125,000	125,000	$128,978

COSTS	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
INPUT COSTS															
Corn, including transport costs		$35,692,308	$36,946,565	$31,212,121	$30,075,188	$47,313,433	$47,851,852	$47,352,941	$47,153,285	$46,521,739	$45,755,396	$45,142,857	$44,714,286	$44,142,857	$42,298,064
Water plus Treatment		$430,769	$436,031	$441,382	$446,824	$452,360	$457,989	$463,714	$469,536	$475,456	$481,476	$487,598	$497,350	$507,297	$465,214
Electricity		$1,949,200	$1,988,184	$2,027,948	$2,068,507	$2,109,877	$2,152,074	$2,195,116	$2,239,018	$2,283,798	$2,329,474	$2,376,064	$2,423,585	$2,472,057	$2,201,146
Natural Gas		$11,732,000	$11,966,640	$12,205,973	$12,450,092	$12,699,094	$12,953,076	$13,212,138	$13,476,380	$13,745,908	$14,020,826	$14,301,243	$14,587,267	$14,879,013	$13,248,435
Enzymes		$2,307,877	$2,336,065	$2,364,735	$2,393,894	$2,423,549	$2,453,709	$2,484,381	$2,515,571	$2,547,289	$2,579,543	$2,612,340	$2,664,587	$2,717,878	$2,492,417
Yeasts		$1,058,400	$1,071,327	$1,084,475	$1,097,848	$1,111,448	$1,125,279	$1,139,345	$1,153,649	$1,168,195	$1,182,987	$1,198,028	$1,221,988	$1,246,428	$1,143,031
Chemicals: Processing & Antibiotics		$962,031	$973,781	$985,732	$997,887	$1,010,248	$1,022,820	$1,035,606	$1,048,607	$1,061,829	$1,075,274	$1,088,945	$1,110,724	$1,132,939	$1,038,956
Chemicals: Boiling & Cooling		$240,923	$243,866	$246,859	$249,903	$252,998	$256,147	$259,349	$262,605	$265,916	$269,283	$272,706	$278,161	$283,724	$260,187
Denaturants		$1,683,138	$1,703,696	$1,724,605	$1,745,871	$1,767,499	$1,789,494	$1,811,863	$1,834,610	$1,857,742	$1,881,265	$1,905,184	$1,943,287	$1,982,153	$1,817,724
Waste Management		$801,538	$811,328	$821,285	$831,413	$841,712	$852,187	$862,839	$873,672	$884,688	$895,890	$907,280	$925,426	$943,934	$865,630
Maintenance		$556,923	$563,725	$570,644	$577,680	$584,836	$592,114	$599,516	$607,043	$614,697	$622,480	$630,394	$643,002	$655,862	$601,455
Alcohol Rail Transportation		$4,000,000	$4,080,000	$4,161,600	$4,244,832	$4,329,729	$4,416,323	$4,504,650	$4,594,743	$4,686,638	$4,780,370	$4,875,978	$4,973,497	$5,072,967	$4,517,025
Management		$120,000	$123,600	$127,308	$131,127	$135,061	$139,113	$143,286	$147,585	$152,012	$156,573	$161,270	$166,108	$171,091	$144,164
All Other & Unspecified		$1,846,154	$1,868,702	$1,891,636	$1,914,962	$1,938,684	$1,962,810	$1,987,345	$2,012,296	$2,037,668	$2,063,469	$2,089,705	$2,131,499	$2,174,129	$1,993,774
FINANCIAL COSTS															
Debt Payment		$5,355,386	$5,355,386	$5,019,723	$3,412,525	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,472,540
Depreciation		$1,350,000	$1,350,000	$1,350,000	$1,350,000	$1,350,000	$1,350,000	$1,350,000	$1,350,000	$1,350,000	$1,350,000	$1,350,000	$1,350,000	$1,350,000	$1,350,000
LABOR COSTS AND TAXES															
Wages and Salaries		$1,200,000	$1,236,000	$1,273,080	$1,311,272	$1,350,611	$1,391,129	$1,432,863	$1,475,849	$1,520,124	$1,565,728	$1,612,700	$1,661,081	$1,710,913	$1,441,642
Benefits		$156,000	$160,680	$165,500	$170,465	$175,579	$180,847	$186,272	$191,860	$197,616	$203,545	$209,651	$215,940	$222,419	$187,413
Insurance Trust Taxes		$120,000	$123,600	$127,308	$131,127	$135,061	$139,113	$143,286	$147,585	$152,012	$156,573	$161,270	$166,108	$171,091	$144,164
State Sales Taxes		$125,654	$127,189	$128,750	$130,337	$131,952	$133,594	$135,264	$136,962	$138,689	$140,445	$142,231	$145,075	$147,977	$135,701
Local Property Taxes		$945,000	$945,000	$945,000	$945,000	$945,000	$945,000	$945,000	$945,000	$945,000	$945,000	$945,000	$945,000	$945,000	$945,000
Local Sales Taxes		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Special Tax Assessments & Payments		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Costs		**$72,633,301**	**$74,411,364**	**$68,875,663**	**$66,676,753**	**$81,058,732**	**$82,164,671**	**$82,244,773**	**$82,635,856**	**$82,607,018**	**$82,455,595**	**$82,470,442**	**$82,763,971**	**$82,929,729**	$78,763,682

REVENUES	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Denatured Alcohol		$54,000,000	$67,600,000	$72,000,000	$103,200,000	$78,000,000	$70,400,000	$68,800,000	$68,000,000	$67,200,000	$66,400,000	$65,200,000	$64,400,000	$63,600,000	$69,907,692
Distillers Grains		$16,873,462	$11,017,099	$12,319,773	$15,368,571	$13,803,358	$12,960,815	$12,833,382	$13,043,431	$13,253,188	$13,510,504	$13,745,143	$14,008,429	$14,362,643	$13,623,061
CO**2		$673,077	$681,298	$689,659	$698,163	$706,812	$715,608	$724,553	$733,650	$742,900	$752,306	$761,872	$777,109	$792,651	$726,897
Total Revenues		**$71,546,538**	**$79,298,397**	**$85,009,432**	**$119,266,735**	**$92,510,170**	**$84,076,423**	**$82,357,935**	**$81,777,080**	**$81,196,088**	**$80,662,810**	**$79,707,014**	**$79,185,538**	**$78,755,294**	$84,257,650

PROFITS AND LOSSES	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
GROSS AND NET PROFIT/LOSS														
Total Revenues		$71,546,538	$79,298,397	$85,009,432	$119,266,735	$92,510,170	$84,076,423	$82,357,935	$81,777,080	$81,196,088	$80,662,810	$79,707,014	$79,185,538	$78,755,294
Total Costs		$72,633,301	$74,411,364	$68,875,663	$66,676,753	$81,058,732	$82,164,671	$82,244,773	$82,635,856	$82,607,018	$82,455,595	$82,470,442	$82,763,971	$82,929,729
Less Federal & State Govt Incentives		$2,812,500	$2,812,500	$2,812,500	$4,312,500	$4,312,500	$4,312,500	$4,312,500	$4,312,500	$0	$0	$0	$0	$0
Less Local Govt Incentives		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross Profit/Loss		**$1,725,737**	**$7,699,533**	**$18,946,269**	**$56,902,481**	**$15,763,939**	**$6,224,252**	**$4,425,663**	**$3,453,725**	**($1,410,929)**	**($1,792,785)**	**($2,763,428)**	**($3,578,434)**	**($4,174,435)**
Less Corporate Income Taxes		$340,147	$1,534,907	$3,784,254	$11,375,496	$3,147,788	$1,239,850	$880,133	$685,745	$0	$0	$0	$0	$0
Net Profit/Loss		**$1,385,590**	**$6,164,627**	**$15,162,015**	**$45,526,985**	**$12,616,151**	**$4,984,401**	**$3,545,530**	**$2,767,980**	**($1,410,929)**	**($1,792,785)**	**($2,763,428)**	**($3,578,434)**	**($4,174,435)**
ALLOCATION OF NET PROFIT/LOSS														
Annual Reserves		$69,279	$308,231	$758,101	$2,276,349	$630,808	$249,220	$177,277	$138,399	$0	$0	$0	$0	$0
Cumulative Reserves		$69,279	$377,511	$1,135,612	$3,411,961	$4,042,768	$4,291,988	$4,469,265	$4,607,664	$3,196,735	$1,403,950	$0	$0	$0
Debt Reduction Payment		$0	$2,256,395	$10,803,914	$22,939,690	$0	$0	$0	$0	$0	$0	$0	$0	$0
Equity Dividends		$1,316,310	$3,600,000	$3,600,000	$20,310,946	$11,985,343	$4,735,181	$3,368,254	$2,629,581	$0	$0	($1,359,478)	($3,578,434)	($4,174,435)
Local Dividends		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Equity Rate of Return		5%	15%	15%	85%	50%	20%	14%	11%	%,	%,	(6%)	(15%)	(17%)

PROFIT/LOSS PER GALLON	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Revenues Per Gallon		**$1.79**	**$1.98**	**$2.13**	**$2.98**	**$2.31**	**$2.10**	**$2.06**	**$2.04**	**$2.03**	**$2.02**	**$1.99**	**$1.98**	**$1.97**
Denatured Alcohol		$1.35	$1.69	$1.80	$2.58	$1.95	$1.76	$1.72	$1.70	$1.68	$1.66	$1.63	$1.61	$1.59
Distillers Grains		$0.42	$0.28	$0.31	$0.38	$0.35	$0.32	$0.32	$0.33	$0.33	$0.34	$0.34	$0.35	$0.36
CO**2		$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02
Total Costs Per Gallon		**$1.75**	**$1.79**	**$1.65**	**$1.56**	**$1.92**	**$1.95**	**$1.95**	**$1.96**	**$2.07**	**$2.06**	**$2.06**	**$2.07**	**$2.07**
Input Costs Per Gallon		$1.58	$1.63	$1.50	$1.48	$1.92	$1.95	$1.95	$1.96	$1.96	$1.95	$1.95	$1.96	$1.96
Financial Costs Per Gallon		$0.17	$0.17	$0.16	$0.12	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03
Labor Costs & Taxes Per Gallon		$0.06	$0.06	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.08	$0.08	$0.08	$0.08
Less Government Incentives		$0.07	$0.07	$0.07	$0.11	$0.11	$0.11	$0.11	$0.11	$0.00	$0.00	$0.00	$0.00	$0.00
Gross Profit/Loss Per Gallon		**$0.04**	**$0.19**	**$0.47**	**$1.42**	**$0.39**	**$0.16**	**$0.11**	**$0.09**	**($0.04)**	**($0.04)**	**($0.07)**	**($0.09)**	**($0.10)**
Less Corporate Income Tax		$0.01	$0.04	$0.09	$0.28	$0.08	$0.03	$0.02	$0.02	$0.00	$0.00	$0.00	$0.00	$0.00
Net Profit/Loss Per Gallon		**$0.03**	**$0.15**	**$0.38**	**$1.14**	**$0.32**	**$0.12**	**$0.09**	**$0.07**	**($0.04)**	**($0.04)**	**($0.07)**	**($0.09)**	**($0.10)**

ETHANOL PLANT ECONOMICS TOOL FOR

Hypothetical 100 MGY Plant -- Proposed 15-BGY Renewable Fuels Standard
Central Nebraska

University of Nebraska Lincoln

OPERATIONS ANALYSIS

PRODUCTION INFORMATION	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	Average
PRIMARY INPUT REQUIRMENTS												
Corn (bu		37,037,037	36,764,706	36,496,350	36,231,884	35,971,223	35,714,286	35,460,993	35,211,268	34,965,035	34,722,222	35,857,500
Water (ga)		259,259,259	257,352,941	255,474,453	253,623,188	251,798,561	250,000,000	248,226,950	246,478,873	244,755,245	243,055,556	251,002,503
Electricity (KwH)		110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000
Natural Gas (millionBTU)		3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000
PRODUCTION YIELD												
Denatured Alcohol (ga)		100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000
Distillers Grains (ton)		351,852	349,265	346,715	344,203	341,727	339,286	336,879	334,507	332,168	329,861	340,646
CO**2 (ton)		324,074	321,691	319,343	317,029	314,748	312,500	310,284	308,099	305,944	303,819	313,753

COSTS	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	Average
INPUT COSTS												
Corn, including transport costs		$74,074,074	$116,544,118	$118,613,139	$118,478,261	$119,424,460	$118,571,429	$117,375,887	$116,549,296	$115,384,615	$114,236,111	$112,925,139
Water plus Treatment		$1,088,889	$1,102,500	$1,116,342	$1,130,417	$1,144,730	$1,159,285	$1,174,084	$1,189,132	$1,204,433	$1,219,990	$1,152,980
Electricity		$5,170,000	$5,273,400	$5,378,868	$5,486,445	$5,596,174	$5,708,098	$5,822,260	$5,938,705	$6,057,479	$6,178,629	$5,661,006
Natural Gas		$29,772,050	$30,367,491	$30,974,841	$31,594,338	$32,226,224	$32,870,749	$33,528,164	$34,198,727	$34,882,702	$35,580,356	$32,599,564
Enzymes		$5,725,926	$5,797,500	$5,870,286	$5,944,303	$6,019,569	$6,096,103	$6,173,926	$6,253,056	$6,333,515	$6,415,323	$6,062,951
Yeasts		$2,625,926	$2,658,750	$2,692,130	$2,726,074	$2,760,591	$2,795,690	$2,831,380	$2,867,670	$2,904,568	$2,942,086	$2,780,486
Chemicals: Processing & Antibiotics		$2,385,185	$2,415,000	$2,445,320	$2,476,152	$2,507,505	$2,539,386	$2,571,804	$2,604,766	$2,638,282	$2,672,360	$2,525,576
Chemicals: Boiling & Cooling		$596,296	$603,750	$611,330	$619,038	$626,876	$634,846	$642,951	$651,192	$659,570	$668,090	$631,394
Denaturants		$4,174,074	$4,226,250	$4,279,309	$4,333,266	$4,388,133	$4,443,925	$4,500,656	$4,558,341	$4,616,993	$4,676,630	$4,419,758
Waste Management		$1,988,889	$2,013,750	$2,039,032	$2,064,742	$2,090,885	$2,117,469	$2,144,501	$2,171,987	$2,199,934	$2,228,350	$2,105,954
Maintenance		$1,381,481	$1,398,750	$1,416,311	$1,434,169	$1,452,328	$1,470,793	$1,489,569	$1,508,661	$1,528,073	$1,547,811	$1,462,795
Alcohol Rail Transportation		$10,000,000	$10,200,000	$10,404,000	$10,612,080	$10,824,322	$11,040,808	$11,261,624	$11,486,857	$11,716,594	$11,950,926	$10,949,721
Management		$202,500	$208,575	$214,832	$221,277	$227,916	$234,753	$241,796	$249,049	$256,521	$264,217	$232,144
All Other & Unspecified		$4,577,778	$4,635,000	$4,693,191	$4,752,366	$4,812,540	$4,873,728	$4,935,946	$4,999,209	$5,063,535	$5,128,939	$4,847,223
FINANCIAL COSTS												
Debt Payment		$12,495,901	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,249,590
Depreciation		$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000
LABOR COSTS AND TAXES												
Wages and Salaries		$2,025,000	$2,085,750	$2,148,323	$2,212,772	$2,279,155	$2,347,530	$2,417,956	$2,490,495	$2,565,209	$2,642,166	$2,321,436
Benefits		$263,250	$271,148	$279,282	$287,660	$296,290	$305,179	$314,334	$323,764	$333,477	$343,482	$301,787
Insurance Trust Taxes		$202,500	$208,575	$214,832	$221,277	$227,916	$234,753	$241,796	$249,049	$256,521	$264,217	$232,144
State Sales Taxes		$311,667	$315,563	$319,524	$323,553	$327,650	$331,816	$336,052	$340,359	$344,738	$349,191	$330,011
Local Property Taxes		$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000
Local Sales Taxes		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Special Tax Assessments & Payments		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Costs		**$164,416,386**	**$195,680,869**	**$199,065,892**	**$200,273,191**	**$202,588,265**	**$203,131,341**	**$203,359,684**	**$203,985,315**	**$204,301,761**	**$204,663,871**	$198,146,657

REVENUES	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	Average
Denatured Alcohol		$258,000,000	$195,000,000	$176,000,000	$174,000,000	$175,000,000	$176,000,000	$176,000,000	$177,000,000	$178,000,000	$180,000,000	$186,500,000
Distillers Grains		$37,852,222	$34,000,919	$31,842,336	$31,322,464	$31,537,950	$31,730,000	$32,094,504	$32,376,937	$32,535,839	$32,857,465	$32,815,064
CO**2		$1,668,981	$1,689,844	$1,711,059	$1,732,634	$1,754,572	$1,776,880	$1,799,564	$1,822,628	$1,846,080	$1,869,926	$1,767,217
Total Revenues		**$297,521,204**	**$230,690,763**	**$209,553,395**	**$207,055,097**	**$208,292,522**	**$209,506,880**	**$209,894,067**	**$211,199,565**	**$212,381,920**	**$214,727,391**	$221,082,280

PROFITS AND LOSSES	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
GROSS AND NET PROFIT/LOSS												
Total Revenues		$297,521,204	$230,690,763	$209,553,395	$207,055,097	$208,292,522	$209,506,880	$209,894,067	$211,199,565	$212,381,920	$214,727,391	$221,082,280
Total Costs		$164,416,386	$195,680,869	$199,065,892	$200,273,191	$202,588,265	$203,131,341	$203,359,684	$203,985,315	$204,301,761	$204,663,871	$198,146,657
Less Federal & State Govt Incentives		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Less Local Govt Incentives		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross Profit/Loss		**$133,104,818**	**$35,009,894**	**$10,487,503**	**$6,781,906**	**$5,704,256**	**$6,375,539**	**$6,534,383**	**$7,214,250**	**$8,080,158**	**$10,063,520**	$22,935,623
Less Corporate Income Taxes		$26,615,964	$2,729,672	$816,925	$527,889	$443,832	$496,192	$508,582	$561,612	$629,152	$783,855	$3,411,367
Net Profit/Loss		**$106,488,854**	**$32,280,222**	**$9,670,578**	**$6,254,018**	**$5,260,424**	**$5,879,347**	**$6,025,801**	**$6,652,639**	**$7,451,006**	**$9,279,666**	$19,524,256
ALLOCATION OF NET PROFIT/LOSS												
Annual Reserves		$5,324,443	$1,614,011	$483,529	$312,701	$263,021	$293,967	$301,290	$332,632	$372,550	$463,983	$976,213
Cumulative Reserves		$5,324,443	$6,938,454	$7,421,983	$7,734,684	$7,997,705	$8,291,672	$8,592,962	$8,925,594	$9,298,145	$9,762,128	$8,028,777
Debt Reduction Payment		$84,000,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,400,000
Equity Dividends		$17,164,412	$30,666,211	$9,187,049	$5,941,317	$4,997,403	$5,585,380	$5,724,511	$6,320,007	$7,078,456	$8,815,683	$10,148,043
Local Dividends		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Equity Rate of Return		31%	55%	16%	11%	9%	10%	10%	11%	13%	16%	18%

PROFIT/LOSS PER GALLON	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Total Revenues Per Gallon		**$2.98**	**$2.31**	**$2.10**	**$2.07**	**$2.08**	**$2.10**	**$2.10**	**$2.11**	**$2.12**	**$2.15**	$2.21
Denatured Alcohol		$2.58	$1.95	$1.76	$1.74	$1.75	$1.76	$1.76	$1.77	$1.78	$1.80	$1.87
Distillers Grains		$0.38	$0.34	$0.32	$0.31	$0.32	$0.32	$0.32	$0.32	$0.33	$0.33	$0.33
CO**2		$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02
Total Costs Per Gallon		**$1.64**	**$1.96**	**$1.99**	**$2.00**	**$2.03**	**$2.03**	**$2.03**	**$2.04**	**$2.04**	**$2.05**	$1.98
Input Costs Per Gallon		$1.44	$1.87	$1.91	$1.92	$1.94	$1.95	$1.95	$1.95	$1.95	$1.96	$1.88
Financial Costs Per Gallon		$0.16	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.04
Labor Costs & Taxes Per Gallon		$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.06	$0.06	$0.06	$0.06	$0.05
Less Government Incentives		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Gross Profit/Loss Per Gallon		**$1.33**	**$0.35**	**$0.10**	**$0.07**	**$0.06**	**$0.06**	**$0.07**	**$0.07**	**$0.08**	**$0.10**	$0.23
Less Corporate Income Tax		$0.27	$0.03	$0.01	$0.01	$0.00	$0.00	$0.01	$0.01	$0.01	$0.01	$0.03
Net Profit/Loss Per Gallon		**$1.06**	**$0.32**	**$0.10**	**$0.06**	**$0.05**	**$0.06**	**$0.06**	**$0.07**	**$0.07**	**$0.09**	$0.20

ETHANOL PLANT ECONOMICS TOOL FOR

Hypothetical 100 MGY Plant -- Current 7.5-BGY Renewable Fuels Standard
Central Nebraska

University of Nebraska Lincoln

OPERATIONS ANALYSIS

PRODUCTION INFORMATION	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
PRIMARY INPUT REQUIRMENTS												
Corn (bu		37,037,037	36,764,706	36,496,350	36,231,884	35,971,223	35,714,286	35,460,993	35,211,268	34,965,035	34,722,222	35,857,500
Water (ga)		259,259,259	257,352,941	255,474,453	253,623,188	251,798,561	250,000,000	248,226,950	246,478,873	244,755,245	243,055,556	251,002,503
Electricity (KwH)		110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000
Natural Gas (millionBTU)		3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000
PRODUCTION YIELD												
Denatured Alcohol (ga)		100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000
Distillers Grains (ton)		351,852	349,265	346,715	344,203	341,727	339,286	336,879	334,507	332,168	329,861	340,646
CO**2 (ton)		324,074	321,691	319,343	317,029	314,748	312,500	310,284	308,099	305,944	303,819	313,753

COSTS	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
INPUT COSTS												
Corn, including transport costs		$74,074,074	$116,544,118	$117,883,212	$116,666,667	$116,187,050	$114,642,857	$112,765,957	$111,267,606	$109,440,559	$107,291,667	$109,676,377
Water plus Treatment		$1,088,889	$1,102,500	$1,116,342	$1,130,417	$1,144,730	$1,159,285	$1,174,084	$1,189,132	$1,204,433	$1,219,990	$1,152,980
Electricity		$5,170,000	$5,273,400	$5,378,868	$5,486,445	$5,596,174	$5,708,098	$5,822,260	$5,938,705	$6,057,479	$6,178,629	$5,661,006
Natural Gas		$29,772,050	$30,367,491	$30,974,841	$31,594,338	$32,226,224	$32,870,749	$33,528,164	$34,198,727	$34,882,702	$35,580,356	$32,599,564
Enzymes		$5,725,926	$5,797,500	$5,870,286	$5,944,303	$6,019,569	$6,096,103	$6,173,926	$6,253,056	$6,333,515	$6,415,323	$6,062,951
Yeasts		$2,625,926	$2,658,750	$2,692,130	$2,726,074	$2,760,591	$2,795,690	$2,831,380	$2,867,670	$2,904,568	$2,942,086	$2,780,486
Chemicals: Processing & Antibiotics		$2,385,185	$2,415,000	$2,445,320	$2,476,152	$2,507,505	$2,539,386	$2,571,804	$2,604,766	$2,638,282	$2,672,360	$2,525,576
Chemicals: Boiling & Cooling		$596,296	$603,750	$611,330	$619,038	$626,876	$634,846	$642,951	$651,192	$659,570	$668,090	$631,394
Denaturants		$4,174,074	$4,226,250	$4,279,309	$4,333,266	$4,388,133	$4,443,925	$4,500,656	$4,558,341	$4,616,993	$4,676,630	$4,419,758
Waste Management		$1,988,889	$2,013,750	$2,039,032	$2,064,742	$2,090,885	$2,117,469	$2,144,501	$2,171,987	$2,199,934	$2,228,350	$2,105,954
Maintenance		$1,381,481	$1,398,750	$1,416,311	$1,434,169	$1,452,328	$1,470,793	$1,489,569	$1,508,661	$1,528,073	$1,547,811	$1,462,795
Alcohol Rail Transportation		$10,000,000	$10,200,000	$10,404,000	$10,612,080	$10,824,322	$11,040,808	$11,261,624	$11,486,857	$11,716,594	$11,950,926	$10,949,721
Management		$202,500	$208,575	$214,832	$221,277	$227,916	$234,753	$241,796	$249,049	$256,521	$264,217	$232,144
All Other & Unspecified		$4,577,778	$4,635,000	$4,693,191	$4,752,366	$4,812,540	$4,873,728	$4,935,946	$4,999,209	$5,063,535	$5,128,939	$4,847,223
FINANCIAL COSTS												
Debt Payment		$12,495,901	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,249,590
Depreciation		$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000
LABOR COSTS AND TAXES												
Wages and Salaries		$2,025,000	$2,085,750	$2,148,323	$2,212,772	$2,279,155	$2,347,530	$2,417,956	$2,490,495	$2,565,209	$2,642,166	$2,321,436
Benefits		$263,250	$271,148	$279,282	$287,660	$296,290	$305,179	$314,334	$323,764	$333,477	$343,482	$301,787
Insurance Trust Taxes		$202,500	$208,575	$214,832	$221,277	$227,916	$234,753	$241,796	$249,049	$256,521	$264,217	$232,144
State Sales Taxes		$311,667	$315,563	$319,524	$323,553	$327,650	$331,816	$336,052	$340,359	$344,738	$349,191	$330,011
Local Property Taxes		$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000
Local Sales Taxes		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Special Tax Assessments & Payments		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Costs		**$164,416,386**	**$195,680,869**	**$198,335,965**	**$198,461,597**	**$199,350,855**	**$199,202,769**	**$198,749,755**	**$198,703,625**	**$198,357,705**	**$197,719,426**	$194,897,895

REVENUES	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Denatured Alcohol		$258,000,000	$195,000,000	$176,000,000	$172,000,000	$170,000,000	$168,000,000	$166,000,000	$163,000,000	$161,000,000	$159,000,000	$178,800,000
Distillers Grains		$37,852,222	$34,000,919	$31,929,015	$31,618,478	$32,139,388	$32,659,643	$33,297,163	$33,878,873	$34,286,364	$34,909,201	$33,657,127
CO**2		$1,668,981	$1,689,844	$1,711,059	$1,732,634	$1,754,572	$1,776,880	$1,799,564	$1,822,628	$1,846,080	$1,869,926	$1,767,217
Total Revenues		**$297,521,204**	**$230,690,763**	**$209,640,074**	**$205,351,112**	**$203,893,960**	**$202,436,523**	**$201,096,727**	**$198,701,502**	**$197,132,444**	**$195,779,127**	$214,224,344

PROFITS AND LOSSES	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
GROSS AND NET PROFIT/LOSS												
Total Revenues		$297,521,204	$230,690,763	$209,640,074	$205,351,112	$203,893,960	$202,436,523	$201,096,727	$198,701,502	$197,132,444	$195,779,127	$214,224,344
Total Costs		$164,416,386	$195,680,869	$198,335,965	$198,461,597	$199,350,855	$199,202,769	$198,749,755	$198,703,625	$198,357,705	$197,719,426	$194,897,895
Less Federal & State Govt Incentives		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Less Local Govt Incentives		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross Profit/Loss		**$133,104,818**	**$35,009,894**	**$11,304,109**	**$6,889,515**	**$4,543,105**	**$3,233,754**	**$2,346,972**	**($2,123)**	**($1,225,261)**	**($1,940,299)**	$19,326,448
Less Corporate Income Taxes		$26,615,964	$2,729,672	$880,621	$536,282	$353,262	$251,133	$181,964	$0	$0	$0	$3,154,890
Net Profit/Loss		**$106,488,854**	**$32,280,222**	**$10,423,489**	**$6,353,233**	**$4,189,843**	**$2,982,621**	**$2,165,008**	**($2,123)**	**($1,225,261)**	**($1,940,299)**	$16,171,559
ALLOCATION OF NET PROFIT/LOSS												
Annual Reserves		$5,324,443	$1,614,011	$521,174	$317,662	$209,492	$149,131	$108,250	$0	$0	$0	$824,416
Cumulative Reserves		$5,324,443	$6,938,454	$7,459,628	$7,777,290	$7,986,782	$8,135,913	$8,244,164	$8,242,040	$7,016,779	$5,076,480	$7,220,197
Debt Reduction Payment		$84,000,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,400,000
Equity Dividends		$17,164,412	$30,666,211	$9,902,314	$6,035,571	$3,980,351	$2,833,490	$2,056,757	$0	$0	$0	$7,263,911
Local Dividends		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Equity Rate of Return		31%	55%	18%	11%	7%	5%	4%	%,	%,	%,	13%

PROFIT/LOSS PER GALLON	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Total Revenues Per Gallon		**$2.98**	**$2.31**	**$2.10**	**$2.05**	**$2.04**	**$2.02**	**$2.01**	**$1.99**	**$1.97**	**$1.96**	$2.14
Denatured Alcohol		$2.58	$1.95	$1.76	$1.72	$1.70	$1.68	$1.66	$1.63	$1.61	$1.59	$1.79
Distillers Grains		$0.38	$0.34	$0.32	$0.32	$0.32	$0.33	$0.33	$0.34	$0.34	$0.35	$0.34
CO**2		$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02
Total Costs Per Gallon		**$1.64**	**$1.96**	**$1.98**	**$1.98**	**$1.99**	**$1.99**	**$1.99**	**$1.99**	**$1.98**	**$1.98**	$1.95
Input Costs Per Gallon		$1.44	$1.87	$1.90	$1.90	$1.91	$1.91	$1.90	$1.90	$1.90	$1.89	$1.85
Financial Costs Per Gallon		$0.16	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.04
Labor Costs & Taxes Per Gallon		$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.06	$0.06	$0.06	$0.06	$0.05
Less Government Incentives		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Gross Profit/Loss Per Gallon		**$1.33**	**$0.35**	**$0.11**	**$0.07**	**$0.05**	**$0.03**	**$0.02**	**($0.00)**	**($0.01)**	**($0.02)**	$0.19
Less Corporate Income Tax		$0.27	$0.03	$0.01	$0.01	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.03
Net Profit/Loss Per Gallon		**$1.06**	**$0.32**	**$0.10**	**$0.06**	**$0.04**	**$0.03**	**$0.02**	**($0.00)**	**($0.01)**	**($0.02)**	$0.16

ETHANOL PLANT ECONOMICS TOOL FOR

Hypothetical 100 MGY Plant -- Proposed 15-BGY Renewable Fuels Standard
Central Nebraska

University of Nebraska Lincoln

OPERATIONS ANALYSIS

PRODUCTION INFORMATION	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	Average
PRIMARY INPUT REQUIRMENTS												
Corn (bu		37,037,037	36,764,706	36,496,350	36,231,884	35,971,223	35,714,286	35,460,993	35,211,268	34,965,035	34,722,222	35,857,500
Water (ga)		259,259,259	257,352,941	255,474,453	253,623,188	251,798,561	250,000,000	248,226,950	246,478,873	244,755,245	243,055,556	251,002,503
Electricity (KwH)		110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000	110,000,000
Natural Gas (millionBTU)		3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000
PRODUCTION YIELD												
Denatured Alcohol (ga)		100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000
Distillers Grains (ton)		351,852	349,265	346,715	344,203	341,727	339,286	336,879	334,507	332,168	329,861	340,646
CO**2 (ton)		324,074	321,691	319,343	317,029	314,748	312,500	310,284	308,099	305,944	303,819	313,753

COSTS	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	Average
INPUT COSTS												
Corn, including transport costs		$74,074,074	$116,544,118	$118,613,139	$118,478,261	$119,424,460	$118,571,429	$117,375,887	$116,549,296	$115,384,615	$114,236,111	$112,925,139
Water plus Treatment		$1,088,889	$1,102,500	$1,116,342	$1,130,417	$1,144,730	$1,159,285	$1,174,084	$1,189,132	$1,204,433	$1,219,990	$1,152,980
Electricity		$5,170,000	$5,273,400	$5,378,868	$5,486,445	$5,596,174	$5,708,098	$5,822,260	$5,938,705	$6,057,479	$6,178,629	$5,661,006
Natural Gas		$29,772,050	$30,367,491	$30,974,841	$31,594,338	$32,226,224	$32,870,749	$33,528,164	$34,198,727	$34,882,702	$35,580,356	$32,599,564
Enzymes		$5,725,926	$5,797,500	$5,870,286	$5,944,303	$6,019,569	$6,096,103	$6,173,926	$6,253,056	$6,333,515	$6,415,323	$6,062,951
Yeasts		$2,625,926	$2,658,750	$2,692,130	$2,726,074	$2,760,591	$2,795,690	$2,831,380	$2,867,670	$2,904,568	$2,942,086	$2,780,486
Chemicals: Processing & Antibiotics		$2,385,185	$2,415,000	$2,445,320	$2,476,152	$2,507,505	$2,539,386	$2,571,804	$2,604,766	$2,638,282	$2,672,360	$2,525,576
Chemicals: Boiling & Cooling		$596,296	$603,750	$611,330	$619,038	$626,876	$634,846	$642,951	$651,192	$659,570	$668,090	$631,394
Denaturants		$4,174,074	$4,226,250	$4,279,309	$4,333,266	$4,388,133	$4,443,925	$4,500,656	$4,558,341	$4,616,993	$4,676,630	$4,419,758
Waste Management		$1,988,889	$2,013,750	$2,039,032	$2,064,742	$2,090,885	$2,117,469	$2,144,501	$2,171,987	$2,199,934	$2,228,350	$2,105,954
Maintenance		$1,381,481	$1,398,750	$1,416,311	$1,434,169	$1,452,328	$1,470,793	$1,489,569	$1,508,661	$1,528,073	$1,547,811	$1,462,795
Alcohol Rail Transportation		$10,000,000	$10,200,000	$10,404,000	$10,612,080	$10,824,322	$11,040,808	$11,261,624	$11,486,857	$11,716,594	$11,950,926	$10,949,721
Management		$202,500	$208,575	$214,832	$221,277	$227,916	$234,753	$241,796	$249,049	$256,521	$264,217	$232,144
All Other & Unspecified		$4,577,778	$4,635,000	$4,693,191	$4,752,366	$4,812,540	$4,873,728	$4,935,946	$4,999,209	$5,063,535	$5,128,939	$4,847,223
FINANCIAL COSTS												
Debt Payment		$12,495,901	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,249,590
Depreciation		$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000	$3,150,000
LABOR COSTS AND TAXES												
Wages and Salaries		$2,025,000	$2,085,750	$2,148,323	$2,212,772	$2,279,155	$2,347,530	$2,417,956	$2,490,495	$2,565,209	$2,642,166	$2,321,436
Benefits		$263,250	$271,148	$279,282	$287,660	$296,290	$305,179	$314,334	$323,764	$333,477	$343,482	$301,787
Insurance Trust Taxes		$202,500	$208,575	$214,832	$221,277	$227,916	$234,753	$241,796	$249,049	$256,521	$264,217	$232,144
State Sales Taxes		$311,667	$315,563	$319,524	$323,553	$327,650	$331,816	$336,052	$340,359	$344,738	$349,191	$330,011
Local Property Taxes		$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000	$2,205,000
Local Sales Taxes		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Special Tax Assessments & Payments		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Costs		**$164,416,386**	**$195,680,869**	**$199,065,892**	**$200,273,191**	**$202,588,265**	**$203,131,341**	**$203,359,684**	**$203,985,315**	**$204,301,761**	**$204,663,871**	$198,146,657

REVENUES	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	Average
Denatured Alcohol		$258,000,000	$195,000,000	$176,000,000	$174,000,000	$175,000,000	$176,000,000	$176,000,000	$177,000,000	$178,000,000	$180,000,000	$186,500,000
Distillers Grains		$37,852,222	$34,000,919	$31,842,336	$31,322,464	$31,537,950	$31,730,000	$32,094,504	$32,376,937	$32,535,839	$32,857,465	$32,815,064
CO**2		$1,668,981	$1,689,844	$1,711,059	$1,732,634	$1,754,572	$1,776,880	$1,799,564	$1,822,628	$1,846,080	$1,869,926	$1,767,217
Total Revenues		**$297,521,204**	**$230,690,763**	**$209,553,395**	**$207,055,097**	**$208,292,522**	**$209,506,880**	**$209,894,067**	**$211,199,565**	**$212,381,920**	**$214,727,391**	$221,082,280

PROFITS AND LOSSES	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
GROSS AND NET PROFIT/LOSS												
Total Revenues		$297,521,204	$230,690,763	$209,553,395	$207,055,097	$208,292,522	$209,506,880	$209,894,067	$211,199,565	$212,381,920	$214,727,391	$221,082,280
Total Costs		$164,416,386	$195,680,869	$199,065,892	$200,273,191	$202,588,265	$203,131,341	$203,359,684	$203,985,315	$204,301,761	$204,663,871	$198,146,657
Less Federal & State Govt Incentives		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Less Local Govt Incentives		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross Profit/Loss		**$133,104,818**	**$35,009,894**	**$10,487,503**	**$6,781,906**	**$5,704,256**	**$6,375,539**	**$6,534,383**	**$7,214,250**	**$8,080,158**	**$10,063,520**	$22,935,623
Less Corporate Income Taxes		$26,615,964	$2,729,672	$816,925	$527,889	$443,832	$496,192	$508,582	$561,612	$629,152	$783,855	$3,411,367
Net Profit/Loss		**$106,488,854**	**$32,280,222**	**$9,670,578**	**$6,254,018**	**$5,260,424**	**$5,879,347**	**$6,025,801**	**$6,652,639**	**$7,451,006**	**$9,279,666**	$19,524,256
ALLOCATION OF NET PROFIT/LOSS												
Annual Reserves		$5,324,443	$1,614,011	$483,529	$312,701	$263,021	$293,967	$301,290	$332,632	$372,550	$463,983	$976,213
Cumulative Reserves		$5,324,443	$6,938,454	$7,421,983	$7,734,684	$7,997,705	$8,291,672	$8,592,962	$8,925,594	$9,298,145	$9,762,128	$8,028,777
Debt Reduction Payment		$84,000,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,400,000
Equity Dividends		$17,164,412	$30,666,211	$9,187,049	$5,941,317	$4,997,403	$5,585,380	$5,724,511	$6,320,007	$7,078,456	$8,815,683	$10,148,043
Local Dividends		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Equity Rate of Return		31%	55%	16%	11%	9%	10%	10%	11%	13%	16%	18%

PROFIT/LOSS PER GALLON	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Total Revenues Per Gallon		**$2.98**	**$2.31**	**$2.10**	**$2.07**	**$2.08**	**$2.10**	**$2.10**	**$2.11**	**$2.12**	**$2.15**	$2.21
Denatured Alcohol		$2.58	$1.95	$1.76	$1.74	$1.75	$1.76	$1.76	$1.77	$1.78	$1.80	$1.87
Distillers Grains		$0.38	$0.34	$0.32	$0.31	$0.32	$0.32	$0.32	$0.32	$0.33	$0.33	$0.33
CO**2		$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02
Total Costs Per Gallon		**$1.64**	**$1.96**	**$1.99**	**$2.00**	**$2.03**	**$2.03**	**$2.03**	**$2.04**	**$2.04**	**$2.05**	$1.98
Input Costs Per Gallon		$1.44	$1.87	$1.91	$1.92	$1.94	$1.95	$1.95	$1.95	$1.95	$1.96	$1.88
Financial Costs Per Gallon		$0.16	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.04
Labor Costs & Taxes Per Gallon		$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.06	$0.06	$0.06	$0.06	$0.05
Less Government Incentives		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Gross Profit/Loss Per Gallon		**$1.33**	**$0.35**	**$0.10**	**$0.07**	**$0.06**	**$0.06**	**$0.07**	**$0.07**	**$0.08**	**$0.10**	$0.23
Less Corporate Income Tax		$0.27	$0.03	$0.01	$0.01	$0.00	$0.00	$0.01	$0.01	$0.01	$0.01	$0.03
Net Profit/Loss Per Gallon		**$1.06**	**$0.32**	**$0.10**	**$0.06**	**$0.05**	**$0.06**	**$0.06**	**$0.07**	**$0.07**	**$0.09**	$0.20

For More Information

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