

## Trends in U.S. Fuel Ethanol Production Capacity: 2005-2009

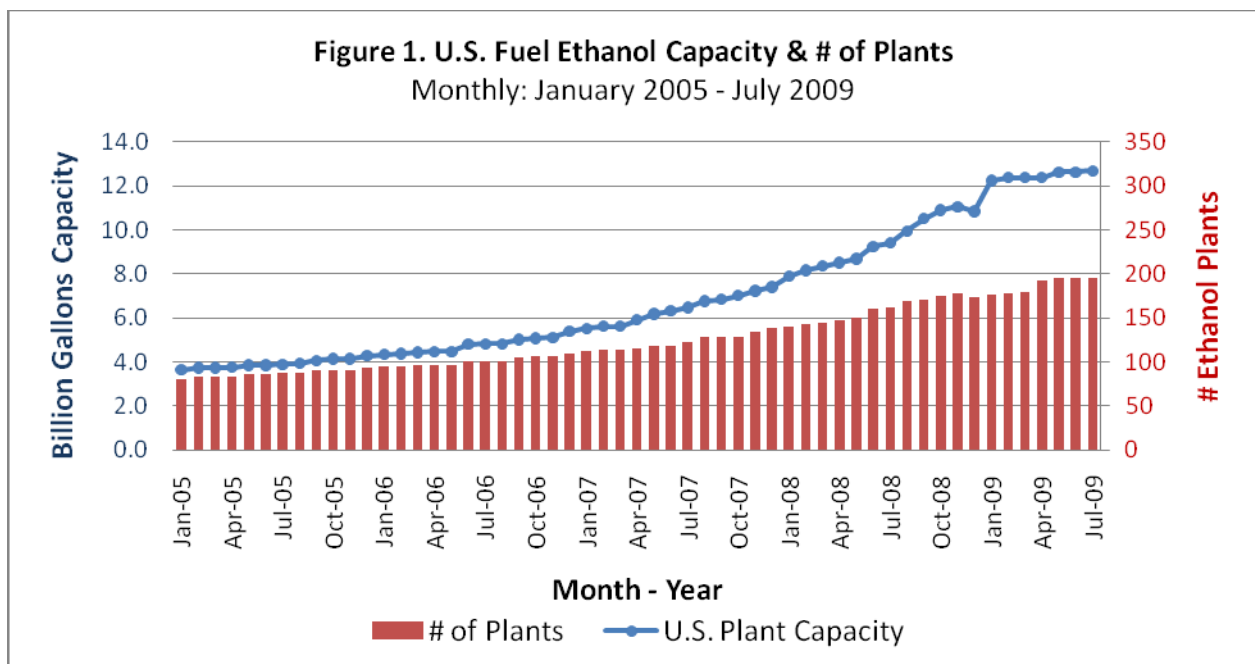
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Since early 2005 the fuel ethanol industry in the United States has gone through a period of expanding capacity which only began slowing in late 2008 – early 2009. Several factors provided the impetus for this ethanol industry expansion, including U.S. government support for blending ethanol with gasoline, adherence by the U.S. gasoline industry to renewable fuels standard requirements, protective ethanol import tariffs, and favorable relationships between the prices of blended fuels (including ethanol products) and ethanol feedstock (i.e., feedgrains) during the 2005 through mid 2008 period. The trend in ethanol plant expansion leveled off in early 2009 because of declining ethanol profitability and due to expansion of U.S. ethanol production to levels approaching the U.S. government's renewable fuels standard mandate in year 2015 of 15 billion gallons.

This article examines the growth of the U.S. fuel ethanol industry from January 2005 through July 2009 using data collected on a monthly basis from the Renewable Fuels Association by the state of Nebraska ([www.neo.ne.gov/statshtml](http://www.neo.ne.gov/statshtml)). This article's focus is on growth in plant numbers, of nameplate plant capacity in production and planned, and growth in estimated feedgrain use needed to supply these ethanol plants.

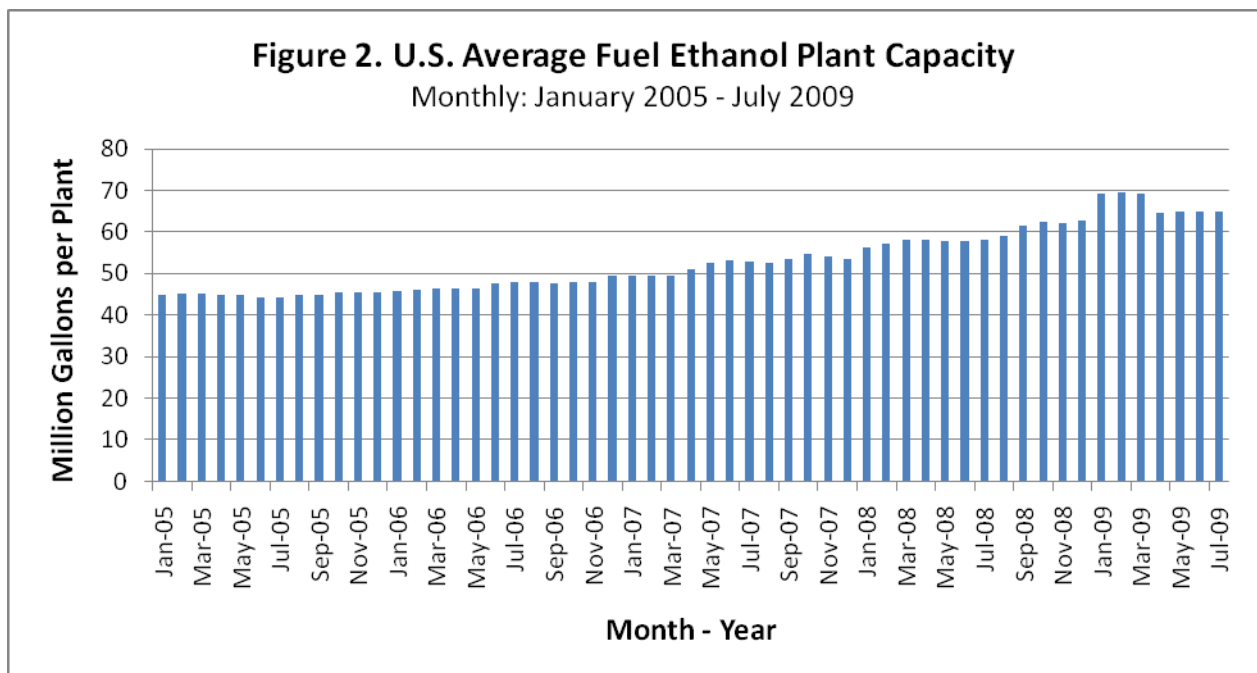
### Trends in Plant Capacity and Number of Plants

Total nameplate production capacity for United States ethanol plants grew from 3.64 to 12.7 billion gallons from January 2005 through July 2009, an increase of nearly 250% (averaging of 4.6% growth per month) (Figure 1).



After increasing to 12.25 billion gallons in January 2009, the rate of expansion in ethanol production capacity slowed considerably, averaging less than 1% (0.6%) per month.

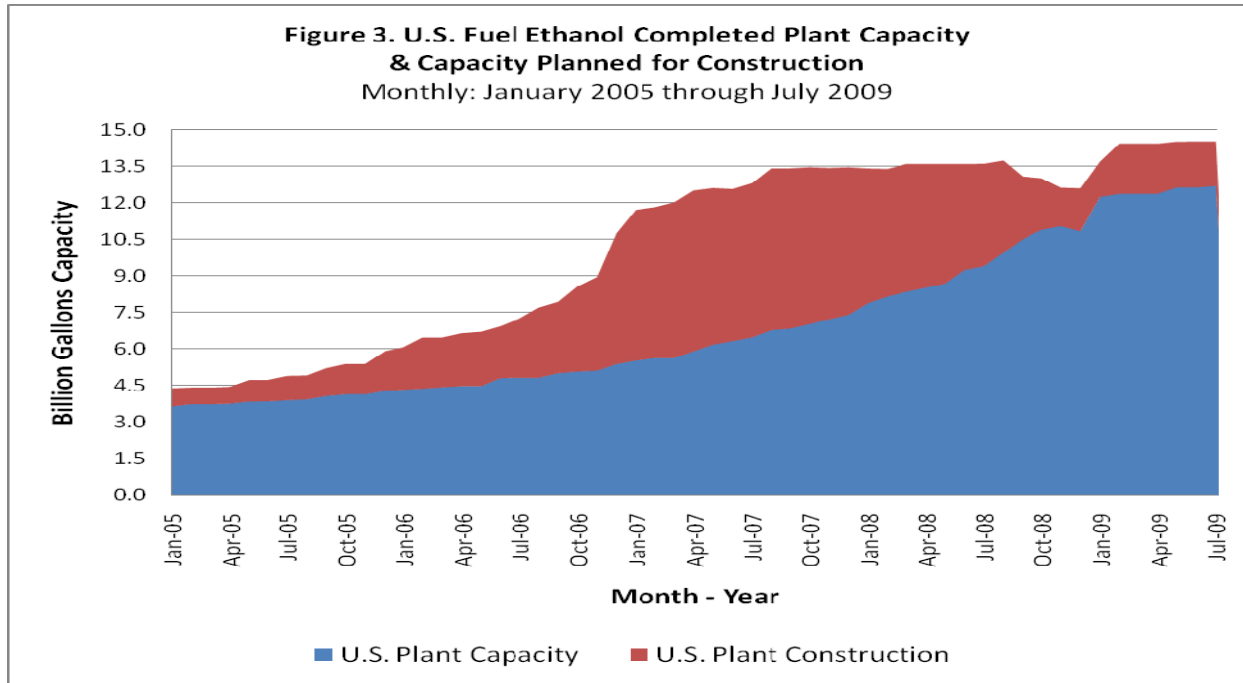
The expansion in the number of U.S. ethanol plants had been steady throughout the 2005-2009 period until December 2008. Challenging economic conditions in the U.S. ethanol industry both leading into and during the December 2008 through March 2009 period lead to a number of either temporary or permanent ethanol plant closures. A return to earlier trends in plant number resumed beginning in April 2009 (Figure 1). The average nameplate capacity of on-line U.S. ethanol plants has steadily increased from approximately 45 million gallons per plant in year 2005 to 65 to 70 million gallons per plant during January – July 2009. A short term spike in average nameplate ethanol plant capacity occurred during January – March 2009, likely due to the dynamics of ethanol plant closures, the opening of new plants, etc. (Figure 2).



**Trends in Planned Ethanol Plant Construction**

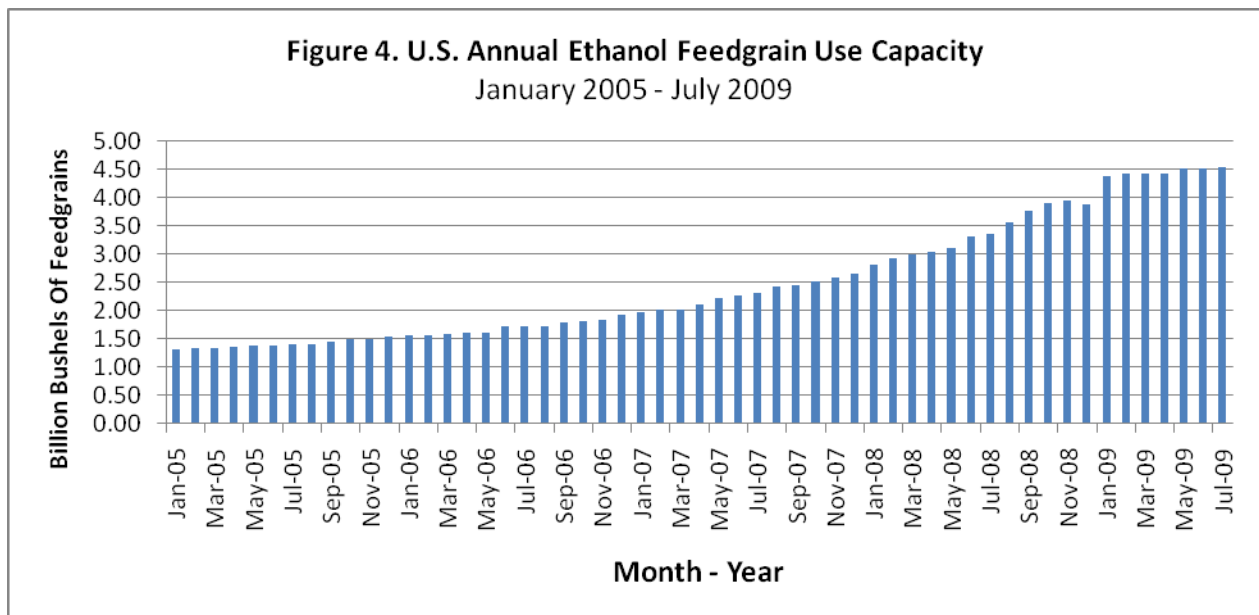
The total amount of existing and planned U.S. ethanol industry production capacity never exceeded the 2015 renewable fuels standard goal of 15 billion gallons (Figure 3). In fact, the amount of the renewable fuels standard is calculated by the U.S. government on a linearly trending basis from the current time to year 2015. It is likely that that the sum of total ethanol production capacity both in place (i.e., already built) and the amount planned (i.e., intended to be built) was somewhat close to the linear trending U.S. renewable fuels standard at that time. The lower level of total existing and planned ethanol production capacity that occurred in late 2008 – early 2009 was likely due to changing expectations and prospects for profitability in the ethanol industry during that time. Since February 2009, total built and planned U.S. ethanol

production capacity has stayed in the range of 14.4 to 14.6 billion gallons, below the renewable fuels standard of 15.0 billion gallons by 2015.



### Total U.S. Feedgrain Use for Fuel Ethanol

U.S. usage of corn or grain sorghum (i.e., feedgrains) as feedstock for fuel ethanol has increased in a manner mirroring the development of U.S. ethanol production (Figure 4).



Assuming that 1 bushel of corn or grain sorghum produces 2.8 gallons of ethanol, the amount of feedgrains needed to keep U.S. ethanol plants running at 100% capacity increased from 1.3 billion bushels in January 2005 to 4.535 billion bushels in July 2009. If expansion of U.S. ethanol production remains at or slightly below the 15 billion gallon fuel standard and the efficiency of converting feedgrains to ethanol remains the same, then U.S. feedgrain use (both corn and grain sorghum together) would be approximately 4.5+ billion bushels.

### Trends in Plant Capacity and Plant Numbers by State

Trends by state in ethanol plant capacity (Figure 5) and plant numbers (Figure 6) mirror those for the overall United States. As of July 2009, the top 9 rated states in terms of ethanol plant capacity, with number of plants and average plant capacity listed are as follows (Table 1):

**Table 1. State Level Ethanol Production Capacity, # of Plants, and Average Capacity per Plant**

1) Iowa	3.286 bln. gl. ethanol,	40 plants,	82 mln. gl. / plant
2) Nebraska	1.523 bln. gl. ethanol,	25 plants,	61 mln. gl. / plant
3) Illinois	1.183 bln. gl. ethanol,	10 plants,	118 mln. gl. / plant
4) Minnesota	1.082 bln. gl. ethanol,	21 plants,	52 mln. gl. / plant
5) South Dakota	1.016 bln. gl. ethanol,	15 plants,	68 mln. gl. / plant
6) Indiana	908 mln. gl. ethanol,	11 plants,	83 mln. gl. / plant
7) Wisconsin	498 mln. gl. ethanol,	9 plants,	55 mln. gl. / plant
8) Kansas	492 mln. gl. ethanol,	12 plants,	41 mln. gl. / plant
9) Ohio	470 mln. gl. ethanol,	6 plants,	78 mln. gl. / plant
10) Other States	2.596 bln. gl. ethanol,	48 plants,	45 mln. gl. / plant

As of July 2009 Iowa had the largest share of U.S. ethanol production capacity (3.286 out of 12.698 billion bushels or 26%) and the most plants (40 out of 197 plants) of any state. Nebraska, Illinois, Minnesota, South Dakota and Indiana followed Iowa in terms of plant capacity with a range of 908 million to 1.523 billion gallons per state. In terms of number of plants, Nebraska (25), Minnesota (21), South Dakota (15), Kansas (12), Indiana (11), Illinois (10), and Wisconsin (9) followed Iowa.

Average plant capacity was largest in Illinois (118 mln. gl.), Indiana (83 mln. gl.) and Iowa (82 mln. gl.), but smallest in Kansas (41 mln. gl.), and in the other states not specifically identified in Table 1 (45 mln. gl.). These trends in the location of ethanol plants and their production capacity likely reflect both local and state feedgrain production capability as well as whether or not ethanol plants in a particular state were built earlier in the construction rush for ethanol plants (pre 2006) when smaller (30 – 40 mln. gl.) ethanol plant capacities were more common.

Figures 5 and 6 indicate that over time a greater proportion of ethanol production capacity and plants has been built outside of the Corn Belt region where the 9 largest ethanol producing states are located. The proportion of ethanol production capacity in the U.S. located outside of these three primary states is sizable (2.596 out of 12.698 billion bushels), and would be ranked



## **Summary**

Trends in U.S. ethanol plant capacity are reflecting a leveling off of expansion in 2009 after a period of rapid, strong growth from early 2005 through late 2008. Future expansion in ethanol production capacity will likely depend on the role of and support for fuel ethanol in U.S. energy and environmental policy the future. Absent an increase in renewable fuels standard or the approval of an increase in the proportion of ethanol that can be blended into gasoline, further expansion of ethanol capacity and implicitly feedgrain usage by ethanol may be limited.