Ethanol Transportation Backgrounder

Expansion of U.S. Corn-based Ethanol from the Agricultural Transportation Perspective

U.S. Department of Agriculture

Agricultural Marketing Service
Transportation and Marketing Programs
Transportation Services Branch

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CONTENTS

The *Ethanol Transportation Backgrounder* is an overview of transportation issues facing a rapidly expanding U.S. ethanol industry in the context of the U.S. corn market—currently the main source of ethanol production in the United States. The aim of the report is to present a frame of reference as the ethanol industry continues to grow and additional transportation benchmarks and indicators develop by providing analysis of transportation requirements for corn-based ethanol and its impact on grain transportation.

SUMMARY

For the first 6 months of 2007, U.S. ethanol production totaled nearly 3 billion gallons—32 percent higher than the same period last year. As of August 29, there were 128 ethanol plants with annual production capacity totaling 6.78 billion gallons, and an additional 85 plants were under construction. U.S. ethanol production capacity is expanding rapidly and is currently expected to exceed 13 billion gallons per year by early 2009, if not sooner.

Ethanol demand has increased corn prices and led to expanded corn production, which is affecting grain transportation as corn use shifts from exports and feed use to ethanol production.

Most ethanol is currently produced in the Nation's heartland, but 80 percent of the U.S. population (and therefore implied ethanol demand) lives along its coastlines. Transportation factors to consider as ethanol production continues to expand in the Nation's heartland include:

- The capacity of the Nation's transportation system to move ethanol, feedstock, and co-products produced from ethanol.
- The availability of corn close to ethanol plants (~ 50 miles).
- The location of feedlots relative to ethanol producing areas.

Ethanol production capacity expansion is occurring faster than originally anticipated. In May, USDA issued a report analyzing the effects of an expansion in biofuel demand on U.S. agriculture. The analysis focused on two ethanol expansion scenarios in relation to the Baseline long-term projections issued in February 2007. Under Scenario 1, U.S. ethanol production increases to 15 billion gallons per year (bgy) by 2016. Under Scenario 2, U.S. ethanol production increases to 20 bgy by 2016. AMS applied its modal share analysis to the three USDA scenarios: baseline (February 2007 long-term projections) and the two scenarios described above to evaluate the impact of ethanol production expansion on grain transportation. The 5-year 2000-2004 modal share rates were assumed to stay constant over the projected period.

- Transportation impacts vary for each scenario and transportation mode due in part to modal share differences.
- Rail and barge demand could decrease if corn exports decrease, but in the short-term increased ethanol and DDGS shipments could offset decreases in rail grain shipments.
- Truck demand increases under all scenarios.

In 2005, rail was the primary transportation mode for ethanol, shipping 60 percent of ethanol production or approximately 2.9 billion gallons of ethanol. Trucks shipped 30 percent and barges 10 percent.

The growth of ethanol production and the construction and expansion of new plants have not been hampered by logistical concerns. Railroads have kept up with ethanol growth in 2006. As ethanol production grew by 26 percent in one year, railroads' shipments of alcohols (most of which is ethanol) increased by 28 percent.

Rail freight is forecast to increase from 1,879 million tons in 2002 to 3,525 million tons by 2035, an increase of nearly 88 percent—before ethanol production expansion.

Truck freight is forecast to almost double from 2002 to 2020, while driver shortages are projected to reach 219,000 by 2015—before ethanol production expansion. In 2004, there were 1.3 million long-haul heavy-duty truck drivers.

INTRODUCTION

On August 8, 2005, President Bush signed the Energy Policy Act of 2005 (EPAct 2005) into law. The comprehensive energy legislation established a nationwide renewable fuels standard (RFS) that was to start at 4 billion gallons in 2006 and increase to 7.5 billion gallons by 2012 (*Table 1).* Under the RFS, an increasing percentage of the national fuel supply is to be provided by renewable, domestic fuels, including ethanol and biodiesel. The key objectives are to reduce consumer fuel prices, increase energy security, improve environmental quality, and stimulate growth in rural America.

Table 1: The Energy Policy Act 2005 RFS Provisions

Year	Renewable Fuels (billions of gallons)
2006	4.0
2007	4.7
2008	5.4
2009	6.1
2010	6.8
2011	7.4
2012	7.5

EPAct 2005, rising petroleum prices, and the switch from MTBE to ethanol as a gasoline oxygenator are widely credited for the expansion in ethanol production capacity. Ethanol is denatured alcohol used as a gasoline additive for its oxygen and octane content and is currently blended into almost half of US gasoline at a maximum 10 percent.[1] The U.S. ethanol industry surpassed the RFS in 2006, when 4.9 billion gallons of ethanol were produced and used. Expanded production capacity currently under construction is expected to double annual ethanol production capacity to 12.9 billion gallons by the end of 2009, if not sooner.[2]

The President announced the Advanced Energy Initiative in the 2006 State of the Union Address. The Advanced Energy Initiative focuses on increasing research and development to encourage technological breakthroughs in the transportation and power sectors that will diversify our resource portfolio.

In his 2007 State of the Union Address, President Bush announced his goal to expand consumption of alternative fuels (including biofuels) to 35 billion gallons in 2017 ("20 in 10"—20 percent of projected gasoline use is to be replaced by renewable or alternative energy sources, as well as improved energy efficiency). Because cellulosic ethanol is not yet a current market reality, this report focuses on transportation requirements for corn-based ethanol and its impact on the grain transportation based on official USDA projections.

[1] Ethanol producers are required by the U.S. Drug Enforcement Administration (DEA) to denature the 200-proof ethanol before it is shipped. DEA has specific guidelines for the process that makes the ethyl alcohol into a fuel grade ethanol—E95.

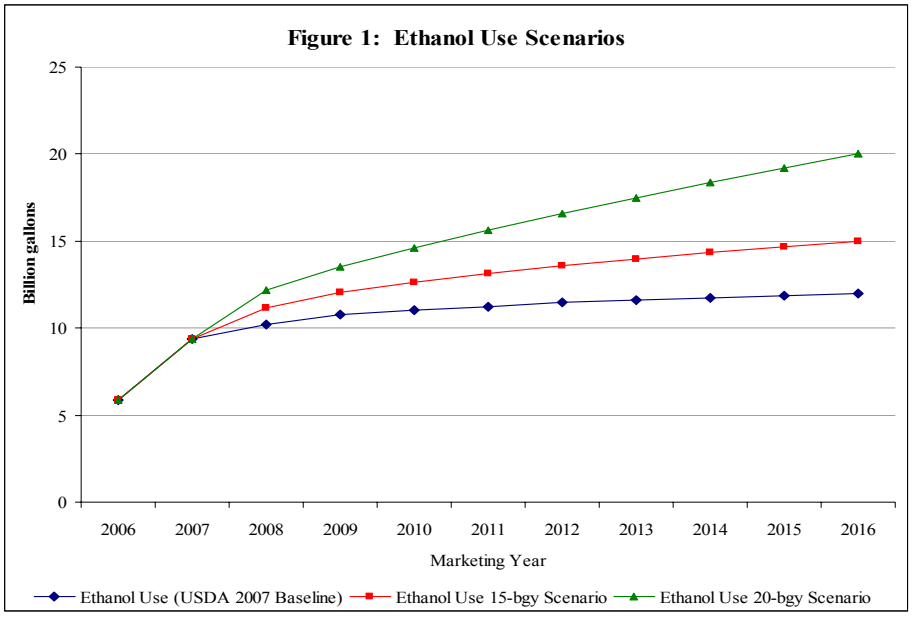
[2] Renewable Fuels Association – capacity as of August 1, 2007, www.rfaethanol.org.

USDA Analysis of Expanded Ethanol Use on U.S. Agriculture

The rapidly expanding ethanol production capacity and Congressional inquiry prompted analysis from USDA in addition to the long-term baseline projections issued in February.[3] In May, USDA issued a special report analyzing the impact of expanding current corn starch-based biofuel production on agriculture under two alternative scenarios.[4] The report examines two scenarios for crop years 2007-16 using an econometric model of the U.S. agricultural sector. Under Scenario 1, annual domestic ethanol production increases to 15 billion gallons (bgy) by 2016—3 bgy higher than assumed in the baseline projections. Under Scenario 2, annual domestic ethanol production increases to 20 bgy by 2016 *(figure 1)*. The increase in ethanol production is assumed to use corn as the feedstock.

USDA projects corn production in the baseline and the 15-bgy scenarios to increase from 13.05 billion bushels (bbu) in 2007 to 14.1 and 14.5 bbu in 2016, respectively. Under the 20-bgy scenario, corn production is expected to increase to 15.5 bbu by 2016 in *(Appendix I, tables 1-3).* Producers are expected to respond to the implied higher corn prices by shifting land from the production of soybeans into corn. Prices for minor feed grains are assumed to increase under both scenarios, thus increasing their estimated production slightly under both scenarios. The area planted to wheat, upland cotton, and rice would decline somewhat under both scenarios, as producers expand the area planted to feed grains.

USDA analysis projects that total area planted would increase under both scenarios, due to the overall increase in profitability in the crop sector. USDA analysis shows that total area planted would increase by an average of 0.9 and 1.9 million acres, for Scenarios 1 and 2, respectively. Thus, the area required to accommodate the expansion in ethanol production is composed of area planted to competing crops and from an overall expansion of area planted.



[3] USDA Agricultural Projections to 2016, February 2007. http://www.usda.gov/oce/commodity/ag_baseline.htm
[4] An Analysis of the Effects of an Expansion in Biofuel Demand on U.S. Agriculture May 2007. http://www.usda.gov/oce/

Transportation Implications

As corn production increases, transportation demand would normally be expected to increase. However, corn use for fuel is likely to have a mixed impact on rail, truck, and barge transportation. For example, trucks are used to ship most of the corn used by ethanol plants. But, the newer and bigger ethanol plants may also use rail for inbound corn shipments.

The variability in modal share of corn transportation is another contributing factor to the mixed impact on rail, barge, and truck sectors. Analysis of the average modal share for the five years (2000-2004) showed that railroads ship approximately 31 percent of corn to export locations and 30 percent to domestic locations; barges—68 percent to export and 2 percent to domestic locations; and trucks—2 percent to export locations and 67 percent to domestic locations.[5]

Corn Modal Share (2000-2004 average), percent			
	Rail	**Barge**	**Truck**
Exports	31	68	2
Domestic	30	2	67

Transportation requirements for ethanol would increase proportionately as production increases. The necessary investment and growth in the biofuel market to reach the suggested long-term targets will depend in part on finding cost-effective, efficient, and safe transportation solutions.

Railroads, trucks, and barges transport most ethanol today from production or import locations to locations where it is blended with gasoline at or near the point of retail distribution *(Appendix II)*. To sustain the market growth needed to meet current suggested targets, or to reach either of the scenarios analyzed by USDA, infrastructure must be developed for transporting biofuel and co-products to market.

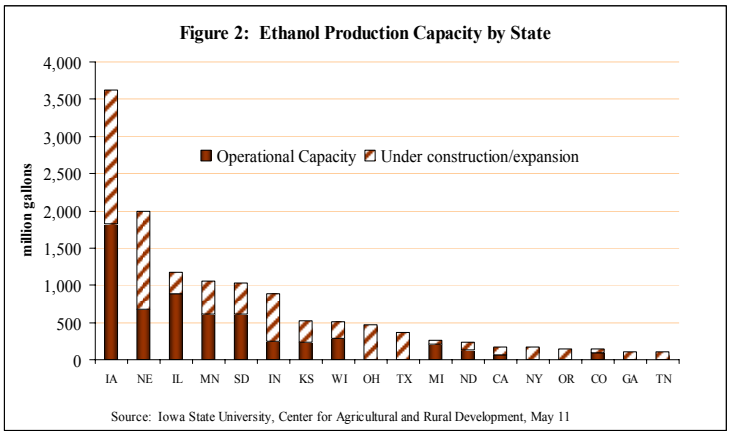
[5] Transportation of U.S. Grains: a Modal Share Analysis, 1978-2004. (Total may not add due to rounding). http://www.ams.usda.gov/tmd/TSB/Modal_Share.pdf

ETHANOL SUPPLY AND DEMAND OVERVIEW

Ethanol Supply

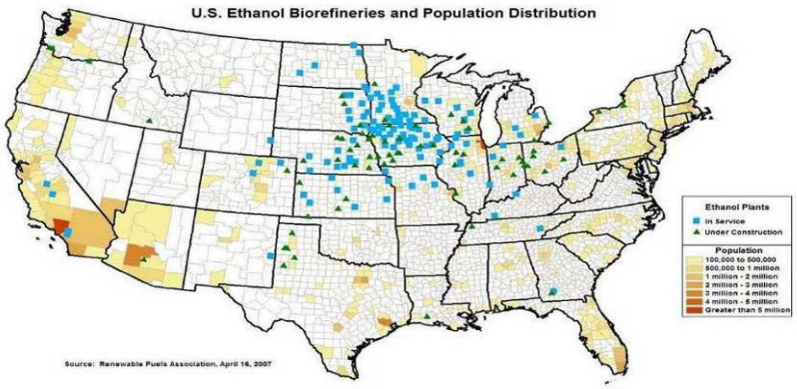
For the first 6 months of 2007, U.S. ethanol production totaled nearly 3 billion gallons—32 percent higher than the same period last year. As of August 29, 128 ethanol plants with a total annual capacity of 6.78 billion gallons were operating, and an additional 85 plants were under construction or expansion. U.S. ethanol production capacity is expanding rapidly and is currently expected to exceed 13 billion gallons by early 2009, if not sooner.

Ethanol production is a function of several factors, including feedstock availability, profitability, tax incentives, and technological advances. Currently, nearly all ethanol produced in the United States uses corn as its feedstock. In theory, the economics of dry feedstock vs. finished liquid fuel transportation favor the location of the ethanol plants in the Corn belt, where the feedstock is plentiful and less expensive. Ethanol is now being produced in more than 20 states, but about 90 percent of production capacity is concentrated in an 8-state area that encompasses Iowa, Nebraska, Illinois, Minnesota, South Dakota, Indiana, Kansas, and Wisconsin (*Figure 2).*



Most ethanol is currently produced in the Nation's heartland, but 80 percent of the U.S. population (and therefore implied ethanol demand) lives along its coastlines. Transportation factors to consider as ethanol production continues to expand in the Nation's heartland include:

- The capacity of the Nation's transportation system to move ethanol, feedstock, and co-products produced from ethanol.
- The availability of corn close to ethanol plants (~ 50 miles).
- The location of feedlots for use of co-products relative to ethanol producing areas.



Ethanol Demand

Ethanol is blended to a maximum ratio of 10 percent ethanol and 90 percent gasoline (E10). Automobiles, as currently manufactured for the U.S. market, are capable of running on E10. The potential demand for ethanol if the United States consumes E10 nationwide could be approximately 14 billion gallons *(Table 2)*. Efforts are underway to examine the use of blends beyond 10 percent in standard automobiles, which could increase potential demand of ethanol and avoid hitting the "blend wall" of an E10 ceiling.

Some regions of the Nation have expanded ethanol use—for example, the California Air Resources Board recently approved the increased use of ethanol in gasoline from the current 5.7 percent volume limit to 10 percent. California's legislature is expected to pass the new rule in the fall of 2007 and the State may start blending ethanol at higher levels as early as 2008. This would increase total ethanol consumption in California to approximately 1.6 billion gallons—about 23 percent of the current ethanol production capacity. Legislatures in southeastern States are also considering increasing ethanol-blending requirements. This adds to the uncertainty of ethanol demand in terms of volumes, timing, and geographic location.

U.S. automakers have corporate average fuel economy (CAFE) standard incentives to increase the production and sale of flex-fuel vehicles (FFV's) that are capable of using fuel that contains 85 percent ethanol and 15 percent gasoline (E85). It is estimated that today there are over 6 million FFV's on the road in the United States *(Appendix II)*. Automakers have pledged to increase that number to 10 million vehicles by 2010 and make FFV's 50 percent of their production line by 2015.

As the number of FFV's increases, the retail availability of E85 gas stations and fuel is expected to follow. Around 1,166 gas stations—less than 1 percent of 121,446 gas stations in the United States in 2002—currently sell E85 gas, concentrated in the Midwest.

Table 2--Potential Ethanol Volumes
(In million gallons, Based on 10% blend of 2004 Motor Gasoline Consumption)

	Ethanol Consumption		
State	**Potential**	**2005**	**Potential % Increase**
Alabama	261	41	533
Alaska	29	6	396
Arizona	274	14	1,830
Arkansas	145		
California	1,579	918	72
Colorado	213	102	109
Connecticut	184	162	14
Delaware	42		
Dist. of Col.	15		
Florida	847		
Georgia	507		
Hawaii	45		
Idaho	63		
Illinois	527	455	16
Indiana	324	136	138
Iowa	166	128	29
Kansas	134	18	635
Kentucky	232	77	202
Louisiana	234	66	256
Maine	71		
Maryland	267	0	90,774
Massachusetts	287	10	2,867
Michigan	500	195	156
Minnesota	272	276	
Mississippi	165		
Missouri	324	127	155
Montana	50	1	3,407
Nebraska	88	53	66
Nevada	109	53	106
New Hampshire	72		
New Jersey	436	7	6,386
New Mexico	98	6	1,526
New York	577	328	76
North Carolina	443	116	280
North Dakota	36	17	111
Ohio	524	264	99
Oklahoma	191		
Oregon	155	31	399
Pennsylvania	523	100	421
Rhode Island	38	10	301
South Carolina	259		
South Dakota	44	27	60
Tennessee	306		
Texas	1,158	29	3,890
Utah	104	2	4,568
Vermont	35		
Virginia	398	106	275
Washington	270	25	972
West Virginia	85	23	275
Wisconsin	257	127	102
Wyoming	33		
United States	**13,997**	**4,059**	**245**

Source: DOE/EIA; Table F13a: Wood, Waste, and Ethanol Consumption Estimates by Sector, 2005
http://www.eia.doe.gov/emeu/states/_seds_updates.html

ETHANOL TRANSPORTATION OUTLOOK:
Current and Projected

Transportation Background

Rapid expansion of the U.S. ethanol industry could have several implications for agricultural transportation, including increasing volumes of ethanol shipments and shifting grain and oilseed marketing patterns that could occur due to changes in production and use.

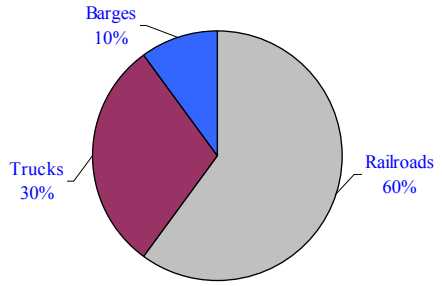
Transportation is typically the third highest expense to an ethanol producer—after feedstock and energy. Balancing transportation operating expenses with fixed infrastructure costs can be critical to sustained profitability for each ethanol plant. Storage needs for ethanol are also related to transportation needs—truck and rail have a faster turnaround and barges can haul larger quantities. For example, trucks offer more flexibility and responsiveness to move the product as the market dictates, reducing storage needs at the ethanol plant. But, barge may offer cost savings due to volumes moved. Other transportation requirements include inbound feedstock and outbound co-products. Corn is shipped to the plant as feedstock (mostly by truck) and distillers grains (dry distillers grains with solubles (DDGS) and wet distillers grains (WDGs)) are shipped by truck, rail, or barge.

For purposes of comparison, a large petroleum 2-barge unit tow hauls 2.52 million gallons (although ethanol is usually shipped in smaller, 630,000-gallon tanker barges), which is equivalent to about 80 railcars or 300 tanker trailers (table 3 and *Appendix II).* In 2005, rail was the primary transportation mode for ethanol, shipping 60 percent of ethanol production—approximately 2.9 billion gallons of ethanol; followed by trucks—30 percent, and barges—10 percent (*figure 3).*

Table 3: CARGO CAPACITY COMPARISON

Capacity (units)	Railcar	Barge	Truck
Grain (bushels)	3,500	52,500	910
Ethanol (gallons)	29,400	630,000	8,000
DDGS (tons)	100	1,500	25

Figure 3: Percent of U.S. Ethanol Production Moved by Mode, 2005



Sources: Railroads - STB Waybill Sample, 2005; Barges - Army Corps of Engineers estimate; Trucks -- Total less Rail and Barge.

Ethanol transactions currently involve two types of marketing arrangements: 1) direct sales to customers and 2) movements to a strategic location. Both types of arrangements require transportation. Movement of the product can be arranged by the customer, supplier, or a third party—known in the petroleum industry as *the marketer*.

As the number of companies producing ethanol increases, the share of ethanol marketed by third parties—marketers—is expected to rise as well. The marketers ensure supply interruptions are kept to a minimum and are able to move large volumes by gathering production from several smaller ethanol plants into unit trains (trains consisting of 85–100 cars that stay together from origin to destination). The role of the regional (shortline) railroads has increased for the shorter movements of ethanol to intermediate rail terminals.

As ethanol volumes rise, the industry may start requiring quality control programs that ensure that shipments are not contaminated with other chemicals. Ethanol producers are expected to continue to rely on qualified ethanol marketers to efficiently distribute their products. Some railroads have instituted a Certificate of Authenticity program that certifies ethanol quality shipments on their railroad.

Transportation Sensitivity to Demand and Distribution Changes

All three modes used to transport ethanol—rail, barge, and truck—are at or near capacity. Total rail freight is forecast to increase from 1,879 million tons in 2002 to 3,525 million tons by 2035, an increase of nearly 88 percent.[6] Federal Highway Administration projects truck freight to almost double from 2002 to 2020, and driver shortages are projected to reach 219,000 by 2015. In 2004, there were 1.3 million long-haul heavy-duty truck drivers.[7] The lock and dam system on the inland waterways is aging.

The lack of excess transportation capacity increases the sensitivity of transportation to sudden changes in transportation demand and distribution patterns. Changes in these patterns brought on by rapidly increasing ethanol production could impact rail network performance, highway congestion, and barge traffic. For example, the increased sensitivity of transportation modes became evident in the aftermath of Hurricanes Katrina and Rita in 2005, when rail had insufficient capacity to transport displaced grain barge freight and trucks could not carry the grain economically for long distances.

To date, logistical concerns have not hampered ethanol production growth or the construction and expansion of new ethanol plants. However, issues that may arise as production grows include:

- Uncertainty about the location of and demand from terminal markets which consolidate, transload, and distribute ethanol for blending. Change in State policies towards ethanol may decrease this uncertainty.
- Shifts in transportation demand for corn, ethanol, DDGS, and WDGs among rail, truck, and barge, in the context of overall traffic and future ethanol production locations.
- Concern about the adequacy of transportation infrastructure to efficiently ship ethanol and co-products.
- Increased transportation demand for agricultural inputs, mainly additional fertilizer for increased corn acreage.

[6] U. S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework, 2006.

[7] Federal Highway Administration; "The U.S. Truck Driver Shortage: Analysis and Forecasts." Global Insight, May 2005.

- Expected long-term growth in overall freight volumes—U.S. Department of Transportation projects total inter-city freight by all modes to grow dramatically from 19.3 billion tons in 2002 to 37.2 billion tons in 2035.[8]

Ethanol Production Scenarios and Transportation

The increased use of corn for ethanol has raised corn prices, and has resulted in increased corn production in the United States and changes in grain transportation as corn use shifts from exports and feed use to ethanol production. In August, USDA forecast corn production for the 2007/08 marketing year to reach about 13.05 billion bushels, up 2.5 billion bushels (24 percent) from last year. Increased grain production typically causes transportation demand to increase. Rapid ethanol production expansion, however, may affect where corn is transported and by which transportation mode. For example:

- Much of the increase in the corn crop will be trucked to ethanol facilities. Trucks currently dominate the local transportation of corn to ethanol plants. Should this trend continue, it may lead to a shift in modal share of grain transportation. However, as corn production is expected to continue to increase, demand for grain transportation for all modes may rise proportionately.
- In August, USDA projected 2007/08 corn exports at 2.15 billion bushels (up 50 million bushels from last year). Projected corn exports, however, decline in 2008/09 and 2009/10 before increasing in subsequent years, which leads to variability in overall rail and barge transportation demand, assuming the historical 5-year average modal share stays the same (*Appendix I, Table 4 footnotes*)[9].
- Price competition in different locations (corn basis) may shift transportation patterns more frequently than in the past because corn used for fuel has created an additional demand for corn and corn origination patterns may change as ethanol production increases. However, if corn supplies are abundant, there may be less price competition and thus fewer shifts in transportation patterns.

Transportation shifts are expected to continue over the next several years, until commodity markets adjust to sustained ethanol production. Since most of the export grain is shipped by rail and barge, a reduction in grain exports may reduce grain movements by these modes.

Transportation requirements could increase as ethanol production reaches 15 billion gallons by 2016; demand for rail and barge services then may recede as export demand decreases under the 20 billion gallon scenario *(figures 4-6 and Appendix I, Tables 1-3).* In the near-term, however, sharp increases in ethanol and DDGS movements are expected to offset any decreases in rail and barge grain transportation due to decreased exports and domestic use. Trucking demand continues to grow for all three scenarios, increasing most dramatically as ethanol production grows from the baseline to the 15-billion gallon target.

[8] U.S. DOT – Freight Analysis Framework, 2002 and 2006.

[9] Changes in market conditions and transportation costs may change modal shares for grains, ethanol, and co-products.

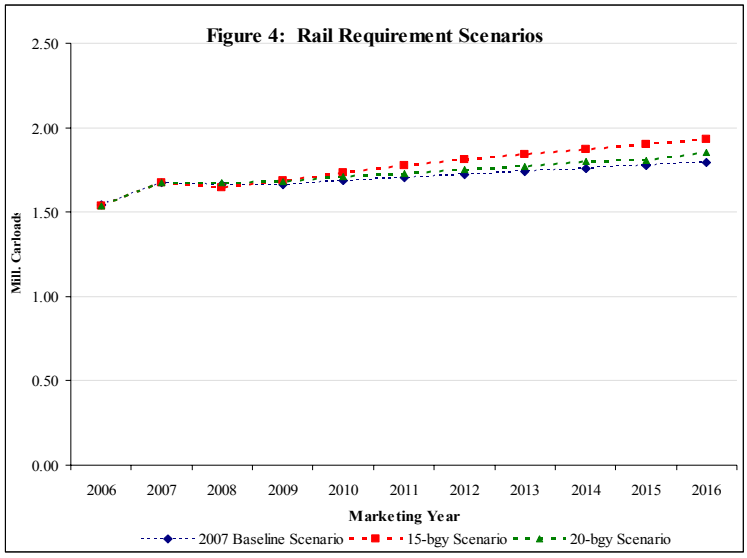


Figure 4: Rail Requirement Scenarios
Mill. Carloads
2.50
2.00
1.50
1.00
0.50
0.00
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
Marketing Year
2007 Baseline Scenario
15-bgy Scenario
20-bgy Scenario

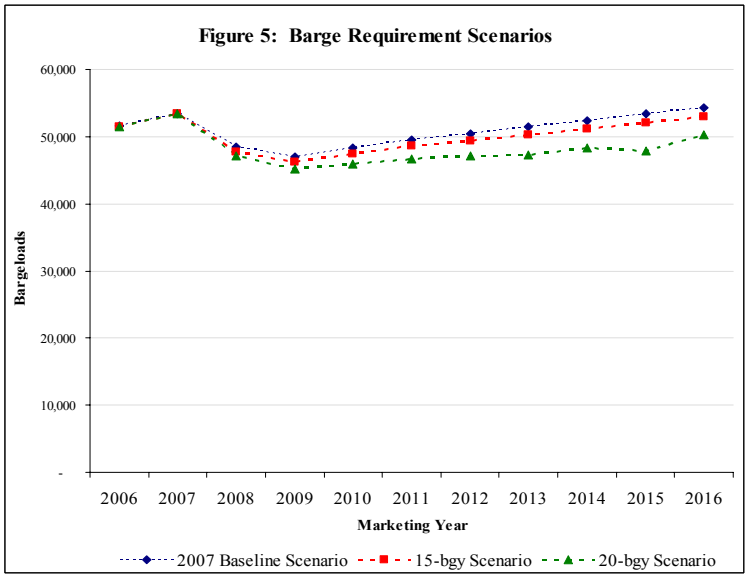


Figure 5: Barge Requirement Scenarios
Bargeloads
60,000
50,000
40,000
30,000
20,000
10,000
-
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
Marketing Year
2007 Baseline Scenario
15-bgy Scenario
20-bgy Scenario

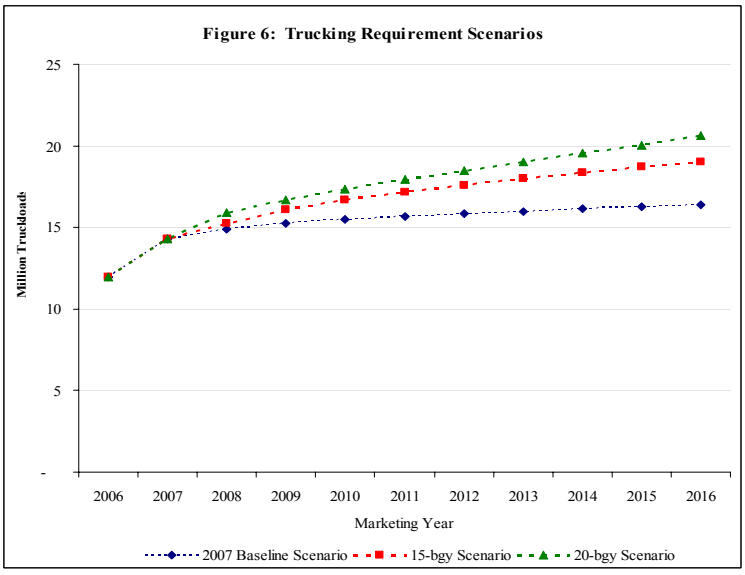
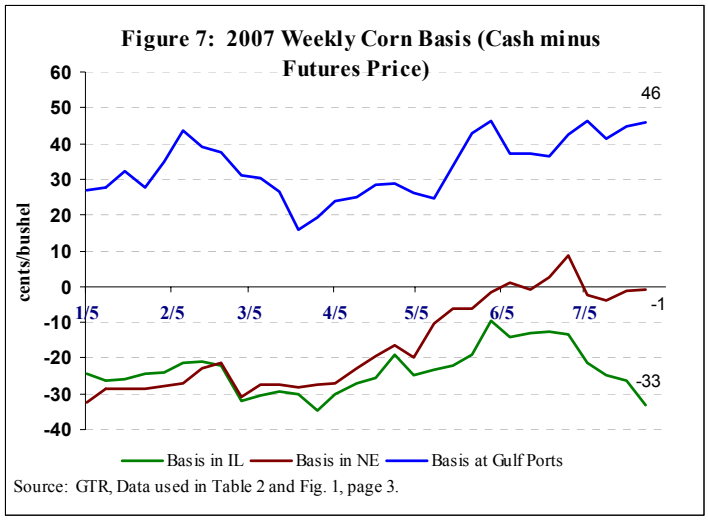


Figure 6: Trucking Requirement Scenarios
Million Truckloads
25
20
15
10
5
-
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
Marketing Year
2007 Baseline Scenario
15-bgy Scenario
20-bgy Scenario

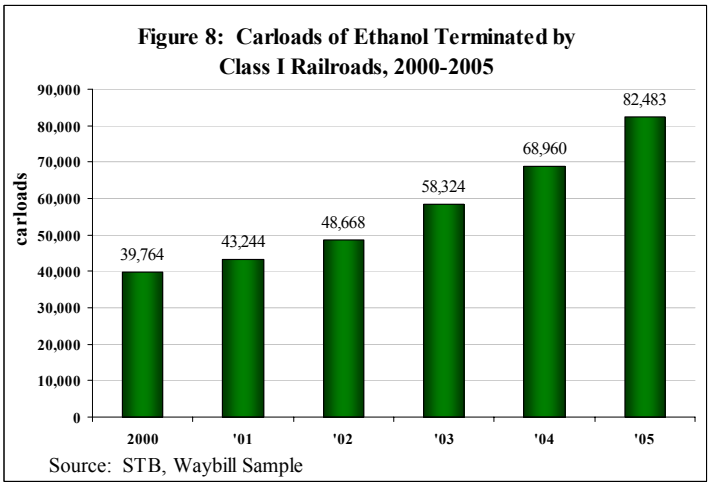
Increased ethanol production could lead major corn-producing states to become corn-deficit states, resulting in the need to source corn from other states and increasing transportation distances for sourced feedstock. Corn prices are expected to vary by location to ration the demand between domestic feedlots, ethanol plants, and exports. For example, as demand for corn at ethanol plants increases, corn prices may strengthen near the ethanol-producing areas relative to corn prices in export locations. This impact is demonstrated by the corn basis, which is the difference between the local cash prices and the nearby Chicago Board of Trade futures contract. Transportation demand may be higher in the areas with stronger prices (stronger basis). Increases in transportation costs, however, may also weaken (decrease) the interior basis, which would cause farm prices to fall in those locations.



The domestic corn basis during the first half of 2007 has been strengthening relative to exports until recently *(Figure 7)*. Corn futures prices have been decreasing from the high of over $4.00 in the spring to $3.20 by the end of July. However, the corn basis in Nebraska and at the Gulf ports have been strong, indicating relatively stronger demand in those locations for ethanol and export use.

Rail

Railroads shipped about 60 percent of ethanol produced in the United States in 2005, or 82,483 carloads *(Figure 8)* and have kept up with the annual ethanol production growth of 26 percent in 2006. According to preliminary Freight Commodity Statistics, the Class I railroads' origination of all alcohols[10] grew by 28 percent.



[10] Preliminary data does not include ethanol-specific statistics, but nearly all growth in alcohol movements during 2006 is expected to be from increased ethanol movement. Freight Commodity Statistics, compiled by Escalation Consultants, Inc.

The expected growth in rail movements of ethanol may pose some hurdles for shippers. Ethanol volumes moved by rail could jump from the projected 190,816 carloads in 2007 to over 408,000 in 2016 (*table 4*). Class I railroads, however, assert that the additional volume due to ethanol is well below the 20.8 million carloads of cargo freight they originated in 2006.

The variability and uncertainty of rail grain transportation demand is a function of grain export projections. For example, in the 20-bgy scenario, projected grain exports decline and rail grain transportation demand would decrease. However, that decrease is more than offset by the increased demand for ethanol and DDGS rail transportation. The consequences of the increased ethanol and DDGS transportation under the 20-bgy scenario occurring during a relatively short period could include a strain on rail transportation and logistics infrastructure. Thus, the interdependence of corn used for fuel vs. corn used for feed (domestic and exports) may translate into uncertainty for rail transportation.

Table 4: Rail Summary, 2006-2010, and 2016 Marketing Years (carloads)

	2006	2007	2008	2009	2010	2016	10-yr Change
Ethanol							
Baseline	119,347	190,816	208,163	219,592	225,306	245,306	125,959
15-bgy	119,347	190,816	227,755	245,551	257,633	306,122	186,776
20-bgy	119,347	190,816	248,163	276,163	298,449	408,163	288,816
All Grain							
Baseline	1,395,263	1,441,309	1,406,463	1,395,589	1,412,880	1,493,286	98,023
15-bgy	1,393,606	1,441,309	1,369,997	1,390,367	1,423,634	1,560,152	166,546
20-bgy	1,393,606	1,441,309	1,371,766	1,343,115	1,344,955	1,357,424	-36,182
DDGS							
Baseline	26,338	41,650	45,325	47,775	49,000	53,288	26,950
15-bgy	26,338	41,650	49,533	53,403	56,030	66,576	40,239
20-bgy	26,338	41,650	53,971	60,061	64,907	88,768	62,431

Unit Train Economics

It is more efficient and cost effective for railroads to move unit trains. The primary reasons include a higher asset utilization rate and lower inventory carrying costs. The industry "rule of thumb" is that the ethanol railcar utilization rate for a unit train is 30 turns per year, compared to 12 turns per year for a single-car shipment. Inventory carrying costs (travel, dwell, and unloading times) for a single-car shipment of ethanol could be as much as four-times that of a unit train. Unit train movements would increase the average number of loadings per year for each ethanol tank car, which could help alleviate potential tank car shortages.

Rail tariff rates for unit trains are typically lower than those for single-car and smaller shipments. For example, BNSF's tariff rate is discounted $900 for a gathered unit train of ethanol vs. a single car shipment of ethanol from Southwest Iowa to the Los Angeles Basin, California *(Table 5)*.

Table 5: Sample BNSF Tariff Rates, effective October, 2007 (excludes fuel surcharges)

Sample Route	Unit Train	Gathered	Single Car	Discount	
				Unit vs. Gathered	Gathered vs. Single
	$/car				
From SW IA to IL	$2,100	$2,500	$2,900	**-$400**	**-$400**
From SW IA to CA, LA Basin	$3,900	$4,400	$5,300	**-$500**	**-$900**
	$/gal				
From SW IA to IL	**$0.07**	$0.09	$0.10	**-$0.014**	**-$0.01**
From SW IA to CA, LA Basin	**$0.13**	$0.15	$0.18	**-$0.017**	**-$0.03**
UNIT TRAIN: a 95-car ethanol train originating at 1 plant					
GATHERED TRAIN: originating at 2 or 3 plants					

http://www.bnsf.com/markets/agricultural/ag_news/year2007/pricing07/p08-23-07a.html

Construction of unit train infrastructure at destination terminals—mostly owned by blenders, refiners, and third-party providers—may become a key to the efficiency of rail ethanol transportation. Factors that may be contributing to a slower rate of the infrastructure development include its capital-intensive nature as well as the sometimes-lengthy permitting process. Locations that are either capable of accepting unit trains of ethanol or currently expanding that capacity include:

- Watson, Carson and Stockton, CA
- Providence, RI
- Sewaren and Linden, NJ
- Ft. Worth and Arlington, TX
- Albany, NY
- Baltimore, MD

Future demand locations could include population centers in the Southeast, the Gulf Coast and Delta Region, and the Pacific Northwest. New terminal facilities that consolidate smaller ethanol shipments from different plants into unit trains are under construction in Manly, IA, and Sauget (near St. Louis), MO.

Similar economics are developing in the DDGS rail shipments. Unit trains of DDGS are currently discounted on BNSF by approximately $7.50 per ton relative to single car movements.[11] Additional DDGS storage at origin and unit train unloading infrastructure at destination would encourage further unit train utilization of DDGS.

[11] http://www.bnsf.com/markets/agricultural/ag_news/year2007/pricing07/p06-14-07a.html

INFRASTRUCTURE ISSUES

Supply Chain Issues

Several supply chain issues could inhibit growth in the ethanol industry. The efficiency of the ethanol transportation system may begin to depend on the ability of the blending market to accommodate additional quantities of ethanol.

The supply and demand of ethanol may become temporarily out of balance because blenders require time and financial incentives to add blending capacity. These extra financial incentives, including cheaper ethanol, could be in addition to the current blender tax credit of $0.51 per gallon, which is in place through 2010. Blenders are watching Federal and State legislative processes carefully to assess the legislative risk to their capital investments.

Grain markets may also be affected by ethanol supply chain issues. There is concern that grain storage shortages may occur as ethanol production capacity and corn crops continue to expand.

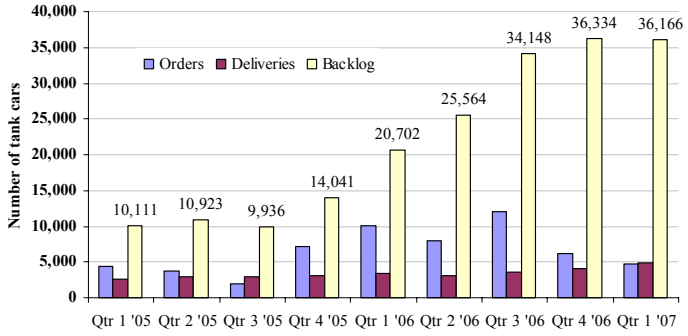
Rail Capacity

Rail capacity typically depends on several factors, including locomotive power and railcar availability and utilization, which are affected by train speeds, dwell time, loading and unloading times, and track capacity. In addition to an efficient logistics infrastructure, an adequate supply of railcars and other transportation equipment for ethanol and DDGS are needed to sustain growth in the ethanol industry.

Ethanol Rail Tank Cars

Ethanol is shipped in standard rail tank cars (approved for flammable liquids)—DOT 111A or AAR T108 rail cars (*Appendix II*). As of January 1, 2007, 41,000 rail tank cars capable of shipping ethanol were in use. Orders for new cars increased substantially in 2006 with a surge in ethanol plant construction and are expected to almost double this fleet in the next 2–2½ years. Rail tank cars are nearly all privately owned, either by leasing companies or shippers. Orders for new rail tank cars, 75 percent of which are estimated to be for ethanol use, started to increase in the 4th quarter 2005 and continued to increase through the 3rd quarter 2006 *(Figure 9)*. Rail tank car manufacturers increased production lines, but the backlog grew from about 10,000 railcars in the 3rd quarter 2005 to a peak of 36,334 railcars in the 4th quarter 2006. By the end of 1st quarter 2007, the manufacturing backlog had decreased to 36,166 railcars.

Figure 9: New Rail Tank Car Orders, Deliveries, and Backlog



Source: Rail Supply Institue, quarterly reports.

Grain Rail Cars

Increased rail service demand is expected to affect railcar fleet composition and availability for moving corn, ethanol, and DDGS.[12] Most grain is shipped in designated covered hopper railcars C113, C114, C213, or C313, which can also be used for other dry bulk commodities *(Appendix II)*. Total covered hopper railcar fleet as of January 1, 2007, was 268,000 railcars—almost 2 percent higher than on January 1, 2005. However, the grain rail car fleet share is estimated to be approximately 160,800—60 percent of the total covered hopper fleet.

Distillers Dried Grains with Solubles (DDGS) Transportation Issues

Ethanol plants that use corn as feedstock produce a co-product called distillers grains (DDGS-dried distillers grains with solubles, WDG-wet distillers grains, and MDG-modified distillers grains)[13]. For every 56-pound bushel of corn, 17.5 pounds of DDGS and 2.76 gallons of ethanol are produced, on average. Dairy cattle operations and cattle feedlots are the primary domestic users of distilled grains as a protein supplement for the ruminant animals. Research is ongoing for increasing the DDGS use by poultry and hog operations, which currently is limited due to nutritional challenges DDGS present to non-ruminant animals.

Production of DDGS is expected to grow proportionately with ethanol production increases. Currently, about 10 percent of DDGS are exported—1.25 million metric tons (mt) in 2006. According to the USDA's Foreign Agricultural Service (FAS), the United States exported approximately 900,000 metric tons of DDGS during the first 6 months of 2007—60 percent higher than the same period last year. The trend of increased DDGS exports is expected to continue. Increased use of barges to ship DDGS to export locations is likely.

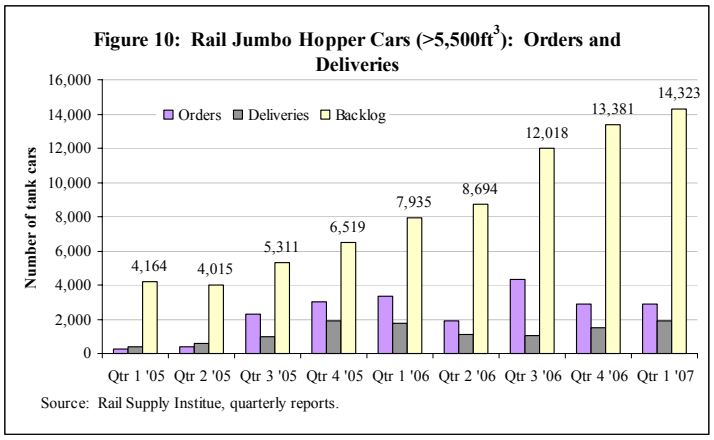
The original co-product of distilled grains from ethanol production is wet distillers grains (WDG). Shipping the WDG's saves energy, but the product is perishable and needs to be trucked to a nearby feeding operation within a couple of days. Drying the product adds cost for the ethanol producer, but provides a more stable product for transport and storage. Railroads and barges ship DDGS long distances and trucks are used for shorter distances.

Demand for shipping DDGS to domestic and export markets has been increasing, thus expanding demand for super jumbo covered hoppers—railcars that are greater than 5,500 cubic feet (ft^3) and have wide gates for easier flowability. During storage and transport, DDGS tends to cake and bridge between particles. Thus, flowability has become one of the major issues that needs to be addressed for effective sales, marketing, distribution, and utilization of distillers grains. Because these co-products do not always flow easily from railcars, workers sometimes hammer the car sides and hopper bottoms in order to induce flow. This can lead to severe damage to the rail cars themselves and can also pose worker safety issues.

[12] Railcar fleet statistics are from Association of American Railroads, telephone conversation with Craig Rockey on July 3, 2007.

[13] http://www.usda.gov/oce/reports/energy/USDA_2002_ETHANOL.pdf

According to the Rail Supply Institute, from first quarter 2005 through first quarter 2007, new deliveries of super jumbo railcars have totaled 11,307, with most of the growth occurring in 2006. DDGS are estimated to use about 70 percent of this fleet *(Figure 10)*. DDGS railcars are nearly all privately owned.



Flowability issues associated with shipping DDGS, based on the feed industry experience of using regular grain covered hoppers, have created expectations of a shorter lifespan for railcars used to ship DDGS. DDGS are also shipped in containers for export. The same flowability issues have started to affect availability of containers. DDGS transportation may be affected if feedlot operations move closer to the ethanol producing areas—more distillers' grains would be sold wet, requiring less rail and more truck transportation to feedlots and decreasing availability of DDGS for export.

Truck Service

Corn for ethanol is most frequently delivered to plants by trucks, typically from corn farms within a 50-mile radius. The truckload requirements just for corn to ethanol—if trucks are assumed to carry 98 percent of the corn delivered to ethanol plants—are expected to increase from 2.3 million in 2006 to 4.7 million truckload equivalents by 2016. The demand for corn trucking increases substantially—to 5.9 and 7.8 million truckloads under scenarios 1 and 2, respectively (*table 6)*.

Table 6: Truck Summary, 2006-2010, and 2016 Marketing Years (million truckloads)

	2006	2007	2008	2009	2010	2016	10-yr Change
Domestic and Export Corn							
Baseline	5.29	5.30	5.33	5.30	5.33	5.55	0.3
15-bgy	5.29	5.30	5.08	5.32	5.49	6.20	0.9
20-bgy	5.29	5.30	5.09	4.95	4.87	4.61	-0.7
Corn for Fuel Use							
Baseline	2.32	3.66	3.98	4.20	4.31	4.68	2.4
15-bgy	2.32	3.66	4.35	4.69	4.93	5.85	3.5
20-bgy	2.32	3.66	4.74	5.28	5.71	7.80	5.5

Standard gasoline tanker trucks (DOT MC306 Bulk Fuel Haulers) are used to ship ethanol from ethanol plants to the blending terminals. These trucks move an estimated 30 percent of ethanol. The current fleet size of the independently operated tank trucks is approximately 10,000. Many petroleum companies own their tanker truck fleet and are not included in the total.

Constraints to truck service include the availability of truck drivers (especially with HAZMAT certification), equipment shortages, and the differences in ethanol routes from the well-established and predictable petroleum routes—in part due to the rapid growth of new ethanol plant construction. In addition, overall truck freight is forecast to almost double from 2002 to 2020, while driver shortages are projected to reach 219,000 by 2015. In 2004, there were 1.3 million long-haul heavy-duty truck drivers.

Tank Barge Service

Barges move an estimated 10 percent of ethanol. The main terminals served by barge include Chicago, IL, New Orleans, LA, Houston, TX, and Albany, NY. Ethanol is typically shipped in 10,000–15,000 barrel[14] tank barges. The number of ethanol plants located near a river facility, however, is relatively small. As the industry grows, the share moved by barge may increase. According to Informa Economics, 2,808 tank barges were in operation in 2006, up from 2,782 in 2005, and 2,777 in 2004. Construction of a 16.6-million-gallon ethanol terminal on the Mississippi River at Sauget, IL, is expected to be completed by June 2008. The Army Corps of Engineers has approved construction of a 5th ethanol storage tank at this location to hold an additional 480,000 gallons by the third quarter of 2008. The terminal will be capable of loading 1.26-million-gallon tank barges as well as 95-car unit trains and trucks.

Potential Pipeline Developments

Pipelines are considered to be the safest and most cost-efficient mode of transportation. The ethanol industry, however, is fairly dispersed and significant infrastructure investments would still be necessary to consolidate sufficient quantities that could then be moved through pipelines.

No ethanol is currently shipped by pipeline due to its corrosive nature and ability to attract water. The pipeline industry, however, led by the Association of Oil Pipe Lines (AOPL) and American Petroleum Institute (API), is moving forward with an accelerated research program to address integrity issues related to shipping ethanol/gasoline blends. The project, managed by the Pipeline Research Council International (PRCI), will focus on an accelerated research effort due to be concluded in 6-12 months. It plans to identify those blends that:

- Can be moved in existing pipelines with little to no modification to the system.
- Can be moved with appreciable modifications.
- Cannot be moved in existing systems but could be moved in specially designed new transmission or short-haul distribution systems.

If and when pipelines are able to ship ethanol blends, it could alleviate potential strain on the rail system. Federal Energy Regulatory Commission and Pipeline Hazardous Materials Safety Administration (PHMSA) regulate the pipeline industry. PHMSA is currently accepting comments on the adequacy of existing regulatory definitions and standards regarding bio-fuels and pipeline safety. Comments are also welcomed on short- and long-term opportunities and challenges associated with transporting biofuels. (http://dms.dot.gov)

[14] 1 barrel = 42 gallons.

Government Biofuel Activities

The Federal government support for a biofuel economy continues to be strong as defined by the national energy policy goals. Transportation issues associated with higher ethanol production targets and biomass feedstock will have to be evaluated as the new technology and other biofuels become a market reality. USDA and DOE co-chair the legislatively-mandated federal Biomass Research and Development (R&D) Board aimed at coordinating the Executive Branch activities to promote the use of biofuels.

The 2002 Farm Bill for the first time included Energy in its title. The 2007 Farm Bill, working its way through Congress, includes several provisions aimed at increasing biofuel production, especially cellulosic-based fuels, and the bioenergy sector in general.

State government energy policies vary greatly and are likely to change as the national energy policy goals are translated into regional policy goals. The current (August 2007) status of State ethanol incentives is as follows.[15]

Seven states have enacted **Renewable Fuels Standards** that require the use of ethanol-blended fuel: Hawaii, Iowa, Louisiana, Minnesota, Missouri, Montana, and Washington. In addition, California legislature is expected to enact the higher ethanol blending rule in the fall of 2007.

Fourteen states have **retailer incentives for ethanol blends and E-85:** Alaska, Connecticut, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Missouri, Minnesota, North Dakota, Oklahoma, and South Dakota.

Twenty-two states have some type of **incentive for ethanol producers:** Hawaii, Illinois, Indiana, Kansas, Maine, Maryland, Minnesota, Mississippi, Missouri, Montana, Nebraska, New York, North Dakota, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, and Wyoming.

[15] Sources: American Coalition for Ethanol, and the Renewable Fuels Association http://www.ethanol.org/index.php?id=79&parentid=26) and http://www.ethanolrfa.org/policy/actions/state/

APPENDIX I – Scenario Tables

Table 1: Baseline Scenario for Transportation Requirements Based on Agricultural Projections to 2016 and World Agricultural Supply and Demand Estimates, August 10, 2007*.

August 17, 2007	Units[1]	Marketing year 2006 [1]	2007 [1]	2008	2009	2010	2011	2012	2013	2014	2015	2016
U.S. Ethanol Production	**mg**	**5,848**	**9,350**	**10,200**	**10,760**	**11,040**	**11,250**	**11,460**	**11,600**	**11,740**	**11,880**	**12,020**
Yield	g/bu	2.72	2.75	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76
Biodiesel Use	mg	500	600	625	650	675	700	700	700	700	700	700
Corn Production	mbu	**10,535**	**13,054**	**12,680**	**12,835**	**13,150**	**13,305**	**13,465**	**13,620**	**13,780**	**13,935**	**14,095**
Share used for fuel	percent	20	26	29	30	30	31	31	31	31	31	31
Grain Use:												
Corn Use	mbu	**11,375**	**12,690**	**12,740**	**12,900**	**13,110**	**13,295**	**13,455**	**13,615**	**13,775**	**13,940**	**14,075**
Feed & residual	mbu	5,750	5,750	5,775	5,725	5,750	5,775	5,800	5,850	5,900	5,950	5,975
Food, seed, & industrial	mbu	3,525	4,790	5,115	5,325	5,435	5,520	5,605	5,665	5,725	5,790	5,850
Fuel alcohol use	mbu	2,150	3,400	3,700	3,900	4,000	4,075	4,150	4,200	4,250	4,300	4,350
Domestic Use (less fuel alcohol use)	mbu	7,125	7,140	7,190	7,150	7,185	7,220	7,255	7,315	7,375	7,440	7,475
Exports	mbu	2,100	2,150	1,850	1,850	1,925	2,000	2,050	2,100	2,150	2,200	2,250
Corn Transportation												
Rail (Class I)	carloads	**811,071**	**816,686**	**795,400**	**791,857**	**801,386**	**810,914**	**818,300**	**827,900**	**837,500**	**847,543**	**854,929**
Barge	bargeloads	**29,914**	**30,568**	**26,701**	**26,686**	**27,670**	**28,655**	**29,316**	**29,987**	**30,657**	**31,330**	**31,990**
Truck	truckloads	**5,292,033**	**5,304,176**	**5,334,396**	**5,304,945**	**5,332,363**	**5,359,780**	**5,386,648**	**5,431,923**	**5,477,198**	**5,526,154**	**5,553,022**
Corn for Alcohol Use Transport.												
Rail (Class I)	carloads	**12,286**	**19,429**	**21,143**	**22,286**	**22,857**	**23,286**	**23,714**	**24,000**	**24,286**	**24,571**	**24,857**
Barge	bargeloads											
Truck	truckloads	**2,315,385**	**3,661,538**	**3,984,615**	**4,200,000**	**4,307,692**	**4,388,462**	**4,469,231**	**4,523,077**	**4,576,923**	**4,630,769**	**4,684,615**
DDGS Production[2]	mil. s. tons	19	30	32	34	35	36	36	37	37	38	38
Exports	mil. s. tons	1.9	3.0	3.2	3.4	3.5	3.6	3.6	3.7	3.7	3.8	3.8
DDGS Transportation												
Rail (Class I)	carloads	**26,338**	**41,650**	**45,325**	**47,775**	**49,000**	**49,919**	**50,838**	**51,450**	**52,063**	**52,675**	**53,288**
Barge	bargeloads	**251**	**397**	**432**	**455**	**467**	**475**	**484**	**490**	**496**	**502**	**508**
Truck	truckloads	**647,000**	**1,023,162**	**1,113,441**	**1,173,627**	**1,203,720**	**1,226,290**	**1,248,860**	**1,263,906**	**1,278,953**	**1,293,999**	**1,309,046**
Soybean Use	mbu	**3,066**	**2,984**	**2,993**	**2,886**	**2,912**	**2,947**	**2,976**	**3,001**	**3,032**	**3,062**	**3,088**
Crush	mbu	1,795	1,800	1,870	1,895	1,920	1,950	1,975	1,995	2,015	2,035	2,060
Seed and residual	mbu	171	164	143	146	147	147	151	151	152	152	153
Domestic Use	mbu	1,966	1,964	2,013	2,041	2,067	2,097	2,126	2,146	2,167	2,187	2,213
Exports	mbu	1,100	1,020	980	845	845	850	850	855	865	875	875
Soybean Transportation												
Rail (Class I)	carloads	**196,731**	**188,869**	**187,223**	**175,389**	**176,577**	**178,434**	**179,760**	**181,160**	**183,091**	**184,977**	**186,166**
Barge	bargeloads	**13,485**	**12,585**	**12,164**	**10,662**	**10,677**	**10,751**	**10,767**	**10,835**	**10,959**	**11,083**	**11,098**
Truck	truckloads	**1,834,571**	**1,826,637**	**1,867,176**	**1,881,714**	**1,904,857**	**1,931,945**	**1,957,758**	**1,975,945**	**1,995,407**	**2,013,978**	**2,037,121**
Wheat Use	mbu	**2,050**	**2,241**	**2,246**	**2,270**	**2,300**	**2,300**	**2,320**	**2,330**	**2,340**	**2,350**	**2,365**
Food	mbu	925	930	935	940	945	950	955	960	965	970	975
Seed	mbu	81	81	81	80	80	80	80	80	80	80	80
Feed & residual	mbu	134	180	280	300	300	270	260	240	220	200	185
Domestic Use	mbu	1,140	1,191	1,296	1,320	1,325	1,300	1,295	1,280	1,265	1,250	1,240
Exports	mbu	910	1,050	950	950	975	1,000	1,025	1,050	1,075	1,100	1,125
Wheat Transportation												
Rail (Class I)	carloads	**315,600**	**346,740**	**344,297**	**347,657**	**352,643**	**353,429**	**357,014**	**359,200**	**361,386**	**363,571**	**366,457**
Barge	bargeloads	**6,240**	**7,200**	**6,514**	**6,514**	**6,686**	**6,857**	**7,029**	**7,200**	**7,371**	**7,543**	**7,714**
Truck	truckloads	**666,374**	**700,549**	**753,846**	**767,033**	**770,879**	**758,242**	**756,593**	**749,451**	**742,308**	**735,165**	**730,769**
Sorghum Use	mbu	**305**	**445**	**320**	**320**	**325**	**325**	**325**	**325**	**325**	**320**	**320**
Feed & residual	mbu	110	180	120	120	125	125	125	125	125	120	120
Food, seed, & industrial	mbu	45	65	50	50	50	50	50	50	50	50	50
Domestic Use	mbu	155	245	170	170	175	175	175	175	175	170	170
Exports	mbu	150	200	150	150	150	150	150	150	150	150	150
Sorghum Transportation												
Rail (Class I)	carloads	**25,000**	**34,429**	**25,429**	**25,429**	**25,571**	**25,571**	**25,571**	**25,571**	**25,571**	**25,429**	**25,429**
Barge	bargeloads	**571**	**762**	**571**	**571**	**571**	**571**	**571**	**571**	**571**	**571**	**571**
Truck	truckloads	**206,044**	**312,637**	**220,879**	**220,879**	**225,824**	**225,824**	**225,824**	**225,824**	**225,824**	**220,879**	**220,879**
Barley Use	mbu	**231**	**235**	**220**	**220**	**226**	**226**	**226**	**231**	**232**	**232**	**237**
Feed & residual	mbu	55	60	45	45	50	50	50	55	55	55	60
Food, seed, & industrial	mbu	156	155	155	155	156	156	156	156	157	157	157
Domestic Use	mbu	211	215	200	200	206	206	206	211	212	212	217
Exports	mbu	20	20	20	20	20	20	20	20	20	20	20
Barley Transportation												
Rail (Class I)	carloads	**34,574**	**35,157**	**32,971**	**32,971**	**33,846**	**33,846**	**33,846**	**34,574**	**34,720**	**34,720**	**35,449**
Barge	bargeloads											
Truck	truckloads	**118,549**	**120,659**	**112,747**	**112,747**	**115,912**	**115,912**	**115,912**	**118,549**	**119,077**	**119,077**	**121,714**

*See Transportation Assumptions in the Summary of Transportation Requirements Table 4, Appendix I; USDA Long-term Projections Report, OCE-2007-1, February 2007.

Units: mg=million gallons; mbu=million bushels; mil. s. tons=million short tons.

[1]USDA, World Agricultural Supply and Demand Estimates (WASDE), August 10, 2007.

[2]DDGS yield = 17.5 lbs/bushel of corn used in ethanol production.

Table 2: Transportation Requirements Based on a 15-bgy Scenario* and August 12, 2007 WASDE for 2006 and 2007.

August 17, 2007	Units[1]	Marketing year 2006 [1]	2007 [1]	2008	2009	2010	2011	2012	2013	2014	2015	2016
U.S. Ethanol Production	**mg**	**5,848**	**9,350**	**11,160**	**12,032**	**12,624**	**13,125**	**13,584**	**13,980**	**14,348**	**14,688**	**15,000**
Yield	g/bu	2.72	2.75	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76
Biodiesel Use	mg	500	600	700	755	805	850	880	910	940	970	1,000
Corn Production	mbu	**10,535**	**13,054**	**12,781**	**12,945**	**13,325**	**13,497**	**13,715**	**13,878**	**14,091**	**14,249**	**14,454**
Share used for fuel	percent	20	26	32	34	34	35	36	36	37	37	38
Grain Use:												
Corn Use	mbu	**11,375**	**12,690**	**12,686**	**13,305**	**13,811**	**14,245**	**14,635**	**14,971**	**15,299**	**15,609**	**15,901**
Feed & residual	mbu	5,750	5,750	5,434	5,754	5,975	6,163	6,337	6,487	6,629	6,764	6,886
Food, seed, & industrial	mbu	3,525	4,790	5,454	5,775	5,995	6,183	6,357	6,508	6,649	6,785	6,907
Fuel alcohol use	mbu	2,150	3,400	4,043	4,359	4,574	4,755	4,922	5,065	5,199	5,322	5,435
Domestic Use (less fuel alcohol use)	mbu	7,125	7,140	6,845	7,170	7,397	7,591	7,772	7,930	8,079	8,228	8,358
Exports	mbu	2,100	2,150	1,797	1,776	1,840	1,898	1,941	1,976	2,021	2,060	2,108
Corn Transportation												
Rail (Class I)	carloads	**811,071**	**816,686**	**760,356**	**787,278**	**812,884**	**835,045**	**854,742**	**871,718**	**888,795**	**905,286**	**920,956**
Barge	bargeloads	**29,914**	**30,568**	**25,888**	**25,738**	**26,655**	**27,476**	**28,100**	**28,613**	**29,252**	**29,811**	**30,489**
Truck	truckloads	**5,292,033**	**5,304,176**	**5,079,445**	**5,317,800**	**5,486,406**	**5,630,781**	**5,764,938**	**5,881,897**	**5,992,790**	**6,103,106**	**6,199,884**
Corn for Alcohol Use Transport.												
Rail (Class I)	carloads	**12,286**	**19,429**	**23,106**	**24,911**	**26,137**	**27,174**	**28,124**	**28,944**	**29,706**	**30,410**	**31,056**
Barge	bargeloads											
Truck	truckloads	**2,315,385**	**3,661,538**	**4,354,515**	**4,694,760**	**4,925,753**	**5,121,237**	**5,300,334**	**5,454,849**	**5,598,439**	**5,731,104**	**5,852,843**
DDGS Production[2]	mil. s. tons	19	30	35	38	40	42	43	44	45	47	48
Exports	mil. s. tons	1.9	3.0	3.5	3.8	4.0	4.2	4.3	4.4	4.5	4.7	4.8
DDGS Transportation												
Rail (Class I)	carloads	**26,338**	**41,650**	**49,533**	**53,403**	**56,030**	**58,254**	**60,291**	**62,049**	**63,682**	**65,191**	**66,576**
Barge	bargeloads	**251**	**397**	**472**	**509**	**534**	**555**	**574**	**591**	**606**	**621**	**634**
Truck	truckloads	**647,000**	**1,023,162**	**1,216,804**	**1,311,880**	**1,376,428**	**1,431,053**	**1,481,099**	**1,524,276**	**1,564,400**	**1,601,471**	**1,635,489**
Soybean Use	mbu	**3,041**	**2,984**	**2,985**	**2,881**	**2,899**	**2,935**	**2,957**	**2,985**	**3,011**	**3,045**	**3,066**
Crush	mbu	1,780	1,800	1,876	1,906	1,929	1,960	1,984	2,008	2,029	2,054	2,080
Seed and residual	mbu	171	164	143	145	146	146	150	150	151	151	152
Domestic Use	mbu	1,951	1,964	2,019	2,051	2,075	2,106	2,134	2,158	2,180	2,205	2,232
Exports	mbu	1,090	1,020	966	830	824	829	822	827	831	841	835
Soybean Transportation												
Rail (Class I)	carloads	**195,074**	**188,869**	**186,105**	**174,425**	**174,901**	**176,790**	**177,455**	**178,989**	**180,338**	**182,444**	**183,100**
Barge	bargeloads	**13,364**	**12,585**	**12,006**	**10,503**	**10,444**	**10,518**	**10,461**	**10,526**	**10,580**	**10,707**	**10,654**
Truck	truckloads	**1,820,451**	**1,826,637**	**1,871,377**	**1,889,641**	**1,910,731**	**1,938,352**	**1,963,146**	**1,984,734**	**2,004,291**	**2,026,992**	**2,050,784**
Wheat Use	mbu	**2,050**	**2,241**	**2,245**	**2,267**	**2,295**	**2,295**	**2,314**	**2,323**	**2,332**	**2,342**	**2,355**
Food	mbu	925	930	935	940	945	950	955	960	965	970	975
Seed	mbu	81	81	81	80	80	80	80	80	80	80	80
Feed & residual	mbu	134	180	285	304	305	277	269	250	231	212	197
Domestic Use	mbu	1,140	1,191	1,301	1,324	1,331	1,307	1,304	1,290	1,277	1,262	1,252
Exports	mbu	910	1,050	945	942	965	987	1,010	1,033	1,056	1,080	1,103
Wheat Transportation												
Rail (Class I)	carloads	**315,600**	**346,740**	**344,033**	**346,963**	**351,669**	**352,299**	**355,672**	**357,719**	**359,699**	**361,781**	**364,430**
Barge	bargeloads	**6,240**	**7,200**	**6,478**	**6,462**	**6,616**	**6,771**	**6,924**	**7,084**	**7,239**	**7,404**	**7,564**
Truck	truckloads	**666,374**	**700,549**	**756,154**	**769,093**	**773,467**	**761,690**	**760,893**	**754,269**	**747,790**	**740,843**	**736,609**
Sorghum Use		**305**	**445**	**326**	**329**	**337**	**338**	**342**	**341**	**346**	**341**	**343**
Feed & residual	mbu	110	180	121	122	128	128	130	129	132	127	128
Food, seed, & industrial	mbu	45	65	50	50	50	50	50	50	50	50	50
Domestic Use	mbu	155	245	171	172	178	178	180	179	182	177	178
Exports	mbu	150	200	155	157	159	160	161	162	163	164	165
Sorghum Transportation												
Rail (Class I)	carloads	**25,000**	**34,429**	**26,109**	**26,460**	**26,843**	**27,010**	**27,270**	**27,342**	**27,614**	**27,523**	**27,653**
Barge	bargeloads	**571**	**762**	**589**	**599**	**604**	**609**	**614**	**617**	**622**	**624**	**627**
Truck	truckloads	**206,044**	**312,637**	**223,672**	**224,943**	**232,062**	**232,196**	**235,192**	**234,459**	**237,764**	**232,402**	**234,057**
Barley Use		**231**	**235**	**202**	**202**	**208**	**208**	**208**	**214**	**215**	**215**	**220**
Feed & residual	mbu	55	60	47	48	53	54	54	60	60	61	66
Food, seed, & industrial	mbu	156	155	134	134	135	134	134	134	135	134	134
Domestic Use	mbu	211	215	182	182	188	188	188	194	195	195	200
Exports	mbu	20	20	20	20	20	20	20	20	20	20	20
Barley Transportation												
Rail (Class I)	carloads	**34,574**	**35,157**	**30,289**	**30,330**	**31,201**	**31,261**	**31,260**	**32,053**	**32,194**	**32,243**	**32,957**
Barge	bargeloads											
Truck	truckloads	**118,549**	**120,659**	**103,037**	**103,186**	**106,339**	**106,555**	**106,554**	**109,423**	**109,931**	**110,111**	**112,695**

*See Transportation Assumptions in the Summary of Transportation Requirements Table 5, Appendix I; USDA Long-term Projections Report, OCE-2007-1, February 2007.

Units: mg=million gallons; mbu=million bushels; mil. s. tons=million short tons.

[1]USDA, World Agricultural Supply and Demand Estimates (WASDE), August 10, 2007.

[2]DDGS yield = 17.5 lbs/bushel of corn used in ethanol production.

Table 3: Transportation Requirements Based on a 20-bgy Scenario* and August 10, 2007 WASDE for 2006 and 2007.

August 17, 2007	Units[1]	Marketing year 2006 [1]	2007 [1]	2008	2009	2010	2011	2012	2013	2014	2015	2016
U.S. Ethanol Production	**mg**	**5,848**	**9,350**	**12,160**	**13,532**	**14,624**	**15,625**	**16,584**	**17,480**	**18,348**	**19,188**	**20,000**
Yield	g/bu	2.72	2.75	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76
Biodiesel Use	mg	500	600	700	755	805	850	880	910	940	970	1,000
Corn Production	mbu	**10,535**	**13,054**	**12,877**	**13,097**	**13,564**	**13,799**	**14,108**	**14,338**	**14,711**	**14,782**	**15,464**
Share used for fuel	percent	20	26	34	37	39	41	43	44	45	47	47
Grain Use:												
Corn Use	mbu	**11,375**	**12,690**	**13,012**	**13,262**	**13,593**	**13,879**	**14,158**	**14,375**	**14,731**	**14,802**	**15,406**
Feed & residual	mbu	5,750	5,750	5,465	5,270	5,163	5,056	4,966	4,869	4,840	4,687	4,771
Food, seed, & industrial	mbu	3,525	4,790	5,808	6,305	6,703	7,068	7,419	7,745	8,066	8,374	8,684
Fuel alcohol use	mbu	2,150	3,400	4,406	4,903	5,299	5,661	6,009	6,333	6,648	6,952	7,246
Domestic Use (less fuel alcohol use)	mbu	7,125	7,140	6,867	6,672	6,567	6,462	6,376	6,281	6,258	6,109	6,209
Exports	mbu	2,100	2,150	1,739	1,687	1,727	1,755	1,774	1,761	1,824	1,741	1,951
Corn Transportation												
Rail (Class I)	carloads	**811,071**	**816,686**	**757,264**	**735,528**	**729,674**	**722,816**	**716,764**	**707,235**	**710,699**	**690,256**	**717,156**
Barge	bargeloads	**29,914**	**30,568**	**25,135**	**24,394**	**24,868**	**25,197**	**25,404**	**25,200**	**26,015**	**24,874**	**27,639**
Truck	truckloads	**5,292,033**	**5,304,176**	**5,094,334**	**4,949,144**	**4,873,120**	**4,796,444**	**4,733,312**	**4,663,048**	**4,647,963**	**4,535,833**	**4,614,066**
Corn for Alcohol Use Transport.												
Rail (Class I)	carloads	**12,286**	**19,429**	**25,176**	**28,017**	**30,277**	**32,350**	**34,335**	**36,190**	**37,988**	**39,727**	**41,408**
Barge	bargeloads											
Truck	truckloads	**2,315,385**	**3,661,538**	**4,744,705**	**5,280,045**	**5,706,132**	**6,096,711**	**6,470,903**	**6,820,513**	**7,159,197**	**7,486,957**	**7,803,790**
DDGS Production[2]	mil. s. tons	19	30	39	43	46	50	53	55	58	61	63
Exports	mil. s. tons	1.9	3.0	3.9	4.3	4.6	5.0	5.3	5.5	5.8	6.1	6.3
DDGS Transportation												
Rail (Class I)	carloads	**26,338**	**41,650**	**53,971**	**60,061**	**64,907**	**69,350**	**73,607**	**77,583**	**81,436**	**85,164**	**88,768**
Barge	bargeloads	**251**	**397**	**514**	**572**	**618**	**660**	**701**	**739**	**776**	**811**	**845**
Truck	truckloads	**647,000**	**1,023,162**	**1,325,837**	**1,475,429**	**1,594,493**	**1,703,635**	**1,808,197**	**1,905,890**	**2,000,530**	**2,092,118**	**2,180,652**
Soybean Use	mbu	**3,041**	**2,984**	**2,969**	**2,859**	**2,864**	**2,892**	**2,900**	**2,920**	**2,923**	**2,974**	**2,920**
Crush	mbu	1,780	1,800	1,868	1,893	1,909	1,935	1,951	1,970	1,979	2,009	2,000
Seed and residual	mbu	171	164	142	144	145	145	148	147	149	147	152
Domestic Use	mbu	1,951	1,964	2,010	2,037	2,054	2,079	2,100	2,117	2,128	2,155	2,152
Exports	mbu	1,090	1,020	959	822	810	813	800	803	795	819	768
Soybean Transportation												
Rail (Class I)	carloads	**195,074**	**188,869**	**185,064**	**172,980**	**172,563**	**173,978**	**173,745**	**174,766**	**174,483**	**178,041**	**172,984**
Barge	bargeloads	**13,364**	**12,585**	**11,928**	**10,401**	**10,273**	**10,320**	**10,195**	**10,230**	**10,148**	**10,431**	**9,860**
Truck	truckloads	**1,820,451**	**1,826,637**	**1,862,831**	**1,876,680**	**1,890,727**	**1,913,147**	**1,930,578**	**1,946,413**	**1,955,087**	**1,981,343**	**1,974,803**
Wheat Use	mbu	**2,050**	**2,241**	**2,245**	**2,264**	**2,291**	**2,290**	**2,308**	**2,316**	**2,323**	**2,333**	**2,341**
Food	mbu	925	930	936	941	946	951	956	961	966	971	975
Seed	mbu	81	81	81	79	79	79	79	79	79	79	80
Feed & residual	mbu	134	180	289	310	314	290	285	270	257	238	234
Domestic Use	mbu	1,140	1,191	1,305	1,330	1,340	1,320	1,320	1,310	1,302	1,288	1,289
Exports	mbu	910	1,050	940	934	952	970	987	1,006	1,021	1,045	1,052
Wheat Transportation												
Rail (Class I)	carloads	**315,600**	**346,740**	**343,798**	**346,369**	**350,695**	**351,056**	**354,087**	**355,852**	**357,247**	**359,505**	**360,807**
Barge	bargeloads	**6,240**	**7,200**	**6,446**	**6,404**	**6,526**	**6,651**	**6,769**	**6,896**	**6,999**	**7,167**	**7,212**
Truck	truckloads	**666,374**	**700,549**	**758,193**	**772,057**	**777,847**	**767,872**	**768,930**	**764,167**	**760,210**	**753,692**	**754,674**
Sorghum Use		**305**	**445**	**333**	**335**	**345**	**348**	**353**	**357**	**359**	**360**	**358**
Feed & residual	mbu	110	180	123	120	125	125	125	125	125	120	120
Food, seed, & industrial	mbu	45	65	50	50	50	50	50	50	50	50	50
Domestic Use	mbu	155	245	173	170	175	175	175	175	175	170	170
Exports	mbu	150	200	161	165	170	173	178	182	184	190	188
Sorghum Transportation												
Rail (Class I)	carloads	**25,000**	**34,429**	**26,986**	**27,535**	**28,303**	**28,771**	**29,360**	**29,925**	**30,275**	**30,899**	**30,697**
Barge	bargeloads	**571**	**762**	**613**	**630**	**647**	**660**	**677**	**692**	**702**	**723**	**718**
Truck	truckloads	**206,044**	**312,637**	**227,212**	**226,280**	**232,829**	**234,028**	**235,539**	**236,987**	**237,885**	**234,906**	**234,387**
Barley Use		**231**	**235**	**223**	**218**	**223**	**222**	**222**	**226**	**226**	**225**	**230**
Feed & residual	mbu	55	60	50	45	50	50	50	55	55	55	60
Food, seed, & industrial	mbu	156	155	154	153	153	152	152	151	151	150	150
Domestic Use	mbu	211	215	203	198	203	202	202	206	206	205	210
Exports	mbu	20	20	20	20	20	20	20	20	20	20	20
Barley Transportation												
Rail (Class I)	carloads	**34,574**	**35,157**	**33,477**	**32,686**	**33,442**	**33,318**	**33,197**	**33,785**	**33,833**	**33,664**	**34,372**
Barge	bargeloads											
Truck	truckloads	**118,549**	**120,659**	**114,577**	**111,713**	**114,452**	**114,001**	**113,563**	**115,692**	**115,865**	**115,253**	**117,816**

*See Transportation Assumptions in the Summary of Transportation Requirements Table 6, Appendix I; USDA Long-term Projections Report, OCE-2007-1, February 2007.

Units: mg=million gallons; mbu=million bushels; mil. s. tons=million short tons.

[1]USDA, World Agricultural Supply and Demand Estimates (WASDE), August 10, 2007.

[2]DDGS yield = 17.5 lbs/bushel of corn used in ethanol production.

Table 4: Summary of Transportation Requirements for the Baseline Scenario[1]

		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Rail (Grain, Ethanol and DDGS)	carloads	**1,540,947**	**1,673,775**	**1,659,951**	**1,662,955**	**1,687,186**	**1,704,991**	**1,722,921**	**1,740,590**	**1,758,209**	**1,775,935**	**1,791,879**
Grain		1,395,263	1,441,309	1,406,463	1,395,589	1,412,880	1,425,480	1,438,206	1,452,406	1,466,554	1,480,811	1,493,286
Corn		823,357	836,114	816,543	814,143	824,243	834,200	842,014	851,900	861,786	872,114	879,786
Soybeans		196,731	188,869	187,223	175,389	176,577	178,434	179,760	181,160	183,091	184,977	186,166
Wheat		315,600	346,740	344,297	347,657	352,643	353,429	357,014	359,200	361,386	363,571	366,457
Sorghum		25,000	34,429	25,429	25,429	25,571	25,571	25,571	25,571	25,571	25,429	25,429
Barley		34,574	35,157	32,971	32,971	33,846	33,846	33,846	34,574	34,720	34,720	35,449
Ethanol		119,347	190,816	208,163	219,592	225,306	229,592	233,878	236,735	239,592	242,449	245,306
DDGS		26,338	41,650	45,325	47,775	49,000	49,919	50,838	51,450	52,063	52,675	53,288
Barge	bargeloads	**51,641**	**53,392**	**48,433**	**47,052**	**48,291**	**49,571**	**50,471**	**51,414**	**52,414**	**53,416**	**54,297**
Grain		50,462	51,511	46,382	44,889	46,072	47,310	48,168	49,083	50,055	51,029	51,882
Ethanol		928	1,484	1,619	1,708	1,752	1,786	1,819	1,841	1,863	1,886	1,908
DDGS		251	397	432	455	467	475	484	490	496	502	508
Truck	truckloads	**11,946,255**	**14,323,147**	**14,883,041**	**15,238,073**	**15,478,967**	**15,654,619**	**15,839,436**	**15,987,581**	**16,134,891**	**16,279,520**	**16,416,962**
Grain		11,079,956	12,949,360	13,387,100	13,660,946	13,861,247	14,006,455	14,160,827	14,288,675	14,415,689	14,540,021	14,657,166
Ethanol		219,300	350,625	382,500	403,500	414,000	421,875	429,750	435,000	440,250	445,500	450,750
DDGS		647,000	1,023,162	1,113,441	1,173,627	1,203,720	1,226,290	1,248,860	1,263,906	1,278,953	1,293,999	1,309,046

[1]**Transportation Mode Assumptions, Grain (2000-2004 average):**

	Corn	Soybeans	Wheat	Sorghum	Barley
Exports					
Rail	30%	34%	60%	48%	67%
Barge	68%	59%	36%	20%	--
Truck	2%	7%	4%	32%	33%
Domestic					
Rail	31%	16%	49%	10%	51%
Barge	2%	3%	--	--	--
Truck	67%	81%	50%	90%	48%

Source: Transportation of U.S. Grains: A Modal Share Analysis, 1978-2004. October 2006, USDA/AMS/TSB

[1]**Transportation Mode Assumptions--Ethanol, Feedstock, DDGS:**

	Ethanol in 2005	Feedstock (corn)	DDGS
Rail	60%	2%	14%
Barge	10%	--	2%
Truck	30%	98%	86%

Sources: AAR, Army Corps of Engineers, Commodity Freight Statistics, TSB estimates.

Capacity (units)	Railcar	Barge	Truck
Grain (bushels)	3,500	52,500	910
Ethanol (gallons)	29,400	630,000	8,000
DDGS (tons)	100	1,500	25

Table 5: Summary of Transportation Requirements for the 15-bgy Scenario[1]

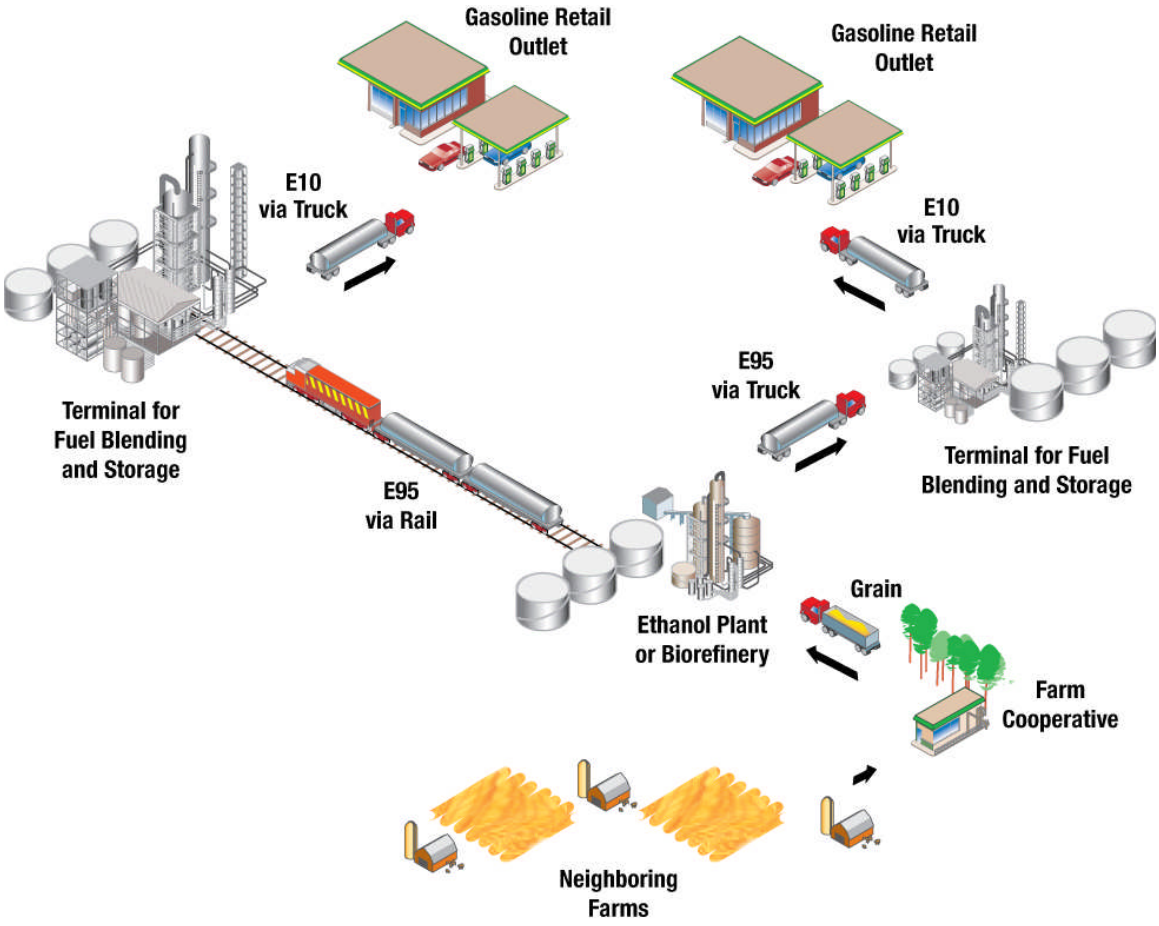
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Rail Total	carloads	**1,539,290**	**1,673,775**	**1,647,285**	**1,689,321**	**1,737,297**	**1,775,689**	**1,812,039**	**1,844,120**	**1,874,845**	**1,904,634**	**1,932,850**
Grain		1,393,606	1,441,309	1,369,997	1,390,367	1,423,634	1,449,578	1,474,523	1,496,764	1,518,346	1,539,687	1,560,152
Corn		823,357	836,114	783,462	812,189	839,021	862,219	882,866	900,662	918,501	935,696	952,012
Soybeans		195,074	188,869	186,105	174,425	174,901	176,790	177,455	178,989	180,338	182,444	183,100
Wheat		315,600	346,740	344,033	346,963	351,669	352,299	355,672	357,719	359,699	361,781	364,430
Sorghum		25,000	34,429	26,109	26,460	26,843	27,010	27,270	27,342	27,614	27,523	27,653
Barley		34,574	35,157	30,289	30,330	31,201	31,261	31,260	32,053	32,194	32,243	32,957
Ethanol		119,347	190,816	227,755	245,551	257,633	267,857	277,224	285,306	292,816	299,755	306,122
DDGS		26,338	41,650	49,533	53,403	56,030	58,254	60,291	62,049	63,682	65,191	66,576
Barge Total	bargeloads	**51,520**	**53,392**	**47,676**	**46,229**	**47,389**	**48,567**	**49,403**	**50,241**	**51,184**	**52,120**	**52,983**
Grain		50,341	51,511	45,433	43,811	44,852	45,929	46,673	47,431	48,300	49,168	49,968
Ethanol		928	1,484	1,771	1,910	2,004	2,083	2,156	2,219	2,277	2,331	2,381
DDGS		251	397	472	509	534	555	574	591	606	621	634
Truck Total	truckloads	**11,932,134**	**14,323,147**	**15,240,308**	**16,074,384**	**16,661,012**	**17,145,105**	**17,602,654**	**17,992,432**	**18,357,855**	**18,698,300**	**19,020,350**
Grain		11,065,835	12,949,360	13,605,004	14,311,304	14,811,184	15,221,865	15,612,155	15,943,906	16,255,405	16,546,029	16,822,361
Ethanol		219,300	350,625	418,500	451,200	473,400	492,188	509,400	524,250	538,050	550,800	562,500
DDGS		647,000	1,023,162	1,216,804	1,311,880	1,376,428	1,431,053	1,481,099	1,524,276	1,564,400	1,601,471	1,635,489

Table 6: Summary of Transportation Requirements for the 20-bgy Scenario[1].

		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Rail Total Carloads	carloads	**1,539,290**	**1,673,775**	**1,673,900**	**1,679,339**	**1,708,312**	**1,730,516**	**1,753,544**	**1,772,071**	**1,800,410**	**1,808,849**	**1,854,355**
Grain		1,393,606	1,441,309	1,371,766	1,343,115	1,344,955	1,342,289	1,341,488	1,337,753	1,344,525	1,332,093	1,357,424
Corn		823,357	836,114	782,440	763,545	759,952	755,166	751,099	743,426	748,687	729,983	758,564
Soybeans		195,074	188,869	185,064	172,980	172,563	173,978	173,745	174,766	174,483	178,041	172,984
Wheat		315,600	346,740	343,798	346,369	350,695	351,056	354,087	355,852	357,247	359,505	360,807
Sorghum		25,000	34,429	26,986	27,535	28,303	28,771	29,360	29,925	30,275	30,899	30,697
Barley		34,574	35,157	33,477	32,686	33,442	33,318	33,197	33,785	33,833	33,664	34,372
Ethanol		119,347	190,816	248,163	276,163	298,449	318,878	338,449	356,735	374,449	391,592	408,163
DDGS		26,338	41,650	53,971	60,061	64,907	69,350	73,607	77,583	81,436	85,164	88,768
Barge Total Bargeloads	bargeloads	**51,520**	**53,392**	**47,080**	**45,122**	**45,873**	**46,628**	**47,079**	**47,272**	**48,328**	**47,862**	**50,293**
Grain		50,341	51,511	44,635	42,402	42,933	43,488	43,746	43,758	44,640	44,006	46,273
Ethanol		928	1,484	1,930	2,148	2,321	2,480	2,632	2,775	2,912	3,046	3,175
DDGS		251	397	514	572	618	660	701	739	776	811	845
Truck Total Truckloads	truckloads	**11,932,134**	**14,323,147**	**15,909,526**	**16,674,227**	**17,332,492**	**17,915,410**	**18,491,119**	**19,014,100**	**19,565,318**	**20,011,768**	**20,610,841**
Grain		11,065,835	12,949,360	14,127,689	14,691,348	15,189,599	15,625,838	16,061,022	16,452,710	16,876,738	17,200,100	17,680,189
Ethanol		219,300	350,625	456,000	507,450	548,400	585,938	621,900	655,500	688,050	719,550	750,000
DDGS		647,000	1,023,162	1,325,837	1,475,429	1,594,493	1,703,635	1,808,197	1,905,890	2,000,530	2,092,118	2,180,652

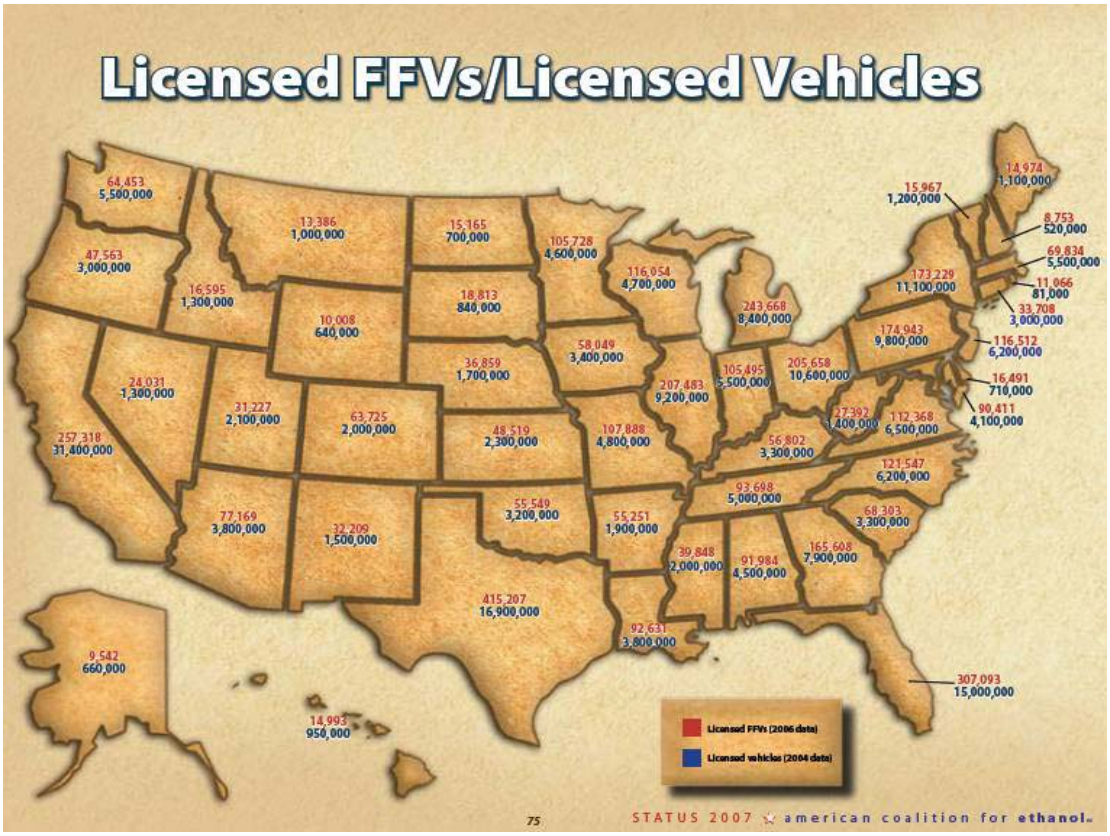
Appendix II – Illustrations

1. Rail and Truck Ethanol Distribution System



Source: National Bioenergy Center, National Renewable Energy Laboratory; E95 is Fuel Ethanol (200-proof alcohol denatured with 5 percent natural gasoline.)

2. Flex-Fuel Vehicles in the United States



E85 Stations by State, as of July 31, 2007

STATE	E85	STATE	E85
Alabama	2	**Mississippi**	1
Alaska	0	**Missouri**	59
Arizona	9	**New Jersey**	0
Arkansas	4	**New Mexico**	6
California	4	**New York**	6
Colorado	26	**North Carolina**	9
Connecticut	0	**North Dakota**	24
Delaware	1	**Ohio**	34
DC	3	**Oklahoma**	1
Florida	10	**Oregon**	5
Georgia	9	**Pennsylvania**	11
Hawaii	0	**Rhode Island**	0
Idaho	3	**South Carolina**	46
Illinois	146	**South Dakota**	58
Indiana	84	**Tennessee**	9
Iowa	68	**Texas**	29
Kansas	15	**Utah**	4
Kentucky	7	**Vermont**	0
Louisiana	0	**Virginia**	5
Maine	0	**Washington**	6
Maryland	7	**West Virginia**	2
Massachusetts	0	**Wisconsin**	60
Michigan	44	**Wyoming**	6
Minnesota	306	**U.S. Total**	1166

Source: State data as of July 31, 2007:
http://www.eere.energy.gov/afdc/infrastructure/station_maps.h

3. Freight Specs by Mode

a) Rail Tank Car – typically 30,000 gallons, AAR type T108.

Example:

PLCX 129025 is a non-insulated tank without coils. This is the type of tank that usually carries alcohol, methanol and related products. This has a 29,815 gallon capacity. It was built in October 1987 by Trinity Industries (File # 8725). DOT class 111A100W1. AAR car type code T108. External length 67'11".

Source: Freight Cars Journal

b) Tanker Truck – 8,000 gallons

c) Tank barge – 1 million gallons (23,900 barrels)

Inland Liquid Cargo Tank Barge

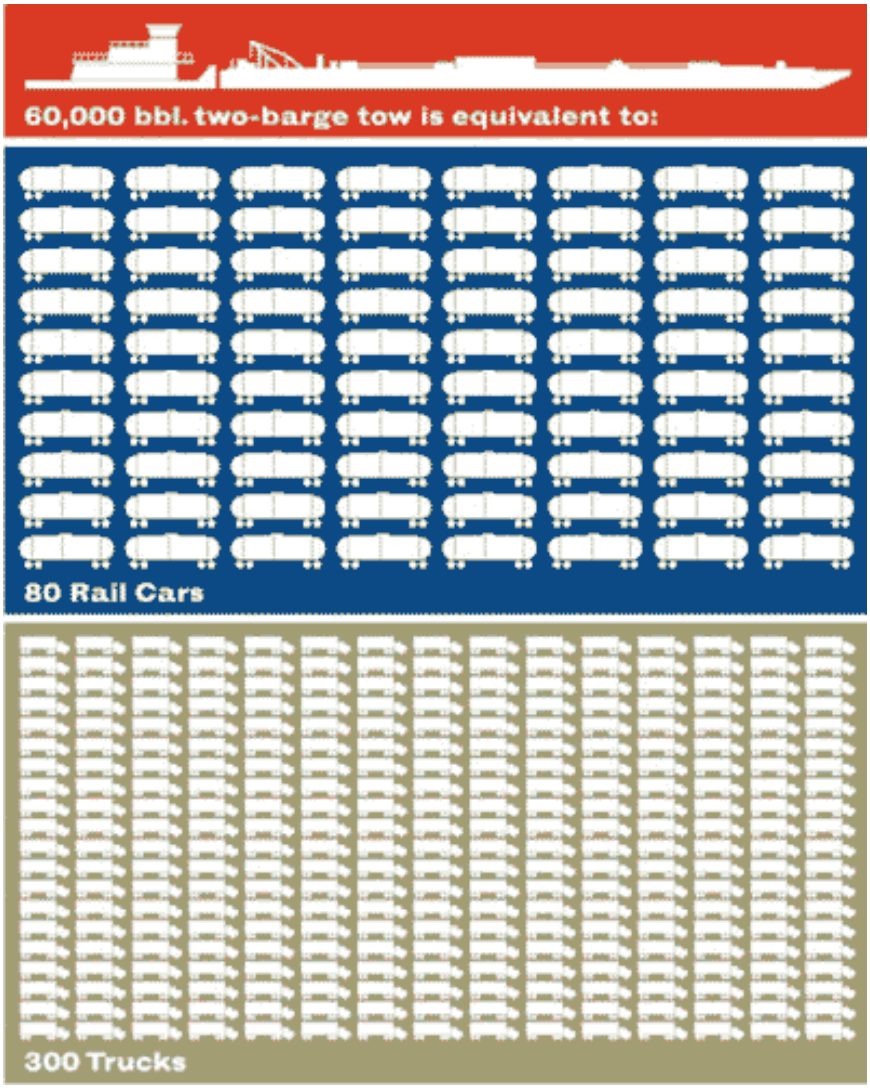
Kirby Corp. – 2-barge tow capacity 60,000 barrels, 2.52 million gallons, 1 barge – 1.26 mill. gal.
http://www.kirbycorp.com/corp/history.cfm

d) **5161-Cubic Foot Covered Hopper**

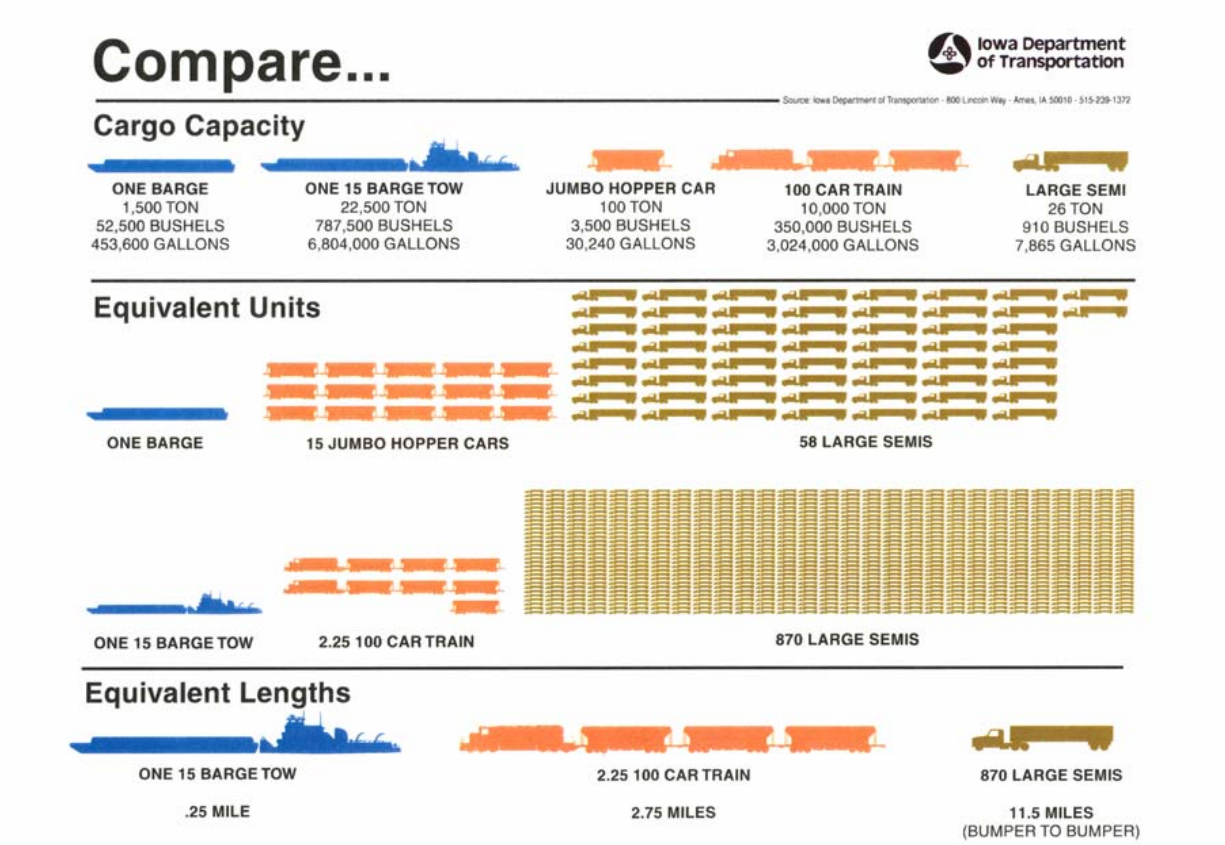
This 286,000 lb. gross rail load covered hopper has standard 24-inch continuous trough hatch and standard 30-inch by 30-inch discharge outlets. A wide assortment of options is available including a variety of hatch and gate configurations as well as interior lining if required.

http://www.trinityrail.com/railcars/hopper/pdfs/hopper_5161.pdf

4. a. Ethanol Cargo Capacity Comparison



4. b. Grain Cargo Capacity Comparison



Resources and Links

Grain Transportation Report – Weekly developments affecting the transport of grain in the domestic and international marketplace. *www.ams.usda.gov/tmdtsb/grain/*

National Weekly Ethanol Summary – Weekly spot prices for ethanol and distillers' grains. *http://www.ams.usda.gov/lsmnpubs/PDF_Weekly/Ethanol.pdf* (PDF)

Market News Reports Portal – Searchable database of prices for various commodities at many locations. *http://marketnews.usda.gov/portal/lg*

USDA Baseline Projections – Long-term projections of many commodities. *http://www.usda.gov/oce/commodity/ag_baseline.htm*

USDA Economic Research Service Briefing Room – In-depth analyses of economic issues in agriculture. *http://www.ers.usda.gov/Briefing/*

USDA Economic Research Service – ***Ethanol Expansion in the United States. How Will the Agricultural Sector Adjust?*** *May* 2007. *http://www.ers.usda.gov/Publications/FDS/2007/05May/FDS07D01/fds07D01.pdf* (PDF)

Feed Grains Backgrounder – An overview of the current and projected situation for U.S. feed grains. *http://www.ers.usda.gov/Publications/FDS/2007/03Mar/FDS07C01/*

Feed Grains Database – A queriable database that contains monthly, quarterly, and annual data on prices, supply, and use of corn and other feed grains, including data published in the monthly *Feed Outlook* and the annual *Feed Yearbook* reports. *www.ers.usda.gov/data/feedgrains/*

Ethanol Facts: Food vs. Fuel – the Renewable Fuels Association provides a perspective on the issue. *http://www.ethanolrfa.org/resource/facts/food/*

Review of Transportation Issues and Comparison of Infrastructure Costs for a Renewable Fuels Standard – Report from DOE's Energy Information Administration. *http://www.eia.doe.gov/oiaf/servicerpt/fuel/rfs.html*

Alternative Fuels Data Center – A portal to information about alternative fuels and vehicles from DOE. *http://www.eere.energy.gov/afdc/*

Iowa State University CARD – Locations of ethanol plants in the United States *http://www.card.iastate.edu/research/bio/tools/ethanol.aspx*

Potential Infrastructure Constraints on Ethanol Production in Iowa – From Iowa State. *http://www.extension.iastate.edu/ag/GinderPresent.indd.pdf (PDF)*

Railroads: BNSF, *www.bnsf.com*;
CSX, *www.csx.com*;
CN, *http://www.cn.ca/productsservices/grain/resource_centre/Ethanol/en_ethanol.shtml*
Norfolk Southern Corporation,
http://www.nscorp.com/nscportal/nscorp/Customers/Industrial%20Products/Agriculture/
Union Pacific, *http://www.uprr.com/customers/ag-prod/ethanol.shtml*

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