

## **Appendix B**

### **Differences From the *AEO2001* Reference Case**

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The reference case for this study was established to provide a baseline scenario representing the nominal forecast for petroleum refining and marketing without the new requirement for ultra-low-sulfur diesel fuel (ULSD). The reference case reflects the mid-term reference case forecast published by the Energy Information Administration (EIA) in its *Annual Energy Outlook 2001* (*AEO2001*).<sup>160</sup> Both the reference case for this study and the *AEO2001* reference case were prepared using EIA's National Energy Modeling System (NEMS).<sup>161</sup> Both cases reflect the "Tier 2" Motor Vehicle Emission Standards and Gasoline Sulfur Control Requirements finalized by the U.S. Environmental Protection Agency (EPA) in February 2000. Both cases also incorporate bans or reductions for the gasoline additive methyl tertiary butyl ether (MTBE) in the States where such legislation has been passed. They do not include a waiver of the Federal oxygen requirement for reformulated gasoline.

Updates in databases and assumptions that were incorporated into NEMS after the publication of *AEO2001*, however, resulted in minor differences in the reference case forecasts. Differences between the two forecasts relevant to the ULSD study are discussed in this appendix.

#### Return on Investment

The *AEO2001* forecast assumed a 15-percent hurdle rate in the decision to invest and a 15-percent return on investment (ROI) over the 15-year life of a refinery processing unit. To be consistent with the EPA analysis, the reference case for this study used a 10-percent hurdle rate and a 5.2-percent ROI over a 15-year financial lifespan. The revised rates do not have a significant impact on the marginal costs for producing current 500 ppm highway diesel fuel in the reference case forecast.

#### Diesel Fuel Consumption

The *AEO2001* reference case assumed that 85 percent of the demand for diesel fuel in the transportation sector was for highway use. More recently, however, EIA has determined that refinery production of highway diesel approximates the total demand for diesel fuel in the transportation sector. Therefore, the reference case for this study assumes that the production of 500 ppm highway diesel fuel is equal to the total demand in the transportation sector.

Two major factors account for the revised assumption. First, some of the highway diesel produced at refineries

is downgraded in the distribution system. The EPA estimates that currently about 2.2 percent of highway diesel is downgraded. Second, some highway-grade diesel has been used for non-road or other uses, because the price differential between low-sulfur and high-sulfur diesel has not been large enough to make separate distribution infrastructures economical. As a result, it has been noted that some customers purchase low-sulfur diesel for non-road uses. In California, the State requires the same low sulfur standard for both highway and non-road diesel (except for railroad and maritime uses).

#### Import Supply Curves

The NEMS Petroleum Market Module (PMM) uses import supply curves developed from an international refinery model external to NEMS to represent the supply of available imports. In preparation for this study, new sets of crude and product import supply curves were estimated, adding supply curves for ULSD. The new import curves were used in the reference case for this study, but ULSD imports were not allowed.

#### Refining Technology Database

The PMM represents petroleum refining and marketing. The refining portion is a linear programming representation incorporating a detailed refining technology database that includes process options, product blending to specification, and investment costs. This database is updated annually to produce the *AEO* forecasts. There have been some minor changes since *AEO2001*, mostly associated with product blending. Although four new distillate desulfurization units were added as part of the refining technology database update, those four units were not allowed in the reference case. Therefore, the updates had minimal impact on the reference case for this study as compared with the *AEO2001* reference case.

#### NEMS Operation Mode

For the *AEO2001* reference case, all modules of the NEMS were executed to solve for supply and demand balance in the U.S. domestic energy market through 2020. For this study only the relevant modules were executed, including the International Energy Module, Transportation Demand Module, Industrial Demand Module, and the Petroleum Market Module. This mode of NEMS operation greatly reduced the model run time without significantly affecting the results.

<sup>160</sup>Energy Information Administration, *Annual Energy Outlook 2001*, DOE/EIA-0383(2001) (Washington, DC, December 2000), web site [www.eia.doe.gov/oiaf/aeo/](http://www.eia.doe.gov/oiaf/aeo/). See also web sites [www.eia.doe.gov/oiaf/assumption/pdf/0554\(2001\).pdf](http://www.eia.doe.gov/oiaf/assumption/pdf/0554(2001).pdf) and [www.eia.doe.gov/oiaf/supplement/index.html](http://www.eia.doe.gov/oiaf/supplement/index.html).

<sup>161</sup>Model documentation reports for NEMS and its modules as well as a summary report, *NEMS: An Overview*, are available at web site [www.eia.doe.gov/bookshelf/docs.html](http://www.eia.doe.gov/bookshelf/docs.html).