

## Appendix G

# Key Assumptions for the *IEO2006* Kyoto Protocol Case

### Energy-Related Emissions of Greenhouse Gases

The System for the Analysis of Global energy Markets (SAGE)—the model used by EIA to prepare the *IEO2006* mid-term projections—does not include non-energy-related emissions of greenhouse gases, which are estimated at about 15 to 20 percent of total greenhouse gas emissions, based on inventories submitted to the United Nations Framework Convention on Climate Change (UNFCCC). SAGE models global energy supply and demand and, therefore, does not address agricultural and other non-energy-related emissions.

EIA implicitly assumes that percentage reductions of non-energy-related emissions and their associated abatement costs will be similar to those for energy-related emissions. Non-energy-related greenhouse gas emissions are likely to grow faster than energy-related emissions; however, the marginal abatement costs for non-energy-related greenhouse gas emissions are not known and cannot be estimated reliably. In SAGE, each region's emissions reduction goal under the Kyoto Protocol is based only on the corresponding estimate of that region's energy-related carbon dioxide emissions, as determined by EIA data. It is assumed that the required reductions will also be proportionately less than if all gases were included.

### Carbon Dioxide Emissions

For *IEO2006*, EIA modeled only energy-related carbon dioxide emissions. Energy-related emissions of other greenhouse gases, such as methane, nitrous oxide, and sulfur hexafluoride, are not included in the analysis. The current SAGE framework uses historical data on fuel consumption and emissions from EIA's *International Energy Annual 2003* to calibrate the base year for the model's Reference Energy System (RES).<sup>19</sup> The *International Energy Annual* does not provide historical data for methane and nitrous oxide emissions, and currently there are no plans to do so in the future.

EIA assumes that emissions reduction proportions and abatement costs for energy-related methane and nitrous oxide will be sufficiently similar to those for carbon dioxide that—given their lesser share of total emissions (approximately 15 percent from energy and non-energy sources combined)—the per-unit carbon price derived by modeling carbon dioxide alone is representative of the abatement costs for all energy-related greenhouse gas emissions. The UNFCCC estimates that total Annex I emissions of greenhouse gases (in carbon dioxide equivalents) in 2003 had the following composition: carbon dioxide, 81.1 percent; methane, 9.1 percent; nitrous oxide, 6.5 percent; and other gases, 1.6 percent.<sup>20</sup>

<sup>19</sup>EIA data differ slightly from the data submitted to the UNFCCC for energy-related carbon dioxide emissions. It is assumed that the differences will not have a significant effect on estimates of abatement costs.

<sup>20</sup>United Nations Framework Convention on Climate Change (UNFCCC), Greenhouse Gas Inventory Database, Queried for 2003 "National Totals" and "Total Fuel Combustion (Sectoral Approach)" for all greenhouse gases for all Annex I countries except Russia, Poland, and Liechtenstein, web site <http://ghg.unfccc.int/index.html>.

