

Appendix C. Updates to Reference Case

The following list identifies the enhancements made to the *AEO2007* reference in the preparation of the reference case for this analysis.

Macroeconomic Changes from *AEO2007* Reference Case

- Ethanol was included in the transportation fuels as input to the Global Insight macroeconomic model because of its magnitude.

Petroleum Market Model Changes from *AEO2007* Reference Case

- Added an improved representation of international ethanol import supply as a function of price.
- Updated the cellulose ethanol representation from a simple input supply curve to a merchant plant representation that incorporates capital investment and production decision making as well as technology learning.
- Updated the biodiesel representation to a merchant plant representation and added the ability to process animal fats.
- Incorporated the flexibility to choose between imports of petroleum gasoline or gasoline blending components.
- Increased the ethanol blending percentage in non-California reformulated and oxygenated gasoline to 10 percent. The change represents a recent EIA reassessment of the market.
- Lowered the DDGS netback price for ethanol production whenever corn-ethanol production exceeds 18 billion gallons.
- Adjusted maximum build rates for ethanol plants consistent with current market investment trends.

The *AEO2007* analysis assumed that the maximum ethanol import quantity that would be available at any price through the entire projection horizon would be about 900 million gallons per year. A review of a recent study for potential Brazilian ethanol production and exports to the U.S. through 2012 provided new data points through which simple exponential supply curves were estimated by year.³⁵ Whether the levels of ethanol supply from Brazil to the United States will increase as assumed by these curves will depend critically on the level of investments made in Brazil to expand their sugar cane crop production and ethanol conversion facilities and the competition for the ethanol from the rest of the world.

The study cited above claims that there are over 90 million hectares (over 200 million acres) of cleared but idle, non-environmentally sensitive, land available for development of ethanol production. If the land was aggressively developed for sugar cane production,

³⁵University of Campinas, Sao Paulo, Brazil, *Study of the Possibilities and Impacts of the Production of Large Quantities of Ethanol with the Aim to Partially Replace Gasoline in the World*.

Brazilian ethanol production could grow to over 50 billion gallons per year. Large-scale investments for plant and infrastructure, estimated to be between \$150 billion to \$250 billion dollars, would be required to build roads, purchase farming equipment, expand the ethanol transportation infrastructure, build new conversion plant facilities, and provide for port and ship expansions. One of the scenarios addressed in this analysis, the Low Import Cost Case assumes that such investments are made for Brazilian ethanol development.

Renewable Market Model Changes from *AEO2007* Reference Case

- Added offshore wind technology as a capacity expansion option in selected coastal regions, with revised cost and performance estimates.
- Updated corn and biomass feedstock costs consistent with University of Tennessee POLYSYS study.

EIA's estimates of biomass supply curves were taken from the U.S. Department of Agriculture's latest estimates through 2015, which were developed under contract with Dr. Ugarte at the University of Tennessee using an integrated land and crop competition model. EIA contracted with Dr. Ugarte to extend these curves through 2030. The corn supply curves also were developed using POLYSYS and were generally higher-priced than those in *AEO2007* for the same level of demand; however, the maximum availability of corn supply in the new estimate is much larger than the *AEO2007* Reference Case and allows for corn imports when corn prices and demand are sufficiently high. In addition to the Reference Case, a High Yield Case was constructed to evaluate the impact of potentially higher biomass crop yields. Similar to the reference case, the biomass supply curves through 2015 were obtained from the USDA and extended through 2030 by Dr. Ugarte under contract to the EIA.

Electricity Market Models Changes from *AEO2007* Reference Case

- Modified the interregional transmission cost structure to allow renewable capacity additions from one region to serve adjacent regions, with higher associated transmission costs.
- Improved the representation of competition for biomass for electricity generation and cellulosic ethanol production.
- Added offshore wind technology as a capacity expansion option in selected coastal regions, with revised cost and performance estimates.