Appendix B. Key Updates and Changes to the *AEO2007* Reference Case Assumptions

The following list identifies the changes that were made to the *AEO2007* version of the NEMS models, input assumptions, and policy assumptions to allow analysis of the proposed Policy.

Macroeconomic Changes from *AEO2007* Reference Case

- The 51-cent-per-gallon subsidy on ethanol was allowed to expire as stated in current U.S. law.
- Ethanol was included in the transportation fuels as input to the Global Insight macroeconomic model because of its magnitude.
- For the Policy cases, the producer price index for farm products was increased by 50 percent of the corn price increase derived from the renewables module. Grains, livestock, poultry, eggs, and dairy constitute 90 percent of the producer price index for farm products. On a wholesale level, this assumes that 60 percent of the corn price increase was passed on for the above mentioned categories.
- Ethanol imports were included in non-petroleum industrial supplies and materials imports in the Global Insight macroeconomic model.

Petroleum Market Module Changes from *AEO2007* Reference Case

- The 51-cent-per-gallon blenders' subsidy on ethanol and the 54-cent import tariff were allowed to expire simultaneously in 2010, approximating current U.S. law.
- While the blenders' tax credit is set to expire 1 year after the ethanol import tariff, both laws were assumed to expire in the same year to preserve the intent of the requested analysis.
- 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.
- Added totally new logic to represent the demand for E85 as function of price and a number of other key consumer preferences within the Petroleum Market Module to represent producer and consumer behavior in an RFS policy. The new formulation was necessary to ensure and accelerate convergence of demand and prices in the RFS case.

- Incorporated the flexibility to choose between imports of petroleum gasoline and 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. The change, while critical in the Policy cases, has little influence on the reference or high price cases of *AEO2007*.

- Added logic to implement EPACT2005 Provision 942 (Cellulosic Biofuel Production Incentives) in the Policy cases. The extension allows for further support for cellulosic ethanol if prices are expected to be economic sooner in the time horizon through an RFS.

- 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 United States through 2012 provided new data points through which simple exponential supply curves were estimated by year.[36] 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 sugar cane crop production and ethanol conversion facilities and the competition for the ethanol from the rest of the world. The removal of the import tariff combined with the new ethanol import supply curves results in ethanol imports that are three times larger than in the *AEO2007* reference case.

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 were aggressively developed for sugar cane production, 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-Cost Ethanol Imports Case assumes that such investments are made for Brazilian ethanol development.

[36]University 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.*

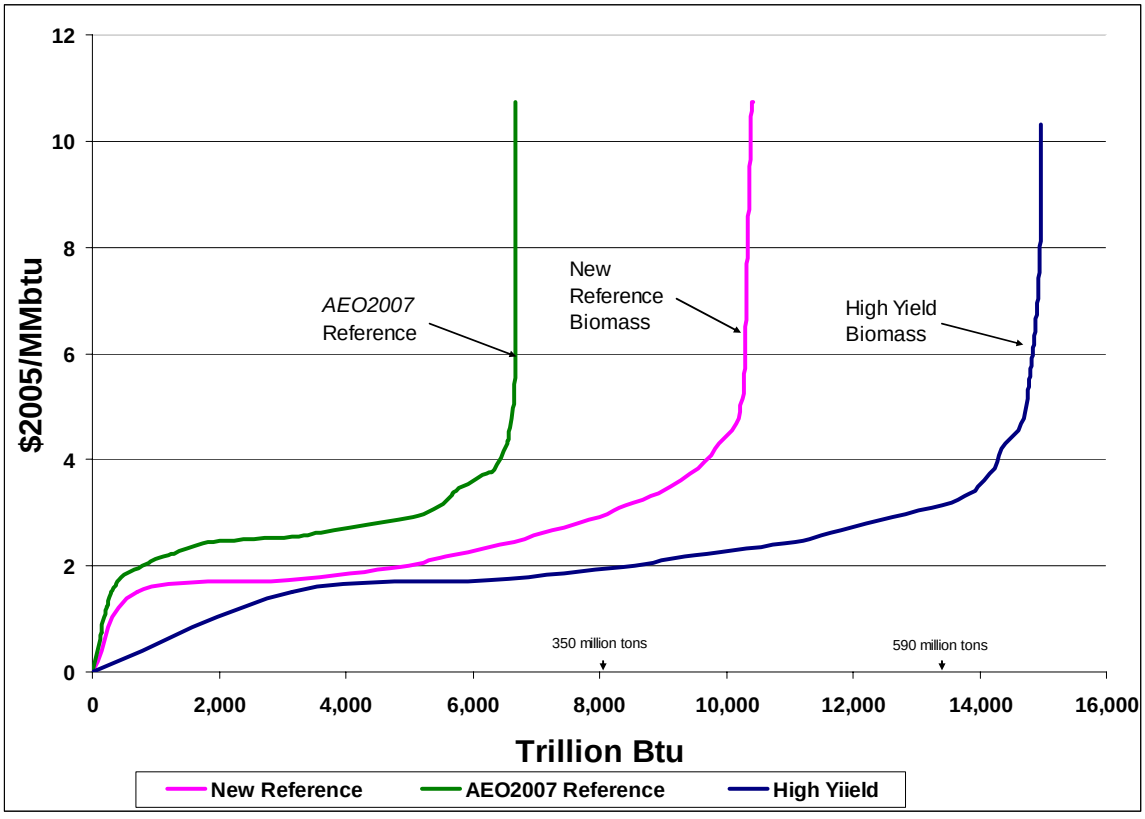
Renewable Market Module Changes from *AEO2007* Reference Case

- 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 (Figure B1).

Figure B1. *AEO2007* Reference Case and High Yield Biomass Supply Curves, 2030



Source: Dr. Daniel de la Torre Ugarte, University of Tennessee. Using the agricultural model POLYSIS.

Transportation Module Changes from *AEO2007* Reference Case

- The Policy cases incorporated two key provisions of S.23—the manufacture of dual-fueled vehicles and the expanded infrastructure for distribution of fuels like E85—as stated by study request letter.

S.23 requires that all new light-duty vehicle (LDV) sales be dual-fuel capable (high percentage blends of ethanol and gasoline and biodiesel and diesel) by 2017. Such provisions will probably be vigorously debated and opposed by LDV manufacturers and owners of affected fuel dispensing stations. Since the potential to produce domestic biodiesel supply is expected to be much smaller than the potential to produce domestic ethanol supply, all new LDV sales were assumed to be E85 capable by 2017. The second provision requires that at least 25 percent of all gasoline distribution stations provide E85 refueling. The costs of developing such an infrastructure will be significant, but S.23 does not specify who will bear the costs. It is likely that such costs will be borne at least in part by consumers and possibly by the firms required to provide the dispensing stations. Such costs, which were not available and were not estimated for this analysis, could significantly increase the economic impacts on the U.S. economy.

Electricity Market Module 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, which is especially important in an RPS scenario.

- 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.

Because a combined RPS and RFS had never been previously analyzed, the logic for equilibration of biomass supply and demand between the electric power sector and the motor transportation sector needed to be created. The newly constructed algorithm equates the biomass supply price between both sectors.